



BUILDING BLOCKS FOR THE LONG-TERM GOVERNANCE OF B&C WASTE IN BELGIUM

FINDINGS FROM A COLLABORATIVE RESEARCH PROJECT BY THE UNIVERSITIES OF ANTWERP, LIÈGE AND MAASTRICHT (JUNE 2018 – DECEMBER 2019)

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PREFACE

This report presents the overall findings of a three-tier study commissioned by ONDRAF/NIRAS, the Belgian radioactive waste management agency. It was conducted between June 2018 and December 2019 by a consortium consisting of the Universities of Antwerp, Liège and Maastricht.

Each of the participating research teams contributed a specific, complementary view regarding the long-term governance of high-level and long-lived radioactive waste (category B&C waste):

- CRESC¹ (University of Antwerp - UA) conducts sociological research on environmental and social change. Within the context of this research project, the group's expertise relating to the governance of transitions and risk management and the role of science, knowledge and culture in social and environmental change was mobilized.
Contributing researchers: Axelle Meyermans & Anne Bergmans
- SPIRAL² (University of Liège - UL) is a multidisciplinary research centre (bringing together researchers from the social sciences and humanities, as well as from the environmental sciences), with a strong focus on risk analysis and management, and public policy appraisal. For this project, the centre's expertise regarding governance in a context of scientific uncertainty and dynamics of technological innovation was particularly relevant.
Contributing researchers: Céline Parotte & Catherine Fallon
- MSI³ (Maastricht University - MU) is known for its integrative approaches to sustainability research. The institute aims to contribute to global sustainability by supporting sustainable development at the local and regional levels. For this project, the group's expertise regarding foresight and governance for sustainable development was mobilized.
Contributing researchers: Nicole Rijkens-Klomp & Ron Cörvers

The researchers of CRESC and SPIRAL have long experience in studying radioactive waste and its management as a socio-technical challenge in a national and international context. MSI complements this expertise with a view on wider system and governance challenges following the complexity of human-environment interaction.

The research was conducted independently with an explicit focus on **governance** and **process design**. The central research question of the project is as follows:

'HOW CAN A GOVERNANCE PROCESS BE DESIGNED THAT IS SUFFICIENTLY ROBUST AND FLEXIBLE TO GUARANTEE INTERGENERATIONAL STAKEHOLDER INVOLVEMENT AND THE SAFE MANAGEMENT OF B&C WASTE, BOTH NOW AND IN THE FUTURE?'

It was addressed in three complementary strands, each with a specific output. This report combines the insights of all three research strands and focusses on the joint lessons drawn.

This report was finalised on 10 April 2020—around the time a new Strategic Environmental Assessment (SEA) procedure was launched. After a follow-up discussion on 15 December 2020, a supplementary section was added presenting B&C waste and spent fuel as 'matters of care'.

¹ <https://www.uantwerpen.be/nl/onderzoeksgroep/cresc/>

² <http://www.spiral.ulg.ac.be/>

³ <https://www.maastrichtuniversity.nl/research/maastricht-sustainability-institute-msi> (formerly ICIS)

EXECUTIVE SUMMARY

This report presents the overall findings of a research project commissioned by ONDRAF/NIRAS, the Belgian radioactive waste management agency. The research was performed by a consortium of research institutes at the Universities of Antwerp, Liège and Maastricht between June 2018 and December 2019.

Research question and methodology

The aim of the research was to provide suggestions on how to organise a governance process addressing the long-term management of B&C waste, including the transition from adopting to implementing a specific management strategy. It was the explicit choice of the research team not to focus on 'implementing geological disposal', as this was not the official policy at the time the study was launched. The researchers thus did not address what the long-term management strategy (or solution) for B&C waste should be, instead examining what type of governance should be put in place in order to enable decision-making on B&C waste, in addition to facilitating the subsequent implementation of the chosen long-term management strategy. To this end, the central research question was as follows: *'How can a governance process be designed that is sufficiently robust and flexible to guarantee intergenerational stakeholder involvement and the safe management of B&C waste, both now and in the future?'*

The research project was organised in three work packages (WPs), which were conducted in parallel, according to complementary objectives. The first work package (WP1) focussed on mapping key relevant stakeholders (both current and future) and the positions that they had recently adopted concerning the nuclear industry, and particularly with regard to the management of B&C waste. The second work package (WP2) focussed on the long-term future of the nuclear waste problem and how this governance challenge might be influenced by autonomous key drivers of change in the areas of science, technology, economy, society, policy and institutions (and for which scenarios were developed and discussed with ONDRAF/NIRAS). Based on preliminary results from WP1 and insights from previous research conducted by the University of Liège and the University of Antwerp, the third work package (WP3) involved the broader collection of Belgian stakeholders' views on core issues relating to a future governance process for B&C waste.

The research team applied a variety of methods for data collection (i.e. semi-directive interviews, surveys, focus groups, Delphi method and scenario workshops), all of which were of a qualitative nature. The methods were also aimed at collecting a wide range of opinions and positions from a heterogeneous set of actors who made up the target public, extending beyond ONDRAF/NIRAS to include current and future stakeholders (including a number of Dutch stakeholders) in the nuclear waste programmes of Belgium. It is important to point out that this qualitative approach was intended to identify prominent tendencies and a plurality of positions. It is essential to bear these aspects in mind when reading the results. The information presented in this report consists of perceptions of the reality of nuclear waste as seen by the respondents.

The research team met regularly with the staff and management of ONDRAF/NIRAS to discuss topics of interest and to report on progress. The research was conducted independently, and the results and recommendations are summarised in this final report (which is based on internal working reports).

Key dimensions for a long-term governance process

As could be expected, there are multiple ways to frame and solve the problem of B&C waste. Moreover, these frames and solutions are far more fine-grained than a simple analysis of the advantages and disadvantages associated with deep geological disposal, the long-term management option advanced by ONDRAF/NIRAS. One thing that is clear to all, however, is that the long-term governance of B&C waste constitutes a multi-dimensional problem that calls for a collaborative, multi-actor approach.

The research results point to a general feeling that the focus is excessively restricted to geological disposal as the definitive solution to the problem of high-level and long-lived waste in Belgium. Additional clarity and

transparency are expected. In 2010, as well as today, societal actors stress the need for and willingness to participate in a process of collective decision-making, contingent on the willingness to open up, to re-frame the debate and to extend public and stakeholder consultations beyond the legitimation of political *faits accomplis*. Some doubts have been expressed with regard to whether these conditions are currently being met.

The respondents did not hold ONDRAF/NIRAS solely responsible for more transparency. They urged other actors in the nuclear waste chain to take responsibility as well, including with regard to shared responsibilities in managing the B&C waste problem and organising a related governance process.

The results of this research are in line with previous studies concluding that ONDRAF/NIRAS is perceived as pushing a solution to a problem that the general public does not see. In general, the respondents acknowledged the fact that the nuclear waste is already there; that the way in which it is currently stored today may be considered safe for now, but that it cannot continue indefinitely; and that the European Union (EU) demands that its Member States adopt appropriate long-term policies in this regard. Established by the 2011 Waste Directive, this demand clearly entails an obligation to ensure public and stakeholder participation in the decision-making process regarding spent fuel and radioactive waste management. In light of the international consensus existing amongst specialised agencies, regulatory bodies, and dedicated organisations (e.g. the International Atomic Energy Agency [IAEA] and the OECD Nuclear Energy Agency [NEA]) and the implicit assumption of geological disposal as the end point in the EU Waste Directive, participation tends to centre on the implementation of this solution.

It would appear advisable to re-frame the issue: starting from the problem, rather than from an envisioned solution, and inviting societal actors and stakeholders to participate in a debate on the question of high-level and long-lived radioactive materials present in society and how to develop care practices for the present and the future. These measures would provide a means of explicitly recognising communities that are already hosting storage facilities as privileged stakeholders (because they have the waste/radioactive material, and not because they might get a disposal facility). Within the Belgian context, this would imply revisiting a part of the debate on the 2011 Waste Plan, starting from the present situation and looking towards the future.

Even though 70% of the respondents to our survey identified geological disposal as the management solution that they 'considered interesting to further explore', they also indicated that this should be done within a broader context (e.g. in parallel consideration of a programme of R&D on alternative options). It therefore seems advisable to broaden the debate, rather than narrowing it. The results further point to a strong recommendation that ONDRAF/NIRAS should not accelerate into a narrow mode of 'implementing geological disposal' if the new Strategic Environmental Assessment (SEA) procedure should lead to a political decision favouring geological disposal as the 'ultimate solution' for B&C waste in Belgium.

The long-term nature of the B&C waste problem calls for a reflexive, flexible and therefore stepwise governance process. For the respondents, this meant that the first and most important step should be to prepare an overall framework (and, ideally, to establish it in legislation), identifying key steps and general principles for ensuring participation on a continuous basis.

As previously mentioned, the respondents expected greater clarity and transparency from ONDRAF/NIRAS and other responsible actors concerning the problem of B&C waste and related issues. Putting this request for transparency into practice, the interviews and Delphi survey generated three clear expectations: (1) Active sharing of information on the issue at hand; (2) Traceability of the decision-making process; and (3) Clarity about the link between participation and decision-making.

Finally, the respondents expressed several expectations that could be categorised under monitoring and control. They expressed a combined need for monitoring and follow-up with regard to the long-term management strategy, as well as of the associated governance process. The respondents referred to an intrinsic link between these two aspects.

Recommendations for a governance process

The research indicates that the decision-making process and the long-term governance and management of B&C waste depends on the framing of the nuclear waste problem in policy and society, as well as on the associated framing of the actors regarding by whom these processes should be carried out and why they should be carried out in that way. It is important to note that, when actors frame a problem, they usually also have an idea of the intended direction of problem-solving. The results of the current research clearly suggest that many respondents were willing to support ONDRAF/NIRAS in its demand to take further steps with regard to the geological disposal of B&C waste as at least part of a long-term solution. In contrast, other respondents did not (and perhaps never will) support this solution, and those who did support it did not necessarily base their conclusions on the same problem definition. It would therefore be very difficult, if not impossible to define a one-sided governance approach that could cover virtually all dimensions and expectations from all stakeholders in a satisfactory way. In light of the existence of multiple care narratives, one key question concerns whether these narratives can co-exist within a single dedicated long-term management programme. To this end, multiple efforts and a mix of initiatives and responsive actions towards new and unexpected developments will be needed in order to ensure that B&C waste is being taken care of through a collective and open decision-making process, with a maximum of engagement and transparency.

In theory, ONDRAF/NIRAS and other stakeholders in the nuclear waste debate have a variety of governance options, which touch upon key questions concerning such topics as the management options that are available for radioactive waste, how stakeholders can be involved in the decision-making process, the type of participation that is needed and when, what the organisation of the nuclear chain looks like, and whether there is space for a public debate. The governance approach could focus on actors and stakeholders in the radioactive waste debate in order to gain (or increase) support for geological disposal. At the same time, however, it could also make a cognitive turn, focussing on the re-framing of the B&C waste problem, and thus the possible solutions to the problem.

The theoretical governance options discussed in this report are intended to inspire the debate in policy and society with regard to what the long-term management of B&C waste could look like, and which governance options and choices there are to be made. The options presented here are definitely not intended as a blueprint. The nuclear issue is much too complex and 'wicked' to allow for that.

In addition to theoretical reflection, this research is intended to advance several tangible recommendations regarding the design of a long-term governance process for B&C waste:

- Long-term radioactive waste management is a socio-technical challenge.
- Regardless of its practical implementation, any long-term management solution is experimental by nature.
- One transparent and democratic way of addressing this challenge is through participatory technology assessment, preferably piloted by a mixed committee.
- Debates organised on such issues must take the form of multiple debates in multiple interconnected arenas.
- A long-term management programme should not be based on any single care narrative.

Planning a governance process for the long-term management of high-level radioactive waste is a long-term prospect. The importance of a reflexive, flexible and stepwise collective governance approach can therefore not be emphasised enough. Such a process should be based on multiple views of caring for this material, as held by multiple 'carers', both now and in the future. This will require an empathic attitude towards the needs and expectations of all current and future stakeholders in the nuclear energy and nuclear waste debate. Caring for the waste and its environment calls for a paradigm shift at three levels:

- Approach the waste as matter of care: Acknowledge multiple ways of caring, and allow them to co-exist; establishing common ground by proceeding from shared uncertainties rather than from shared 'facts'.
- Start by talking about waste (how it is produced, what it is and where and how it is kept today), before talking about waste management solutions: establish a community of stakeholders who care about the waste, and not only those who care about a particular end-point for it.
- Engage with all stakeholders who care, and particularly those who are directly affected, including local (and on-site) communities and citizens. This should be done throughout the entire length of the process, thus inevitably spanning several decades and generations of stakeholders. Although intergenerational engagement is an ideal goal, it can be reached only by starting with the present generation in a collective and open process of decision-making and governance.

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1 INTRODUCTION

Belgium became 'a nuclear player' as early as the 1920s, due to the exploitation of uranium mines in Katanga, which was then a province in the country's colony of Congo. In return for supplying the US and UK with uranium, Belgium was able to start up its own nuclear research programme soon after the Second World War, and it began experimenting with nuclear reactors for civil energy production in the 1950s.

In 1952, a national nuclear research centre, which is now known as the Belgian Nuclear Research Centre (SCK CEN), was founded. In the years and decades that followed, it would attract other nuclear activity to the Mol-Dessel-Geel region. Most of these companies have since left the area or ceased to exist, leaving a legacy of contaminated sites and buildings. Such 'historical waste', as it is now known, includes a prototype reprocessing plant for spent fuel, which was in operation from 1966 to 1974. Today, all of the abandoned plants have been decommissioned, and the remaining historical or legacy waste is treated and stored on the grounds of Belgoprocess in Dessel.

Belgium entered the age of nuclear energy production in the 1970s, with the development of a total of seven pressurized water reactors (PWR) on two different sites: four in Doel (municipality of Beveren, in Flanders) and three in Tihange (municipality of Huy, in Wallonia). Since January 2003, Belgium has had a 'nuclear phase-out' policy.⁴ Although the maximum lifespan of the existing nuclear power plants has since been extended, the ultimate phase-out still stands. Current regulations⁵ stipulate 2025 as the year in which all nuclear power production in Belgium will end.⁶ On 5 March 2020, however, the Constitutional Court quashed the decision to extend two of the reactors in Doel, arguing in its ruling that the requirement to organise an environmental impact assessment and public enquiry prior to taking this decision had not been met.⁷

The national agency for radioactive waste management,⁸ ONDRAF/NIRAS, was founded in 1980/1981. As a government agency by Law⁹ and Royal Decree,¹⁰ it distinguishes three categories of radioactive waste: low-level and medium-level, short-lived conditioned waste (Category A), low-level and medium-level, long-lived conditioned waste (Category B), and high-level, short-lived and long-lived conditioned waste (Category C). Category A waste corresponds to the category of low-level waste, as included in the 2009 IAEA classification. With a risk to people and the environment for several hundreds of years, and containing only limited quantities of long-lived radionuclides, this type of waste can be considered for surface or near-surface disposal. Category B waste is contaminated with such quantities of long-lived radionuclides that it poses a risk to people and the environment for several tens to hundreds of thousands of years in some cases. It corresponds to the category of medium-level waste, as included in the 2009 IAEA classification. Category C waste contains large quantities of long-lived radionuclides, and it will continue to generate heat for several decades. It corresponds to the category of high-level waste, as included in the 2009 IAEA classification. Because of these characteristics, waste of both Categories B and C demand a different long-term management strategy than does waste of category A (National Programme Committee 2015: 28).

⁴ Law of January 31, 2003 regarding the gradual discontinuation of industrial nuclear power generation (Moniteur Belge 28/02/2003).

⁵ Law of December 8, 2013 amending the law of January 31, 2003 regarding the gradual discontinuation of industrial nuclear power generation and the law of April 11, 2003 regarding the provisions for decommissioning the nuclear power plants and managing the spent fuel from these plants (Moniteur Belge 24/12/2013) & Law of June 12, 2016 amending the law of January 31, 2003 regarding the gradual discontinuation of industrial nuclear power generation, in order to establish the yearly contributions for the prolonging of the operational life-time of the plants Doel 1 and Doel 2 (Moniteur Belge 22/06/2016).

⁶ <https://fanc.fgov.be/nl/dossiers/kerncentrales-belgie>

⁷ <https://www.const-court.be/public/f/2020/2020-034f.pdf>

⁸ <https://www.niras.be/>

⁹ Law of August 8, 1980 regarding budget proposals 1979 – 1980 (1) (Moniteur Belge 15/08/1980: art.179) and subsequent amendments.

¹⁰ Royal Decree of March 30, 1981 stipulating the mission and tasks of the public agency for radwaste management (Moniteur Belge 05/05/1981) and subsequent amendments.

Until the mid-1990s, the Belgian strategy for the management of the back end of the fuel cycle consisted of reprocessing spent fuel from all commercial nuclear power reactors. This strategy was brought to an end in 1993, by Parliamentary Resolution.¹¹ Since that time, all spent fuel has been stored on the surface at the sites of the nuclear power plants, pending a decision regarding its future. The electricity producers have retained ownership of this material and, as long as they do not declare it as 'waste', they are responsible for its safekeeping. Vitrified waste from the reprocessing of spent fuel in the past belongs to Category C, as does most non-reprocessed spent fuel that has been declared as waste. Only certain fuels from research reactors belong to Category B waste (National Programme Committee 2015: 28).

For Category A waste, a long-term management strategy (surface disposal in the municipality of Dessel) has been developed through a participatory governance process launched in 1998. In 2006, this strategy was confirmed by the Federal government.¹² At the time this report was written, the licence application for this disposal facility was under review by the regulator, AFCN-FANC.

For waste of Category B and Category C (hereinafter referred to jointly as B&C waste), ONDRAF/NIRAS issued a Waste Plan in 2011, preceded by a Strategic Environmental Assessment (SEA) and a social consultation conducted in 2009–2010. The agency subsequently suggested that the Federal government should decide that, in principle, geological disposal in poorly indurated clay would be the best long-term management option for B&C waste, including any non-reprocessed spent fuel that would be declared as waste. In its recommendation to the Federal government, AFCN-FANC acknowledged a preference for geological disposal, although it considered it premature to take any decision regarding the geological host formation (FANC 2011). No further political decision has been taken on this matter to date (10 April 2020).

The study of which this report is the result was commissioned by ONDRAF/NIRAS in 2018 to provide insight and recommendations concerning how to organise a governance process for dealing with the long-term management of B&C waste, including moving from adoption to the implementation of a specific management strategy. **It was the explicit choice of the research team not to focus on 'the implementation of geological disposal', as this was not the official policy at the time that this study was launched.** Instead, the study focussed on general principles for a governance process aimed at strengthening stakeholder involvement and the safe management of B&C waste, both now and in the future. The current study thus does not address what the long-term management strategy (or solution) for B&C waste should be, instead examining which type of governance should be put into place to enable decision-making on B&C waste and the subsequent implementation of the long-term management strategy that is ultimately selected. This is because governance concerns the questions of what is to be governed, by whom and how (and why in that way).

¹¹ Parliamentary Resolution of December 22, 1993 regarding the use of plutonium and uranium containing fuel in Belgian nuclear power plants and the opportunity for the reprocessing of nuclear fuel rods (Parlementaire Stukken – 1991 – 1995: 0541/9 – 91/92 (B.Z.)).

¹² Council of Ministers, Meeting of June 23, 2006: Disposal of radioactive waste (category A). 2006A42450.020

2 RESEARCH DESIGN AND METHODOLOGY: THREE COMPLEMENTARY WORK PACKAGES

A dual strategy was developed for this 18-month research project, consisting of an extensive enquiry into the problem definitions of a wide variety of concerned actors, including their expectations regarding a multi-stakeholder governance process around B&C waste (WP1 and WP3) and an internal reflection within ONDRAF/NIRAS on future challenges (WP2).

The three work packages (WPs) were conducted in parallel, following complementary objectives, with WP1 focussing on **mapping key relevant stakeholders (both current and future) and the positions** that they had recently adopted concerning the nuclear industry, and particularly with regard to the management of B&C waste. Based on the preliminary results of WP1, as well as insights from previous research conducted by the Universities of Liège and Antwerp, WP3 involved the broader collection of **Belgian stakeholders' views on core issues relating to a future governance process for these types of waste**. The second work package (WP2) focussed on the long-term **future of the nuclear waste problem** and how this governance challenge might be influenced by autonomous key drivers of change in the areas of science, technology, economy, society, policy and institutions (and for which **scenarios** were developed and discussed with ONDRAF/NIRAS staff and management).

The researchers applied a variety of data-collection techniques: semi-directive interviews, surveys, focus groups, the Delphi method and scenario workshops. In this section the methodological choices for each WP are presented, along with details on how the data were collected and who the invited participants were, as well as the response rates and the type of data analysis that was applied.

2.1 COMPLEMENTARY DATA-COLLECTION TECHNIQUES

In summary, this research project consisted of:

- Extensive desk-top research, 22 in-depth interviews with key Belgian and Dutch stakeholders and two focus-group discussions with local actors directly concerned with nuclear sites.
- Two rounds of a bilingual online questionnaire survey consisting of 109 items, and with participation by 242 Belgian stakeholders.
- Three scenario workshops with ONDRAF/NIRAS senior staff and management.

2.2 WP1 AND WP3: IDENTIFYING THE NEEDS AND EXPECTATIONS OF BELGIAN (AND DUTCH) STAKEHOLDERS

For WP1, three data-collection techniques were used:

First, **desk-top research** was conducted in order to provide an overview of positions that have been adopted by various actors in the past, particularly with regard to the ONDRAF/NIRAS Waste Plan issued in 2011. Official statements, reports and declarations were analysed. A timeline was constructed in collaboration with members of the senior staff and management of ONDRAF/NIRAS, presenting the institutional history of the nuclear sector and practice of radioactive waste management in Belgium, as well as the history of nuclear energy and R&D programmes for nuclear waste, including moments of public engagement or public response.

Between February and May 2019, this information was complemented with **22 in-depth interviews** conducted with key Belgian (and Dutch actors) representing a variety of positions. The researchers also contacted actors whom they regarded as **directly concerned, but thus far not actively participating in the public debate** (e.g. regional administrations, local communities hosting nuclear power plants or other facilities where high-level and/or long-lived radioactive materials are stored). These interviews were combined with **two focus-group discussions** with local stakeholders who were directly concerned with nuclear sites.

WP1 provided an overview of the positions that had been adopted thus far and by whom, categorising actors as speaking in the name of (a) a public government or administration, (b) a private market player, (c) a research institute, (d) a civil society organisation, (e) a media representative or (f) a private citizen. Inspired by the 'Advocacy Coalition Framework' (ACF) literature (e.g. Sabatier 1988, Weible 2006), the researchers identified the following aspects for each actor (as far as possible): field of competence; mission, vision and values; position with regard to nuclear energy production; problem definition regarding radioactive waste (particularly B&C waste) and their positions with regard to the principles of long-term management; active involvement in the radioactive waste debate to date; and strategies and main communication channels used to influence the debate. The key themes emerging in the analysis of the expectations of a multi-stakeholder governance process concerning B&C waste were subsequently used to feed into a broader two-round Delphi enquiry. For an extensive report on the findings from this WP, see Meyermans and Bergmans 2019, WP1 Report.³³

For WP3, a broad online and iterative survey known as the **Delphi method** was used.

The Delphi method is a particular type of written (online) survey, consisting of a variety of open, semi-open and closed questions, and it is conducted in at least two consecutive rounds. After the first round, the responses that have been obtained are rendered anonymous and analysed by the research team, who uses the results to propose a new series of open, semi-open or closed questions to follow up on the collective responses from other the previous round (see below). The method makes it possible to reach a large number of participants at the same time.

The survey was directed at Belgian stakeholders and was conducted in both French and Dutch. From April to November 2019, **580 people were invited** to take part in this bilingual online survey on 'the future of the long-term management of high-level radioactive waste and spent fuel in Belgium'.

First, similar to WP1, WP3 targeted respondents beyond the group of 'usual suspects' (i.e. the institutional actors who are legally responsible, along with their most direct contacts). The researchers also explicitly invited people (as individual citizens or representatives of associations and institutions) who had adopted a critical stance in the past, either with regard to the nuclear industry in general or the approach taken by ONDRAF/NIRAS in particular.

Second, to design the survey, the researchers relied on previous analyses of research from the teams from the Universities of Liège and Antwerp (Fallon et al. 2012, Parotte 2018). These analyses were coupled with various stakeholder positions, regardless of whether they had been for or against nuclear energy over the years.

During the **first Delphi round (April–June 2019)**, **54 questions were asked**, divided over seven topics:

1. Past events in nuclear programmes that matter for the future
2. The desirable future for B&C waste, including principles of reversibility and retrievability
3. The future of the nuclear production chain, including the future of spent fuel
4. The future of financial management and control
5. The participation of stakeholders in the decision-making process
6. The controllability of and follow-up on the HLRW programme
7. Profile questions

Based on the analysis of the first Delphi round, **55 new questions** were asked during the **second Delphi round (October–November 2019)**, organised around **four main topics**:

1. Framing of debates on nuclear waste management in the future
2. The type of progressive participation desired by the stakeholders
3. Management of financial perspective
4. Independence and missions of the control and monitoring bodies

In all, **242 participants replied** to this online survey (for a total of 11,695 responses). The participants represented a highly **pluralistic panel of respondents**, presenting themselves as citizens and scientific experts,

³³ <https://repository.uantwerpen.be/docstore/d:irua:5864>

environmental associations in favour of or against nuclear power, healthcare professionals, professionals involved in emergency planning, trade unions and federal/regional/local civil servants. **A large majority of respondents indicated that they had been interested in these issues for longer than a decade. Three fourths of the respondents expressed a desire for further involvement** with these topics in the future, due to their jobs (e.g. 'Consultant', 'NGO', 'Trade Union', 'Academia') or for activities and interests that were either directly or indirectly associated with nuclear energy.

WP3 provided a full overview of the needs and expectations of the various Belgian stakeholders regarding the long-term management of high-level radioactive waste and the type of decision-making process that they would like to have implemented. For an extensive report on the findings from this WP, see Parotte and Fallon 2020, WP3 Final Report ²⁴).

2.3 WP2: BROADENING THE MINDSET OF ONDRAF/NIRAS

For WP2, three scenario workshops were organised with members of the senior staff and management of ONDRAF/NIRAS. They were invited to take part in an exploration of future scenarios in order to derive insights concerning the B&C waste problem, how this issue might change over time as a result of various developments and what this could mean for the governance and management of nuclear waste.

The workshops resulted in a set of environmental scenarios ('future B&C waste ecosystems') and their options and consequences for multi-stakeholder governance.

The purpose of the WP2 scenario workshops was twofold. First, they were intended to broaden the mindset of ONDRAF/NIRAS by having managers and staff members consciously think about impending changes and challenges concerning the long-term management of nuclear waste and what they could mean for a joint-governance approach. The workshops were also intended to help ONDRAF/NIRAS arrive at a future agenda, taking into account potential threads and opportunities for the agency's role as a 'guardian' of the safe management of all radioactive waste on Belgian soil.

The methodology applied was scenario analysis (a frequently used method within the domain of future studies). To create the set of scenarios, the research team collaborated with members of the staff and management of ONDRAF/NIRAS to work through a number of consecutive phases. A macro-level framework covering the various systemic layers of the B&C waste problem was first used to scan and analyse the autonomous key drivers of change (i.e. in the areas of science, technology, economy, society, policy and institutions) that might affect the future ecosystem of radioactive waste.

An exploration in terms of impact on the different systemic layers of the radioactive waste ecosystem led to an initial selection of the most relevant developments, as well as to a set of challenges presented by these developments. The results were then used to craft a series of scenario storylines, following a morphological scenario methodology. The scenarios were subsequently elaborated and deepened in terms of their impact on the systemic layers of the radioactive waste ecosystem, the radioactive waste chain and its actors, thereby also identifying key governance elements and principles. Due to the complex issue at hand, and because of emphasis on the ability to adapt and remain flexible with regard to governance in light of a wide range of potential future states, the researchers opted not to integrate their insights into a small, limited set of scenarios, and instead to work with a large, diverse set of scenarios.

All scenarios should be understood as possible future worlds. It should be noted that scenarios have been introduced as a mental tool with which to move beyond current mental frameworks. The future that actually comes to be will most likely be a combination of some of the future worlds described in the scenarios, and they might even contain elements that could not have been anticipated. It is important to note that future scenarios

²⁴ https://orbi.uliege.be/bitstream/2268/246178/1/Final_Report_WP3_Parotte_Fallon_2020.pdf?fbclid=IwARoSWI5Lc8eZ-hb8IUmapovU22iX1sHwXSa3jI6ypontfqzCESgV3YvdTE

should be regarded as a methodology for use in exploring the future, and they are not in any way intended to predict the future.

2.4 REFUSAL TO PARTICIPATE?

Several invited participants either **explicitly or implicitly refused to participate** in this research.¹⁵ **This is a result in itself.** Amongst those who explicitly refused to participate in either of the work packages, the researchers identified three types of positions:

- Those refusing to participate by virtue of their personal convictions or positions
- Those who felt that they were not sufficiently competent or involved with the topic to participate
- Those who were strongly and directly involved in radioactive waste management, but who could not or would not participate for some reason

Some of the groups identified by the researchers as 'future' stakeholders in long-term management of high-level radioactive waste did not identify themselves as such, and they therefore they did not have any interest in taking part in the research.

Others refused the researcher's official invitations. This was especially the case for environmental associations that are openly opposed to nuclear energy. For example, some people considered the survey inadequate, while others explicitly supported one specific future for the nuclear programme over another. Refusal to participate is a form of participation that is just as legitimate as any other, and it may represent the will to refuse the framing imposed during an institutionalised consultation (Parotte, 2018). Within the context of this research project, such refusals were often followed by an exchange of arguments (by email or telephone, outside of the online survey), in which the researcher clarified and re-clarified the way in which the questionnaire had been constructed, as well as its objective and the manner in which the results would be presented.

Finally, some of those who were invited to participate could not be convinced of the importance of this type of consultation process. Even if they were strongly and directly concerned with the topic, their schedules prevented them for active participation.

2.5 QUALITATIVE ANALYSIS: HIGHLIGHTING A PLURALITY OF POSITIONS

All of the methods **applied were of a qualitative nature**, aimed at collecting **a wide range of opinions and positions from a heterogeneous set of actors** who made up the target public, extending beyond the staff and management of ONDRAF/NIRAS to include current and future stakeholders in the nuclear waste programmes of the Netherlands and Belgium. It is important to note that this qualitative approach was intended to identify main tendencies and a plurality of positions. **It was in no way intended to produce a statistically representative snapshot** in favour of any specific option for management, financing or participation (Petit Jean 2019). Instead, this research project is intended to **highlight the plurality of Belgian and Dutch stakeholders and the positions of ONDRAF/NIRAS.**

It is thus essential to bear these aspects in mind when reading the results reported in this document. The information presented here consists of **perceptions of nuclear waste reality as seen by the respondents.**

¹⁵ See Parotte and Fallon 2020, WP3 Final report in particular for further details.

3 KEY DIMENSIONS FOR A LONG-TERM GOVERNANCE PROCESS

This section addresses the key dimensions for the governance of B&C waste, derived primarily from the interviews (WP1) and the two-round Delphi survey (WP3), as explained in the previous section. Where appropriate, these findings are linked to experiences in other countries, based on previous research (Bergmans et al. 2008, Van Berendoncks and Bergmans 2012, Fallon et al. 2012, Kallenbach-Herbert et al. 2014, Bergmans et al. 2015, Landström and Bergmans 2015, Parotte 2018, Meyermans et al. 2019) and the researchers' interactions with other waste management programmes (in France, Canada, Sweden, Switzerland, Germany, Finland, the UK, Spain and Slovenia/Croatia) over the past decade in various roles, ranging from that of observer to that of active advisor.

3.1 A MULTI-DIMENSIONAL AND MULTI-ACTOR PROBLEM

As could be expected, there are multiple ways to frame and solve the problem of B&C waste. Moreover, these frames and solutions are far more fine-grained than a simple analysis of the advantages and disadvantages associated with deep geological disposal, the long-term management option advanced by ONDRAF/NIRAS and the international expert community. One thing that is clear to all, however, is that the long-term governance of B&C waste constitutes a multi-dimensional problem, that calls for a collaborative, multi-actor approach.

3.1.1 GEOLOGICAL DISPOSAL AS A SOLUTION, BUT FOR WHICH PROBLEM?

Awareness of the problem of radioactive waste in general and B&C waste in particular appears to be quite limited amongst actors who do not see themselves as directly linked to or interested in the nuclear sector (positioning themselves as supportive, critical or neutral). This clearly emerged in the interviews, and it is in line with the findings of the most recent SCK-CEN Barometer, which demonstrates that people in general have little knowledge of how high-level (or other) radioactive waste is currently being managed. About half of the respondents to that survey reported actually believing that it is already stored underground (Turcanu et al. 2018).

Invitations to participate in the Delphi enquiry were explicitly sent to people who had previously expressed an interest in the radioactive waste issue in some way.¹⁶ This group reflects a broad diversity of profiles, including concerned citizens, civil society representatives, public administrators and scientists. **Of those who were more engaged, almost 70% regarded geological disposal as the 'most realistic' solution**, and more than half were of the opinion that 'doing nothing' (i.e. delaying any steps towards implementation) was not a solution. **Nevertheless, a large majority of the respondents insisted that the future of B&C waste management cannot be discussed without addressing the entire nuclear production chain, the role of new nuclear technologies and the status of spent nuclear fuel, in addition to exploring the possibility of multi-state joint management solutions.** In this case as well, there were some similarities between the more informed respondents in this research and the sample of the general public invited to respond to the SCK-CEN Barometer. In the Barometer, almost as many respondents (66%) reported believing that geological disposal should be implemented as soon as possible as did those (57%) who did not think that geological disposal would solve the problem of high-level waste (Turcanu et al. 2018: 47- 49).

Particularly during the interview round, reference was made to the 'first of its kind', and thus experimental nature of designing and building a geological disposal facility, and that a flexible and stepwise (see also infra) governance process would thus be needed. The respondents expressed a variety of views concerning what geological disposal could and should mean and how it should be put in practice. **Uncertainty remains regarding the inventory of radioactive waste and, while most respondents insisted that a full overview of this**

¹⁶ They had expressed this through such means as involvement in formal and informal consultations organised by ONDRAF-NIRAS in the past, statements in the media and participation in related conferences, workshops, information sessions and hearings.

inventory would be needed before deciding on a strategy for all waste types, many also acknowledged that shifts may still occur in the future and that developments in technology and/or policy may call for changes along the way.

In combination with the arguments that several stakeholders provided for refusing to take part in this research project, the results point to a **general feeling that the focus is excessively restricted to geological disposal as the definitive solution to the problem of high-level and long-lived waste in Belgium**. They regarded the problem as multi-dimensional and argued that the governance process should aim to incorporate these dimensions as much as possible, rather than screening out some from the start.

Additional clarity and transparency are expected. First, such clarity and transparency are needed with regard to the status and amount of all radioactive materials in Belgium, including those currently present and those that are likely to materialise in the foreseeable future, in line with current policy and industrial practice. Second, the impact of any change in current policy and practice (particularly regarding nuclear energy production) on the inventory of radioactive waste and the potential consequences for the safe management thereof should be addressed more openly when discussing options for long-term waste management. The latter point was stressed by both proponents and opponents of geological disposal. Nevertheless, talking about 'solving the waste issue' undoubtedly continues to raise suspicion amongst certain actors that some parties will point to the implementation of geological disposal as evidence that the 'Achilles' heel of nuclear power' has been resolved (as also argued by Blowers, Lowry and Solomon 1991). This suspicion appears to be fed by the perceived direct service relationship between ONDRAF/NIRAS and the nuclear industry, as a consequence of the financing mechanisms under which the Belgian waste management agency operates. Third, with regard to geological disposal as the suggested way forward, a collective debate is expected regarding the design options and safety criteria (e.g. concerning expectations relating to reversibility, retrievability and monitoring), criteria for site selection, financing and other issues, with an explicit demand to approach these matters not only as a technical challenge, but also as a socio-political issue.

The respondents' call for greater transparency is fully in line with the conclusions of the Citizen Forum, organised by the King Baudouin Foundation on behalf of ONDRAF/NIRAS in 2010. According to the Citizen Forum, this matter calls for an appropriate decision-making process that guarantees 'more transparency, and more interaction with society' (KBS 2010: 7). Given the sensitive nature of the B&C waste problem and the extremely long time frames associated with it, this cannot be addressed solely from a technical-scientific perspective, regardless of how sound the science may be. **In 2010, as well as today, societal actors stress the need for and willingness to participate in a process of collective decision-making, contingent on the willingness to open up, to re-frame the debate and to extend public and stakeholder participation beyond the legitimisation of political *faits accomplis*.**

3.1.2 THIS IS NOT THE PROBLEM OF ONDRAF/NIRAS ALONE

The respondents did not hold ONDRAF/NIRAS solely responsible for greater transparency. They also urged other actors in the nuclear waste chain (see Figure 1) to take responsibility as well.

Throughout their responses, the interviewees and respondents to the survey clearly indicated that they regard B&C waste as a multidimensional and multi-actor issue. The perception that multiple actors are involved is rooted not only in the expectation that ONDRAF/NIRAS should interact with a wide variety of societal actors and stakeholders. It also concerns **shared responsibilities in managing the B&C waste problem and organising a related governance process**.

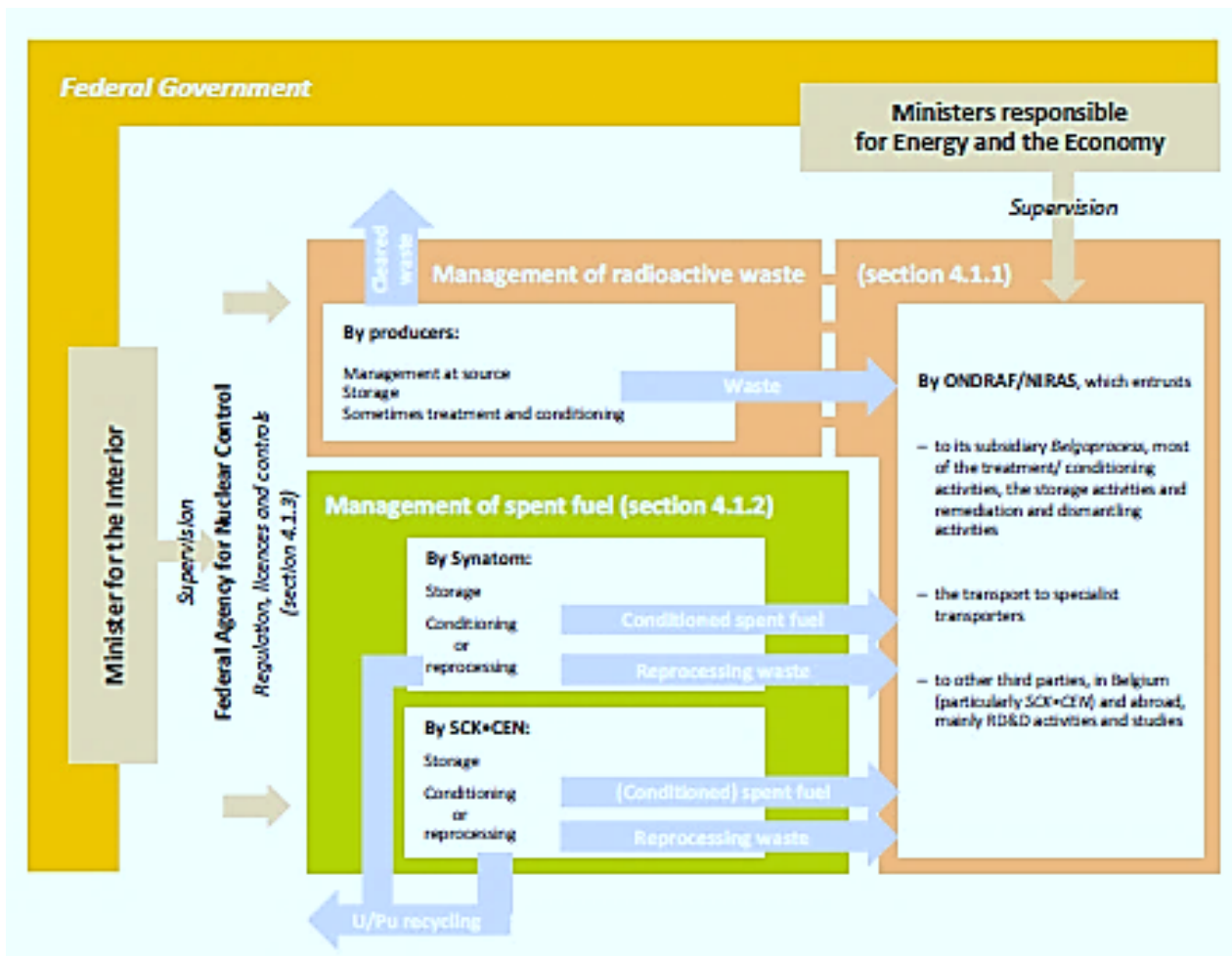


Figure 1 The main actors in the management of radioactive waste and spent fuel in Belgium (National Programme Committee 2015: 8)

The respondents expressed clear expectations specifically with regard to the **regulator, AFCN-FANC**. They demanded that the safety authority should take on a more active and more visible role in terms of providing information, engaging in debate with society on safety aspects and adopting clear regulations. Several of the interview respondents linked the latter to the process for low and intermediate (Category A) waste, suggesting that a lack of guidance and regulatory framework at the start has been a key factor in dragging out the licencing process for the dedicated surface repository for such waste, which started in 2013 and was still in process at the time of the field work for this research project in 2019.

The question of financing the entire operation of technical management and societal governance over a very long time was an issue of concern for many respondents. Although they regarded the principle of 'the polluter pays' as indisputable, many respondents expressed the expectation that the **State** should bear ultimate responsibility in the event that a waste producer should become insolvent. Many would also prefer for there to be an **independent control attached to the Federal Parliament** (e.g. by the Court of Audit). Existing bodies, like the Commission for Nuclear Provisions (CPN-CNV), are generally perceived as too closely linked to the nuclear sector to be considered neutral. Its composition could be opened up to other stakeholders.

Given that the respondents did not perceive either ONDRAF/NIRAS or AFCN-FANC (or their respective Ministries) as being well positioned to take charge of organising debate across the full bandwidth of this multi-dimensional problem, many pointed to the need for a **mixed, pluralist body** at the federal level that would work **together with the relevant authorities** to ensure the effective opening up and active engagement of societal actors and stakeholders in the long-term governance of B&C waste.

Finally, the respondents regarded the matter as **a problem of national interest that concerns everyone**. General principles regarding long-term management technology, the prevailing ethical and safety criteria, governance framework and milestones in a decision-making process are expected to be established in a participatory way at the federal level. With regard to an actual project, the respondents indicated that engagement at the **local or regional level** would be more advantageous. Some even suggested starting at the local level, beginning at the locations where the waste is already present, so that everyone could be considered a stakeholder (although some actually hold a greater stake than others do).

3.2 FRAMING THE (START OF) THE DEBATE(S)

The results of this research are in line with those of previous studies (e.g. Fallon et al. 2012), which have highlighted the perception that ONDRAF/NIRAS is pushing a solution to a problem that the general public does not see.

In general, the respondents acknowledged that the radioactive waste is already there; that the way in which it is currently stored may be considered safe for now, but that it cannot continue indefinitely. They further acknowledged that the European Union (EU) demands that its Member States adopt appropriate long-term policies in this regard. This demand, by means of Council Directive 2011/70/Euratom (hereinafter, the 'Waste Directive'), clearly entails an obligation to ensure public and stakeholder participation in the decision-making process regarding spent fuel and radioactive waste management.¹⁷ In Belgium, however, this 'push' from the EU does not seem to have created any sense of urgency at the political level, and opponents of nuclear energy have tended to view it as a pretext for keeping the nuclear option open.¹⁸

The Waste Directive was transposed into Belgian legislation in June 2014 (hereinafter, the 'Transposition Law')¹⁹ and the first Belgian Programme was adopted in 2015 (National Programme Committee 2015). The Transposition Law (Art. 4) stipulates that any national policy regarding a strategy for the management of long-term radioactive waste should be based on disposal according to a concept of passive safety. It holds ONDRAF/NIRAS responsible for proposing a location for such a facility, and suggests the possibility of installing an 'independent, multi-disciplinary body' to follow up on the national policy. The Federal Government is responsible for adopting the national policy (for which the Transposition Law provides the basis), while the national programme provides the operational framework for putting this policy into practice. The current national programme, which was adopted in 2015, describes the situation as of 31 December 2014 with regard to the legal and regulatory framework, the actors concerned and their respective responsibilities, the state of the waste inventory, existing management practices, long-term plans and financial provisions. With regard to the long-term management of B&C waste, the programme states the following: *'Pursuant to the Law of 3 June 2014 and based on its B&C Waste Plan, in 2015, ONDRAF/NIRAS plans to send a proposal for a national policy for the long-term management of B&C waste to the Ministers responsible for Energy and the Economy. At the same time, it continues its RD&D activities on geological disposal in poorly indurated clay'* (National Programme Committee 2015: 45). Neither the Transposition Law nor the national programme attracted much public or media attention, and both passed as very low-key, inner-circle documents intended to settle formal EU obligations. **No public connection was made to the Waste Plan debate initiated by ONDRAF/NIRAS in 2011, and any momentum or awareness raised about the issue among a wider audience at the time appears to have been lost.**

In light of the developments described above, it would seem advisable to **re-frame** the issue, **starting from the problem, rather than from an envisioned solution**, inviting societal actors and stakeholders to participate in a

¹⁷ Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste (OJ 02/08/2011 – L199/48 – Art. 10).

¹⁸ Colloquium 'Nuclear to fight climate change? The unsolved problem of nuclear waste. Focus on deep geological repository' – Brussels, European Parliament, 5 February 2020 – Intervention by Jan Vande Putte, Greenpeace.

¹⁹ Law of June 3, 2014 amending Article 179 of the law of 8 August 1980 regarding the budget proposals for 1979–1980, in view of the transposition into national law of Directive 2011/70/Euratom ... (Moniteur Belge 27/06/2014).

debate on the issue of the high-level and long-lived radioactive materials that are already present in society, some of which have been declared as waste, while others have not (or not yet) been designated as such. This debate should not be restricted to technical management features or the financial cost of specific projects, but should also consider related environmental, ethical, socio-political, financial and legal issues regarding the entire production chain.

3.2.1 LET'S TALK ABOUT HIGH-LEVEL WASTE (AND SPENT NUCLEAR FUEL)

Such an approach would enhance the possibility of reaching out to those who are not yet convinced that geological disposal is the best (or only) path forward, but who do regard the presence of B&C waste and spent fuel as problematic. Starting from what is, rather than what could be, more clearly highlights the fact that this waste is already amongst us. It thus provides a means towards explicit **recognising communities that are already hosting storage facilities as privileged stakeholders (because they have the waste/radioactive material, not because they might get a disposal facility)**. Moreover, it could help to position the issue of radioactive waste within a broader management context (e.g. nuclear energy production, future energy mix and climate change), with geological disposal only one of several related themes. The inclusion of spent fuel in the re-framing of the debate is more in line with the Waste Directive, and it adds greater transparency regarding its future as waste (whether through reprocessing or not).

An overview of the various themes associated by the respondents to the issue of B&C waste management is provided in Figure 2. The themes indicated in blue are directly related to the realm of competence of ONDRAF/NIRAS. For the themes indicated in grey, other actors have a leading role to play.

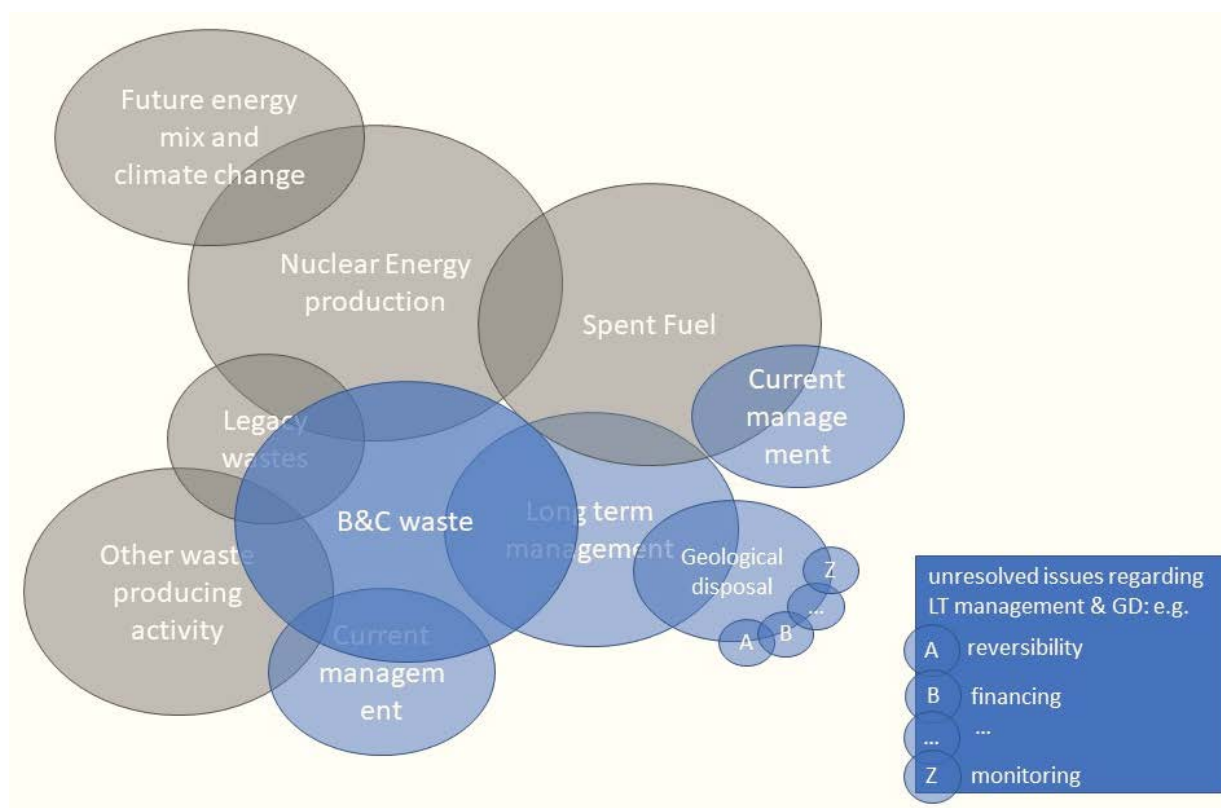


Figure 2 B&C waste as a multi-dimensional problem

Other countries have adopted similar approaches in the past. One example is the work of CoRWM in the UK,²⁰ an extensive three-year (2003–2006) national consultation by a dedicated committee to ‘consider how to

²⁰ <https://www.gov.uk/government/publications/managing-our-radioactive-waste-safely-corwm-doc-700>

manage the UK's higher activity radioactive waste in the long-term'. Another example can be found in Canada, where the NWMO devoted three years (2002–2005) to preparatory work setting up 'conversations about expectations' and dialogues for 'exploring the fundamental issues', before proceeding to 'evaluate management options' and subsequently proposing a management strategy.²¹ Within the Belgian context, this would imply revisiting the 2010 Waste Plan debate in part, **starting from the present situation, and looking towards the future.**

On the production side, debate is needed with regard to issues including:

- Nuclear power production
- New nuclear technologies
- The status of spent nuclear fuel

On the management side, the respondents identified the following as the minimum topics that should be addressed:

- Current storage practice
- Geological disposal
- Alternative or additional technologies
- Safety criteria related to current and long-term management options
- International collaboration
- Reversibility and retrievability as management principles
- Long-term financing and the 'nuclear provisions'

3.2.2 LET'S KEEP TALKING ABOUT HIGH LEVEL WASTE (AND SPENT NUCLEAR FUEL)

It is important to note that this research project proceeded from the seemingly dead-locked situation in which the process of developing the Waste Plan of 2011 had ended. More specifically, the process had failed to result in any political decision on geological disposal in poorly indurated clay, as requested by ONDRAF/NIRAS. As discussed above, however, some implicit decisions have been taken towards disposal (with clearly geological disposal in the minds of the decision-makers), thereby framing a future national policy. The questions that were posed to the respondents regarding their expectations for a governance process therefore focussed on general principles and the issue of 'What next?', and not on how to govern the implementation of any specific long-term management option (particularly geological disposal).

The plans of ONDRAF/NIRAS to launch a new Strategic Environmental Assessment (SEA) on geological disposal in April 2020 (at the demand of the Minister of Energy) were not clear at the start of this research project, and they were therefore not taken into account in the stakeholder enquiries. The Belgian radioactive waste manager had intended for this SEA to result in a decision in principle for geological disposal as the preferred management option, without linking it to any specific geological host environment, and by including several possible variations. Although this approach does allow for some opening up, it nevertheless seems to fall short on a number of expectations raised by the respondents in the current study.

Even though a large majority of the respondents to the survey identified geological disposal as the management solution that they 'considered interesting to further explore' (see WP3 report), they also reported doing this within a wider context, as explained above. It would therefore seem advisable to broadening the debate, rather than narrowing it, and ONDRAF/NIRAS is strongly advised **not to accelerate into a narrow mode of 'implementing geological disposal'**, should the SEA procedure lead to a political decision in favour of geological disposal as the 'ultimate solution' to the problem of B&C waste in Belgium.

For example, as indicated by the extended parliamentary debate in Germany concerning the work of the German Commission on the Storage of High-Level Radioactive Waste (*Kommission Lagerung hoch radioaktiver*

²¹ <https://www.nwmo.ca/en/Canadas-Plan/Selecting-APM-A-Three-Year-Study/Planning-for-the-Study>

Abfallstoffe), even within a context where geological disposal has been the official policy option for years, a debate aimed primarily at implementation (with the first step involving the definition of a siting strategy) merits the inclusion of broader issues, as discussed above. This process, which went on for about two years and culminated in a final report released in July 2016 (*Kommission Lagerung hoch radioaktiver Abfallstoffe* 2016), did manage to bring more sceptical voices to the table as well, and it appears to have advanced some general consensus on how to move forward, at least from the perspective of governance. This process was further accompanied by a nationwide, interdisciplinary research project, ENTRIA (Disposal Options for Radioactive Residues: Interdisciplinary Analyses and Development of Evaluation Principles). The project was funded by the German Federal Ministry of Education and Research (2013–2018), and brought together several universities with combined expertise in the areas of natural sciences, engineering, humanities, law, social and political science, as well as technology assessment. The overarching research topic was the **interdisciplinary development of evaluation principles** for three management options: final disposal in deep geological formations, with no arrangements for retrieval; disposal in deep geological formations, with arrangements for monitoring and retrieval; and long-term surface storage (Röhlig, 2019). A follow-up research project, TRANSENS (Transdisciplinary research on the disposal of radioactive waste in Germany),²² has since been launched, involving again a variety of academic disciplines, addressing four central topics: (1) flexibility and the ability to act in a reversible process; (2) stakeholder perspectives on the safety case; (3) trust in relation to technology, uncertainties and complexity; (4) dialogue and process design.

3.3 ORGANISATIONAL FEATURES

The following dimensions that were advanced by the respondents more specifically address the organisational features or principles of a long-term governance process for B&C waste.

3.3.1 FLEXIBLE AND STEPWISE

The long-term nature of the B&C waste problem calls for a reflexive, flexible and therefore stepwise governance process. For the respondents, this meant that the first and most important step should be to prepare an overall framework (and, ideally, to establish it in legislation), identifying key steps and general principles for ensuring participation on a continuous basis. The respondents' clear demand for continuous participation nevertheless does not mean that they expected such participation to take the same form throughout the process. On the contrary, they insisted that it should not be set in stone, but that it should be regularly reassessed and adapted according to the phases of the process and the audiences targeted.

These insights are not new. They echo the general principles (3) and specific actions (7) identified in 2004 by the OECD Nuclear Energy Agency (NEA) with regard to decision-making for long-term radioactive waste management (see Table 1). Recall that one of the cases that inspired these NEA principles was the partnership approach that had been adopted in Belgium for the long-term management of Category A waste.

All three of the NEA principles and the first four specific actions (see Table 1) were clearly recognisable in the expectations expressed by our respondents, even though they did not explicitly refer to them. The last three actions did not emerge in our results. This could arguably have been because our enquiry did not focus specifically on the issue of siting. One point that was less pronounced in the NEA's principles and actions, but that clearly emerged in the WP1 interviews was that **the first step** should consist of a **debate on general safety principles**, which should not be restricted to technical criteria, but that should also include social criteria and ethical principles. The participants regarded the federal level as the most appropriate for organising a debate on criteria regarding such aspects as location, technical options, economic (and other) incentives and public and stakeholder involvement, with an important role for the regulator, AFCN-FANC.

²² <https://www.transens.de>

3 General Principles

- *Decision making should be performed through visible, iterative processes, providing the flexibility to adapt to contextual changes*, e.g. by implementing a stepwise approach that provides sufficient time for developing a competent and fair discourse.
 - *Social learning should be facilitated*, e.g. by promoting interactions between various stakeholders and experts.
 - *Public involvement in decision-making processes should be facilitated*, e.g. by promoting constructive and high-quality communication between individuals with different knowledge, beliefs, interests, values, and worldviews.
-

7 Specific Actions

- To have an open debate on the national policy regarding energy production and the future of nuclear energy.
- To develop a broad understanding that the status quo is unacceptable and an important problem needs to be solved.
- To define clearly the actors and goals of the waste management programme, including the source, type, and volume of waste to be handled.
- To define a safe and technically and politically acceptable combination of waste management method and site.
- To identify one or more technically and politically acceptable site(s) for a waste management facility.
- To negotiate tailor-made compensation/incentive packages and community oversight schemes with host and neighbouring communities.
- To implement decisions by fully respecting agreements.

Table 1 Excerpt from NEA 2004: 40-41

With regard to the type of process envisioned by the respondents, they clearly indicated that, after 10 years, it would be desirable to conduct a follow-up on the process that was launched in 2009–2010, and that it should not be postponed until a decision in principle is taken on the long-term management of B&C waste. Given that no 'governance' process can exist if there is no room for debate (and negotiation) between stakeholders and public authorities in the decision-making process, **the choice to move towards a decision in principle without having invested in a joint problem definition and joint effort to identify options for problem-solving purposes is likely to risk undermining the legitimacy of further steps in the process.** This automatically touches upon the next dimension, which concerns the question of transparency.

3.3.2 PRACTICING TRANSPARENCY

As already introduced in this report, the respondents expected greater clarity and transparency from ONDRAF/NIRAS and other responsible actors concerning the problem of B&C waste and related issues. Putting this request for transparency into practice, the interviews and Delphi survey generated three clear expectations:

1. Active sharing of information on the issue at hand
2. Traceability of the decision-making process
3. Clarity about the link between participation and decision-making

3.3.2.1 ACTIVE SHARING OF INFORMATION ON THE ISSUE AT HAND

One clear message from the respondents is that **making information accessible is one thing; actively sharing it is another**. Particularly during the interview round, the respondents called for more effort to be invested in outreach and raising awareness and knowledge on the subject. They perceived the outreach activities that had been undertaken by ONDRAF/NIRAS to date as excessively fragmented in terms of both time and stakeholder groups. In this respect, several interviewees indicated they had expected some follow-up activity after the Waste Plan campaign of 2010. This is something that had also been called for by the Citizen Forum, which insisted on 'continuous societal debate' (KBS 2010: 7) and 'systematic deliberation with citizens' to keep politicians alert, to counter the dominance of powerful lobbies (e.g. waste producers) and 'to permanently mobilise and inform the population' (KBS 2010: 6).

The Delphi survey generated the suggestion to set up a high-quality, varied information system that could bring together contributions from multiple sources, including what respondents referred to as 'contradictory expertise'. The respondents also attached importance to the explicit identification of the relevant actors and their standpoints with regard to the issue of B&C waste. In this respect, it is interesting to note that, during the interview round, although most respondents acknowledged the technical expertise that ONDRAF/NIRAS has on the subject, many raised questions regarding the agency's independence, particularly in relation to the nuclear industry.

3.3.2.2 TRACEABILITY OF THE DECISION-MAKING PROCESS

The respondents further expressed the expectation that the process and decisions to be taken would be traceable. The expectations regarding clear milestones (as mentioned in Section 3.3.1) provide a good example. Given the multidimensional nature of the B&C waste problem and the fact that multiple actors share responsibility in the production and management of this waste (see Section 3.1), it is important to have a clear overview of the actors who have a say in the decision-making process and who is responsible for the governance of B&C waste.

That there could be some confusion on this point, is illustrated by the following example:

The task to make 'an inventory of all nuclear installations and sites containing radioactive substances', is assigned by law²³ to ONDRAF/NIRAS. On the waste manager's website, however, no such inventory can be found. Although ONDRAF/NIRAS does issue a 'Nuclear Liabilities Inventory', the nuclear liabilities to which it refers relate solely to '*decommissioned nuclear installations for which insufficient funds are available for decontamination and dismantling, due to a lack of foresight or underestimation of costs*'²⁴ In turn, the regulator (AFCN-FANC) refers to '*the obligation of the operator of a Class II and Class III establishment to maintain an appropriate inventory of radioactive sources and devices*', which requires only the transmission of specific data to the Agency.²⁵

The respondents' expectations regarding traceability were not limited to the process that lies ahead, but also referred to the process that lies behind. It is important for people who are considering the possibility of engaging in the governance process of B&C waste to know how the current situation was reached. The history of legislation relating to radioactive waste management in Belgium is nevertheless characterised by a relatively high level of obscurity. In 1980, the framework for a national waste management policy and its institutional organisation were 'buried' in Article 179 of a law on budget proposals.⁹ Subsequent amendments (e.g. those relating to the aforementioned example of the inventory of nuclear installations and sites or of fixed rates for waste producers),²⁶ which are themselves concealed in other 'potpourri' laws, have only added new layers of

²³ Law of August 8, 1980 as amended by the Law of December 12, 1997 (Moniteur Belge 18/12/1997).

²⁴ <https://www.niras.be/news/de-inventaris-van-de-nucleaire-passiva-uitstekend-instrument-om-de-nucleaire-kosten-ook-de>

²⁵ <https://www.fanc.fgov.be/nl/professionelen/medische-inrichtingen/inventarissen-radioactieve-bronnen-en-toestellen-en>

²⁶ Programme Law (1) of December 30, 2001 (Moniteur Belge 31/12/2001).

complexity. Even though the regulator, AFCN-FANC, does provide a comprehensive and updated overview of all regulation with regard to protection against ionising radiation on its website,²⁷ visitors to the website must devote some effort in order to become familiar with the details of the regulatory framework for radioactive waste management. Most importantly, however, regulations that are adopted as sections (e.g. as one or more articles) within budgets or programme laws lack clear statements and explanations concerning the legislative intent of such regulations.

Moreover, the interviewees expressed the perception that ONDRAF/NIRAS is hiding behind formal procedures, which many interpreted as an excuse for not engaging with stakeholders - with the 2010 Waste Plan campaign as a notable exception.

Finally, the respondents to the survey connected the need for a varied information system regarding the issues at hand to their demand to organise the traceability of the decisions taken, in addition to suggesting the adoption of a 'Pluralist Documentation Centre' (Parotte & Fallon 2020: p.50-55). According to the respondents, such centres were intended to collect and preserve relevant information from a variety of sources (e.g. public agencies, NGOs and the research community) and distribute it to a diverse audience, including politicians and the general public, as well as the scientific community and professionals in the field. Whereas nearly all of the respondents considered it important for such centres to be independent from the nuclear sector, their opinions were divided with regard to how this could be realised in practice. Some respondents argued for joint management by a broad range of stakeholders. Others considered this a role for a public body.

It could be argued that the current National Programme of 2015 offers at least some potential to provide the framework for an extensive documentation platform. This was at least the apparent legislative intention of listing the following elements as part of a 2014 National Programme in the Transposition Law¹⁹ (*author's own translation and synthesis*).

The National Programme shall also include:

- a) the overall goals aimed for in the National Policy measures issued for the management of spent fuel and radioactive waste;*
- b) important milestones and related timeframes;*
- c) an inventory of all spent fuel and radioactive waste, including amount and location, and predictions of future developments, including those resulting from decommissioning activity;*
- d) concepts, plans and technical solutions, from production to disposal;*
- e) concepts and plans for the period following the closure of a disposal facility, including how to maintain knowledge about the facility in the long term;*
- f) RD&D activity needed to implement management solutions;*
- g) responsibilities for implementing the National Programme, along with essential performance indicators for supervising this implementation;*
- h) cost estimates for the programme and the hypotheses on which they are based;*
- i) the available financing mechanisms;*
- j) the programme's transparency policy or process;*
- k) where appropriate, any agreements with other countries concerning the management of spent fuel or radioactive waste, including the use of disposal facilities;*
- l) the identification of additional requirements resulting from the interdependence of the various management stages, from production to disposal, in order to ensure their harmonisation and overall coherence;*
- m) information on any planned or actual changes to installations and/or practices that are likely to have an impact on the management of radioactive waste and spent fuel;*
- n) data on historical situations and any past or current occupational activities that have generated or are generating substances that could potentially be of a nature that qualifies as radioactive waste, as well as the basic principles of the methods envisaged for managing such radioactive waste in the event that its management cannot be ensured based on existing methods.*

Table 2 Excerpt from the Transposition Law of 3 June 2014

²⁷ <https://fanc.fgov.be/nl/reglementering>

At the same time, however, the Transposition Law also mentions both a National Programme and a National Policy, while remaining vague on the difference and relationship between the two. Whereas Belgium has had a National Programme since 2015, there is currently no clarity on the National Policy. Its composing elements are scattered throughout various types of legislation, and they are not entirely consistent on some points (e.g. the definition of radioactive waste in the Transposition Law¹⁹ differs from the one in the Royal Decree founding ONDRAF/NIRAS²⁰). Moreover, in some cases, they implicitly favour certain options (e.g. reversible disposal in the Transposition Law:¹⁹ *'The National Policy Measures...include modalities of reversibility, retrievability and monitoring for a period of time to be determined as elements for the design and operation of each repository...'*). The 2015 National Programme thus inevitably remains vague on the subject. Although it is limited to a description of the existing situation, it appears to have been written primarily as an administrative document intended to fulfil compliance with EU requirements (as called for by the 2011 Waste Directive¹⁷). To serve as a document for the initiation of a public dialogue on B&C waste management (as suggested in Section 3.2.1), some parts may need some rethinking. Part 2 nevertheless does provide a relatively concise, yet comprehensive overview of current practices relating to the management of spent fuel and radioactive waste. In this respect, it does truly appear to be the first of its kind. The actual document was published quite passively on the website of the Federal Ministry of Economy²⁸ under the theme of 'Energy'. The researchers did not find any reference to it on the ONDRAF/NIRAS website. Although AFCN-FANC does provide a link to the document on its website, included within a communication concerning a recommendation on national policy focussing on geological disposal, it can hardly be perceived as a wide disclosure of such an important document.

3.3.2.3 CLARITY ABOUT THE LINK BETWEEN PARTICIPATION AND DECISION-MAKING

In general, the respondents expressed the expectation that politicians at the appropriate levels of government should decide about the management of radioactive waste. They nevertheless insisted that stakeholders should be actively involved (or more actively involved) in the preparation of such decisions. Many respondents alluded to a sense that 'backroom politics' dominated the decision-making process on radioactive waste. This can be linked to the lack of transparency, as described in the previous section.

Several interviewees referred to the participatory approach involving local partnerships for Category A waste as an example of how things could be done differently (without implying that an identical decision-making process should be designed for B&C waste) and as an exemption to the rule in this field. A brief excerpt from the National Programme clearly demonstrates that the legislature has not invested heavily in providing any specific legislative framework for public participation, other than the general obligations regarding public access to government and access to information and public participation in decision-making on environmental matters (often transposed into Belgian law from international laws and conventions).

The lack of an explicit statutory obligation does not mean that no participatory process involving stakeholders can be established. For example, the activities of ONDRAF/NIRAS in 2009 and 2010 with regard to the elaboration of the 2011 Waste Plan clearly highlighted the possibility of envisioning supplementary participatory initiatives aimed at stakeholder groups and experts, as well as citizens, even beyond those prescribed by law (Parotte and Delvenne 2015). This nevertheless poses a risk of an inconsistent pattern in practices concerning radioactive waste and spent fuel policy to date, as again demonstrated by the information in the National Programme (see Table 4, which displays excerpts from Sections 5 and 7). The partnership approach for the long-term management of Category A waste and the societal consultation for the 2011 Waste Plan notwithstanding, current practices constitute passive ways of making information available, and the related communication is directed almost exclusively at official bodies, and not at other stakeholders.

The respondents to this research project clearly expected more. They insisted that, as a key feature of the long-term governance of B&C waste, public and stakeholder participation is not valid unless it ensures a genuine

²⁸ <https://economie.fgov.be/nl/themas/energie/federale-nucleaire/beheer-van-radioactief-afval/nationaal-programma-voor-het>

connection with the institutional decision-making process. At the start of the decision-making process, therefore, it should be clear what the purpose of participation is, when participation will be possible, what is open for discussion and how the input from stakeholders will be incorporated into the decision-making process.

In this respect, it should be noted that, however inviting and inclusive the intentions behind a formal participatory process may be, it is always important to bear in mind that, for various reasons, some stakeholders may remain outside such structures. A flexible, adaptive governance process should thus not ignore 'uninvited' forms of participation. In addition to looking inward (invited participation), such processes should be aware of what is happening on the outside (uninvited participation). It should continuously monitor its environment in order to be responsive to the opinions that are being raised, new issues that are arising or new stakeholders who are emerging over time or as new stages in the process are reached (see e.g. Cuppen 2018, Chilvers, Pallet and Hargreaves 2018).

4.2.6 Transparency and participation

Article 32 of the Constitution, which gives everyone the right to consult any administrative document and to obtain a copy of it, allowing for exceptions

Article 179, § 2, of the Law of 8 August 1980 (ONDRAF/NIRAS Law) [Belgian Official Journal, 1980], which, in particular, allows ONDRAF/NIRAS to create a "medium-term fund" to cover the costs incurred in creating and maintaining the required societal support to ensure the integration of a disposal project into a local community, particularly costs related to the activities and projects of the local community which, through a participative process, ensures the continuity of societal support for the repository

Royal Decree of 30 March 1981 (ONDRAF/NIRAS Royal Decree) [Belgian Official Journal, 1981], which requires ONDRAF/NIRAS to establish and implement an information and communication programme covering all its activities.

Law of 11 April 1994 on administrative publicity [Belgian Official Journal, 1994a]

Law of 15 April 1994 (FANC Law) [Belgian Official Journal, 1994b], which requires FANC to distribute balanced and objective information on the subject of nuclear security and radiation protection

Law of 9 June 1999 containing assent to the Convention on Environmental Impact Assessment in a Transboundary Context and Appendices I, II, III, IV, V, VI and VII, signed in Espoo on 25 February 1991 [Belgian Official Journal, 1999b]

Law of 13 February 2006 on the assessment of the effects of certain plans and programmes on the environment and on public participation in respect of the drawing up of certain plans and programmes relating to the environment (hereafter the "SEA Law") [Belgian Official Journal, 2006a], which transposes Directive 2001/42/EC and Directive 2003/35/EC which amends Council Directives 85/337/EEC and 96/61/EC

Law of 5 August 2006 on public access to environmental information [Belgian Official Journal, 2006b], which transposes Directive 2003/4/EC

Law of 17 December 2002 containing assent to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters and Annexes I and II, signed in Aarhus on 25 June 1998 [Belgian Official Journal, 2003c]

Table 3 Excerpt from the National Programme (National Programme Committee 2015: 16-17)

5 Management of spent fuel by its owners

5.1 Spent fuel from commercial nuclear power plants

Transparency and participation

Synatom sends the inventory of the quantities of spent fuel present in the facilities at the Doel and Tihange sites at 31 December of the previous year to the OECD, the IAEA and Euratom, annually and at their request.

Furthermore, Synatom holds regular consultation and information meetings with FANC during which all the subjects concerning the progress of projects and outstanding issues related to the management of spent fuel are addressed and analysed. Synatom also keeps FANC informed about any problem that may emerge in the management of spent fuel on the power plant sites.

Through its annual report, Synatom communicates more broadly about the management of its spent fuel, within the limits of its obligation to keep confidential any information deemed sensitive by the relevant authorities.

5.2 Spent fuel from commercial nuclear power plants

Transparency and participation

The bilateral agreement between Belgium and the French Republic on the reprocessing of spent fuel from BR2 at AREVA NC La Hague was subject to debate in the Belgian Parliament, the report of which is available on the Chamber and Senate websites.

7 Management of radioactive waste by ONDRAF/NIRAS

7.4 Systematic review of the management of category A, B and C waste

7.4.1 Category A waste (Table 4)

SHORT-TERM & MEDIUM-TERM MANAGEMENT

Transparency and participation: Websites and annual reports of ONDRAF/NIRAS and Belgoprocess, possibility to visit the BP1 and BP2 sites, information meetings.

LONG-TERM MANAGEMENT

Transparency and participation regarding post-conditioning and disposal:

Participation: partnerships methodology, underway since 1998:

co-development of preliminary integrated disposal projects with ONDRAF/NIRAS;

close consultation with ONDRAF/NIRAS for the development of the integrated project to be implemented.

Transparency: Maintaining transparency and participation is an integral part of the integrated disposal project.

ONDRAF/NIRAS' dedicated website, ONDRAF/NIRAS' electronic newsletter, websites of the STORA and MONA partnerships, cAt project leaflets, information evenings, open days, etc.; FANC website.

Transparency and participation regarding the post-closure phase: Maintaining transparency and participation until the controls are ended is an integral part of the integrated disposal project. Financing through a local fund, long after the closure of the repository, of projects improving the local quality of life will be the living memory of the repository.

7.4.2 Category B&C waste (Table 5)

Short-term & Medium-term management

Transparency and participation: Websites and annual reports of ONDRAF/NIRAS and Belgoprocess, possibility to visit the BP1 and BP2 sites, information meetings.

Long-term management

Transparency and participation regarding post-conditioning and disposal:

Transparency:

dedicated websites of ONDRAF/NIRAS and EURIDICE, possibility to visit the HADES underground laboratory; FANC website.

Participation as part of the development of the B&C Waste Plan:

societal consultation at ONDRAF/NIRAS' instigation in the form of a series of dialogue days, an interdisciplinary conference and a public forum;

consultation procedure with official bodies, including FANC, and the general public under the SEA Law, the results of which were taken into account when finalising the Waste Plan.

As with the disposal project for category A waste, in its B&C Waste Plan, ONDRAF/NIRAS plans to develop the long-term management solution for B&C waste within a participative framework.

Transparency and participation regarding the post-closure phase: In its Waste Plan, ONDRAF/NIRAS plans to conduct a societal consultation on the requirements for waste retrievability, controllability of the disposal system and knowledge transfer, this within the scope of the decision-making process to be established.

Table 4 Collected 'transparency and participatory practices' from the National Programme (National Programme Committee 2015: 20-21, 25, 41-44, 46-49)

3.3.3 MONITORING AND CONTROL

Finally, the respondents to the online survey expressed several expectations that could be categorised under the heading of 'monitoring and control'. It is important to stress that these respondents referred to a combined need for monitoring and follow-up of the long-term management strategy, as well as of the related governance process. In fact, they perceived an intrinsic link between these two elements.

A majority of the respondents insisted on the monitoring of the governance process, stemming from their demand that such a process should be flexible and adaptive (see Section 3.3.1). They expected both technical and societal aspects to be addressed jointly in the governance process, and thus also by any control mechanisms. In line with expectations regarding the role of the regulator (as discussed in Section 3.1.2), some respondents suggested making the role of the AFCN-FANC more active, in terms of providing information, adopting regulations and organising debates on safety aspects. In support of this suggestion, many respondents noted that it would be useful to establish an independent mixed pluralist body at the federal level. The possibility of establishing such an entity is provided for in the Transposition Law,¹⁹ which states, '*The National Policies include the modalities of follow-up of these policies, where appropriate by an independent multidisciplinary body*' as part of a new section §6 in Article 179 of the Law of 1980.⁹ The respondents did not express any clear views or expectations regarding the composition of such a body, although they did report expecting it to work closely with the public authorities to assess the B&C waste management process at a strategic level. To a lesser extent, the respondents thought that such a body could also be responsible for evaluating the operational process and public consultations.

Several respondents also advanced the possibility of engaging counter-expertise, particularly for affected communities (either now or in the future) at the local level as an important feature of a system of monitoring and control.

Finally, the respondents insisted on ensuring the principles of reliable financial management for B&C waste. According to their input, in the case of insolvency, the State should inevitably bear ultimate responsibility, and this should be clearly organised by considering the evolving nature of the costs, by presenting a risk analysis about insolvency scenarios of the producers and by ensuring strict control of the sufficiency of funds at the national and European level. At the national level, respondents suggested the organisation of financial control attached to Parliament (like the Court of Auditors). They further advanced the notion that opening the composition of the Nuclear Provisions Commission to other actors not directly associated with the nuclear world should be considered.

4 RECOMMENDATIONS FOR A GOVERNANCE PROCESS

This final section presents recommendations for ONDRAF/NIRAS and other actors and stakeholders in the B&C waste debate. Each of the recommendations addresses one or more of the dimensions discussed in previous sections. As indicated by the current research, the decision-making process and the long-term governance and management of B&C waste depends on the way in which the problem of radioactive waste is framed in policy and society, as well as by whom it is framed and why it is framed in that way. It is important to note that, when actors frame a problem, they usually also have some idea concerning the intended direction of the problem-solving process. Many of the respondents in the current study were apparently willing to support ONDRAF/NIRAS in its demand to take further steps with regard to the geological disposal of B&C waste as at least part of a long-term solution. In contrast, others did not (and possibly never will) support this solution, and those who did support it did not necessarily base their conclusions on the same problem definitions. It would therefore be very difficult, if not impossible to define any unilateral governance approach that could cover virtually all dimensions and expectations from all stakeholders in a satisfactory way. Multiple efforts and a mix of initiatives and responsive actions relating to new and unexpected developments will be needed in order to ensure engagement and maximum of transparency in the long-term governance process of B&C waste.

Several theoretical governance options (for ONDRAF/NIRAS and other stakeholders) in the radioactive waste debate are presented in the figure below. Although the figure is obviously a simplification of the complex problem of radioactive waste management, it does clearly demonstrate that important choices must be made in both policy and society with regard to the long-term management of B&C waste. These choices include such key governance questions as which options are available for the management of B&C waste, how stakeholders can be involved in the decision-making process, which types of participation are needed and when, what the organisation of the nuclear chain looks like, and the availability of room for public debate.

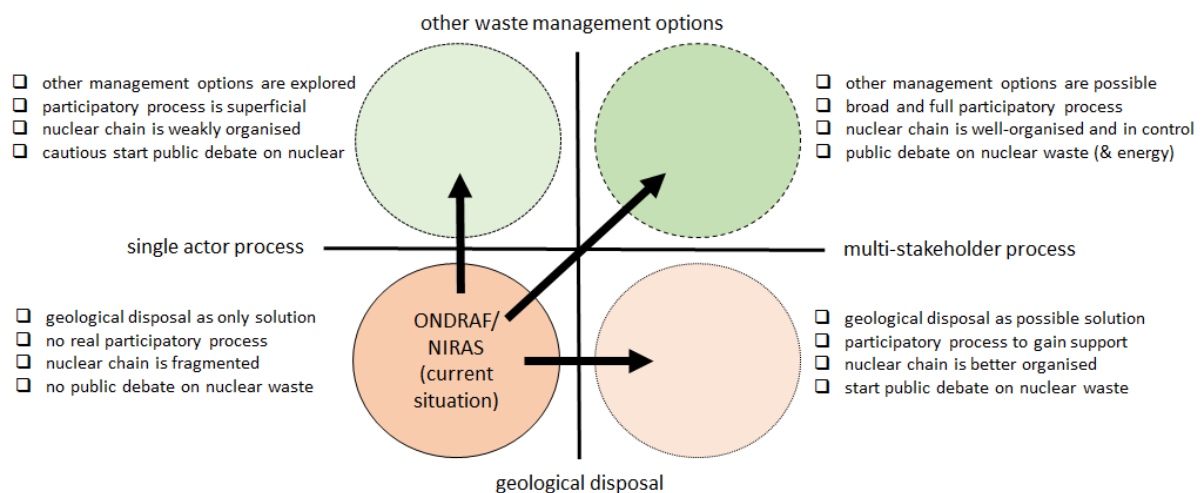


Figure 3 Governance options for B&C waste

As demonstrated by Figure 3, the current situation regarding B&C waste (lower-left quadrant) can be summarised as follows: geological disposal is the preferred and only solution; hardly any participatory process is in place to involve other stakeholders in the decision-making process; the nuclear chain is fragmented, no joint responsibility is taken for the radioactive waste stream; and there is no public debate on B&C waste or spent nuclear fuel. This governance approach need not persist forever (lower-right quadrant). For example, ONDRAF/NIRAS (and other stakeholders in the B&C waste debate) could try to cultivate more support for geological disposal. This would apparently require a participatory, multi-stakeholder process, including improvements in the manner in which actors within the nuclear chain organise themselves and take joint responsibility for the management of B&C waste. Such a change in the governance approach could serve as the

catalyst for a public debate on B&C waste and spent fuel. The shift from a multitude of single-actor processes towards a joint multi-stakeholder process is much more in line with the multi-dimensional and multi-actor characteristics of the long-term management of B&C waste (as also explained in previous sections of this report). Such a shift within the social dimension of the governance strategy is worthy of consideration (by ONDRAF/NIRAS and other stakeholders in the debate on B&C waste).

Instead of focusing on the actors and stakeholders in the radioactive waste debate, it would also be possible to make a cognitive shift in the governance strategy and, more specifically to reframe the problem of (and thus the solutions to) radioactive waste. Although this is a theoretical exercise, the future scenarios (as discussed with ONDRAF/NIRAS staff and management) clearly indicated that the future is highly uncertain and unknown. In the long-term management of B&C waste, many new developments and unexpected events will take place (e.g. renewable energy making nuclear energy obsolete, technological breakthroughs for transforming radioactive waste into a resource, other forms of organisation in society that could lead to the disappearance of current nation states, ...). The re-framing of the radioactive waste problem could possibly make other waste management options conceivable, and even feasible (see the upper left and upper right quadrants of Figure 3). The main difference between these two governance options has to do with fundamental questions concerning the extent to which and the manner in which the long-term management of radioactive waste is perceived as a joint responsibility of all stakeholders (upper right quadrant), or as a fragmented approach in which actors operate mostly in isolation (upper left quadrant). In short, re-framing the radioactive waste problem and opening up a variety of waste management options is also a conceivable governance strategy (for ONDRAF/NIRAS and other stakeholders in the debate on B&C waste).

The theoretical governance options presented in Figure 3 could be dismissed as fantasy and unrealistic. It should nevertheless be noted that the governance challenge ahead will involve arranging for the safe management of radioactive waste for a period ranging from several decades to hundreds of millennia. This is an extremely long period for which there no governance experience exists and in which many changes will take place, some of which can be anticipated, but most of which will be unexpected. For this reason, the governance strategy must also be flexible and adaptive (as discussed in previous sections of this report). The theoretical governance options presented here are intended to inspire the debate in policy and society concerning what the long-term management of B&C waste could look like and which governance options and choices are available to be made. The governance options presented here are definitely not intended as a blueprint. The nuclear issue is much too complex and 'wicked' to allow for that.

In addition to the theoretical governance options, this research project was intended to advance several more tangible recommendations regarding the design of a long-term governance process for B&C waste. These recommendations, which are presented in the following sub-sections, were deduced from the results of the interviews and survey conducted in this research project, combined with the researchers' previous experiences in European and international settings. They are structured around four statements:

- Long-term radioactive waste management is a socio-technical challenge.
- Regardless of its practical implementation, any long-term management solution is experimental by nature.
- One transparent and democratic way to address this challenge is through participatory technology assessment, preferably piloted by a mixed committee.
- Debates organised on these issues must take the form of multiple debates in multiple interconnected arenas.

4.1 LONG-TERM RADIOACTIVE WASTE MANAGEMENT AS A SOCIO-TECHNICAL CHALLENGE

Addressing radioactive waste safely both now and in the future undeniably involves a variety of social and technical aspects. Many of the respondents participating in the current research **emphasised the interconnectedness of these aspects and the need to integrate the socio-technical challenge into one and the same approach**. This is also a *leitmotiv* in the official communications of ONDRAF/NIRAS (see the four-leaf clover containing the interrelated environmental, societal, financial and technical dimensions). Despite such good intentions, however, most efforts involving public and stakeholder participation are directed towards what are regarded as social aspects, as has been established in international research (see e.g. the InSOTEC project).²⁹ It would therefore be worthwhile to consider four crucial observations from that project (Kallenbach-Herbert et. al 2014: 27-31), which focussed on interconnections between the various dimensions. These observations are directly related to expectations expressed by the respondents in the current research:

1. The process of managing radioactive waste is composed of a broad variety of interactions between humans and non-humans, in various constellations and spread out over both space and time. However robust or stable such a process may seem at a certain point in space or time, reconfigurations will inevitably occur in response to changes in the socio-political or economic context, in the accumulated knowledge base, in technology or other developments. Space, time, humans and non-humans are thus in constant interaction, and they bear a strong influence on each other.
2. Wider societal involvement entails more than simply offering citizens a way to express democratic values or cultivating approval for a previously elaborated technical fix. It means that new inputs must be used as input for the technical project, and *vice versa*.
3. If taken seriously, opening up the process to wider societal involvement has the potential to bring in alternative perspectives that could contribute to the creation of new knowledge and the identification of new solutions, which could subsequently influence technical choices.
4. Concerned societal actors could and should be invited to participate more explicitly in the technical debate, and their contributions to the debate should be encouraged to go beyond discussing the local impact of implementation of a specific technology on a specific location. The various dimensions are not mutually exclusive. They are seldom, if ever, the exclusive competence of any particular stakeholder, and every stakeholder should have the opportunity to take part in the debate on each dimension.

4.2 A SOLUTION, BUT OF AN EXPERIMENTAL NATURE

The term 'experimental' was not raised by the respondents themselves. Nevertheless, several interviewees pointed to the fact that the long-term management of radioactive waste is a 'first of its kind' endeavour, which cannot rely on past experience from similar projects (in any case, not for another century or so, at the very least). On the one hand, this calls for a particular type of governance in order to cope with uncertainty over a long period of time. On the other hand, as indicated by the interviewees, even with regard to a specific technical solution (e.g. geological disposal), various interpretations currently exist with regard to what this implies in practice (e.g. with regard to the notions of reversibility and retrievability, or the relative necessity of monitoring). They further noted that these issues are likely to persist for some time, which could be seen as positive, as it creates room for dialogue.

Various authors have labelled the long-term management of high-level radioactive waste, and geological disposal in particular, as 'experimental' or as 'an on-going process of technological innovation' (see e.g. Barthe and Lijnhart 2010, Felt et al. 2007, Kallenbach-Herbert et. al 2014; Landström and Bergmans 2015; Parotte 2018,

²⁹ The InSOTEC project (International Sociotechnical Challenges for implementing geological disposal) was a 40 month (2011-2014) social science research project funded by the European Atomic Energy Community's 7th Framework Programme FP7/20072011 under grant agreement n°2699009.

2020). Considering the time frames associated with the nature of radioactive waste, as well as with the implementation of any long-term management strategy, it is not unlikely that, at present, we are not able to envisage all of the changes or potential problems that could arise over time. This view was clearly acknowledged by most respondents.

The long-term management of radioactive waste calls for a different governance approach that is capable of coping with uncertainties and allowing room for social (and other types of) learning. The comments of the respondents are thus in line with observations from previous research, proposing that understanding the implementation of a long-term management programme is 'a (scientifically) controlled, open-ended exploration towards a possible solution' (Kallenbach-Herbert et. al 2014: 29). In concrete terms, this implies:

1. The need to maintain the capacity for technical innovation and scientific knowledge, and the continuation of research programmes as part of the implementation process, as explicitly indicated by the respondents
2. Letting go of a classic project-based approach, with a clear beginning and end (Fallon et al. 2012, Kallenbach-Herbert et. al 2014, Parotte 2018, Zwetkoff 2012)
3. Identifying regular or milestone 'meeting points', rather than having a rigid roadmap that is etched in stone (Barthe et al. 2010, Kallenbach-Herbert et. al 2014, Parotte 2018). Such milestones could also be understood as a form of momentum for assessing the ongoing process and guiding the process of progressive participation, as called for by the respondents to the Delphi survey.

4.3 A MIXED COMMITTEE TO PILOT A PROCESS OF PARTICIPATORY TECHNOLOGY ASSESSMENT

As indicated by the responses to the survey, there is a tendency to regard the governance process surrounding B&C waste as a process of participatory technology assessment, to be applied in various phases of decision-making and at various levels of government. According to the respondents, such a process could be piloted by a mixed committee of scientists from various disciplines (the exact sciences, the social sciences and the humanities) and representatives of a variety of stakeholder groups, including local communities that are directly involved. With regard to particular aspects (or dimensions, as discussed in the following section), specific consultations could be arranged at specific points in time, aimed at a diverse range of stakeholders or existing advisory bodies.

The Transposition Law¹⁹ (Art. 4) provides for the possibility of adopting an 'independent multidisciplinary body' to follow up on the National Policy on radioactive waste and spent fuel. In the interpretation of the researchers, this committee is intended to co-construct the National Policy, instead of taking the more passive role of merely following up on it. One option would be to install a long-standing committee with rotating membership (but not replacing all members at the same moment, in order to guarantee continuity in the process), linked to Parliament in an advisory capacity (at the Federal level and, potentially, at the level of Regional Government), reporting back on its activity at distinct moments throughout the process.

4.4 ORGANISING MULTIPLE DEBATES IN MULTIPLE INTERCONNECTED ARENAS

To answer the respondents' explicit call to address the long-term management of B&C waste as a multi-dimensional issue (see Figure 2), ONDRAF/NIRAS is strongly recommended to adopt a multi-level stakeholder approach in order to address this issue. All respondents agreed to the motto of 'our waste, our responsibility', which means that the federal, regional and local institutional levels should all be addressed, although not necessarily together or always at the same time.

We suggest that this multi-level approach should be embedded within an even broader ambition striving for multiple debates in multiple interconnected arenas. As previously argued (see Section 3.1.2), this is not a task for ONDRAF/NIRAS alone. It would be extremely challenging, if not impossible to address the multiple

dimensions of the B&C waste problem (as presented in Figure 2) in any single process or arena. Rather than incorporating all of these dimensions into the debate on the long-term management of B&C waste (or a governance process to that end), therefore, it is possible to envisage a different framework: one within which various actors are mandated to organise a broad stakeholder debate on one (or more) particular aspects. It would not be necessary for all of these debates to keep the same pace or engage with exactly the same actors at the same governmental levels. Such an approach could nevertheless place the question of the long-term governance of B&C waste in a broader perspective and help to meet the range of related expectations from various actors involved in the process.

In the following sections, we illustrate this approach for three potential arenas.

4.4.1 TALKING ABOUT HIGH-LEVEL WASTE (AND SPENT FUEL): PART 2

To this end, ONDRAF/NIRAS could start by joining forces with the other members of the National Programme Committee, as well as with competent regional-level authorities regarding environmental and energy policy, in order to design a multi-actor governance process that is capable of flexibly incorporating the strands of debate that Belgian stakeholders have identified as important. Acknowledging the need for a clear boundary between implementer and regulator, the respondents in the current research reported expecting the latter, AFCN-FANC, to be visible in such a process. **In order to reach out to various stakeholders, it is necessary to enhance the plurality of frames in the debate. This requires investment, and a dedication to embracing a new approach to public management** (e.g. as has been the case in Canada). One way of guaranteeing an open and inclusive view could involve the creation of a multidisciplinary task force, attached to the National Programme Committee, for the purpose of preparing the process. Inspiration for such a task force could be found in the composition of the Swedish nuclear waste council (*Kärnavfallsrådet*), the British Committee on Radioactive Waste Management (CoRWM) or the German Commission on the Storage of High-Level Radioactive Waste (*Kommission Lagerung hoch radioaktiver Abfallstoffe*). Participants in the online survey suggested engaging various types of actors in such a task force, referring to experts on technical, social, ethical and financial aspects, along with environmental NGOs, federal and regional administrations and local communities. It is important to stress that, within the institutional constellation of Belgium, such a multi-actor governance process should simultaneously be a multi-level process, entailing at least a federal and a regional component. As indicated above (see Section 3.3.2.2), the current national programme could serve as a foundation for debating at least the issues relating to management (as listed in Section 3.2.1) and the status of spent fuel within such a multi-level, multi-actor process.

It would also be advisable to consider the installation of local 'site-stakeholder groups' (following, but not mimicking, the example of the NDA in the UK) at all locations where B&C waste and other high-level radioactive materials (and particularly spent fuel) are already present in substantial quantities. As discussed earlier in this report (see Section 3.2.1), such communities are the primary stakeholders in this matter. They will be affected regardless of any decision taken on a long-term waste management strategy, and they should therefore be explicitly involved in any related governance process. The structure of these site-stakeholder groups could be inspired by the experiences of the local partnerships in Dessel and Mol, but they should primarily be designed in ways that correspond to the specific situations of the individual localities.

As part of this approach, it could be considered to target young people as a specific stakeholder group at any or all of the relevant policy levels. Several options could be imagined: scenario workshops or an exercise resembling a citizen jury, designed specifically for adolescents or for young adults between 18 and 35 years of age; or appointing a youth panel to study the problem of B&C waste during a dedicated period and formulate recommendations to Parliament or to a pilot committee (e.g. as described above).

4.4.2 TALKING ABOUT HIGH-LEVEL WASTE AND SPENT FUEL IN RELATION TO NUCLEAR ENERGY PRODUCTION

In an ideal scenario, such a governance process would be either preceded or accompanied by a public debate on the national energy policy. For example, this was the case in Germany, where the radioactive waste debate was launched (or re-launched) several years after 'A collective project for the future' for the country's energy transition, which was discussed and presented in 2011 by a transdisciplinary 'Ethics Commission for a safe energy supply'.³⁰ Although it is not the role of ONDRAF/NIRAS to organise a public debate on Belgium's future energy mix and the role of nuclear energy production within such a debate, the debate on radioactive waste cannot be postponed indefinitely. Nuclear energy and radioactive waste are undeniably interconnected, as also claimed by the respondents in the current research (see Section 3.1.1), as well as by other observers (e.g. Laes 2015). In this respect, the recent decision of the Belgian Constitutional Court (March 2020)⁷ to quash the decision to extend the lifetime of Doel 1 and Doel 2 reactors (see Section 1) could be seen as an opportunity. In response, public consultations should be organised with regard to the extension of Doel 1 and Doel 2. In this sense, nuclear energy policy and radioactive waste could be coupled.

Recognition of the interconnectedness existing between nuclear energy and radioactive waste could and should be made more explicit by directing more attention in the B&C waste debate to the impact of various future scenarios for nuclear energy production, as well as for other nuclear technologies and for the management of spent fuel on the B&C waste inventory and related management strategies. **This would meet a primary concern expressed by the respondents participating in the current research with regard to the need to raise awareness amongst a variety of stakeholders and to engage them in the joint definition of the problem and analyses of potential solutions.**

4.4.3 KEEPING AN EYE ON THE FUTURE

In order to support reflexivity in a governance process that is intended to continue for several decades, and with a time horizon for implementation of the radioactive waste management strategy for several hundreds to thousands of years in the future, it is recommended to organise future explorations on a regular basis. Such exercises are useful for strategic discussion within organisations (as was done for this research project in WP2; see Section 2.3), but they could also be useful as part of a long-term multi-stakeholder governance process.

For example, a Futures Committee could be established, in which ONDRAF/NIRAS and various other actors engage in the joint discussion of fluctuating or evolutionary aspects relating to the long-term management of B&C waste and spent nuclear fuel as a multi-stakeholder process, with the insights derived from such discussions being used as input for the governance process. Such a Futures Committee need not take the form of a standing committee, but could involve a more recurrent, *ad hoc* group that could be composed through self-invitation by interested stakeholders from a variety of backgrounds, or as a more representative sample of the interests at play at a particular moment in the governance process. Various strategies are conceivable, and an inclination for out-of-the box thinking by the participants could arguably be an important, if not the decisive factor in considering the various compositions of such a committee. Within this context as well, it could be possible to arrange a dedicated process for young people.

4.5 THE IMPORTANCE OF TAKING KNOWLEDGE SOCIETY SERIOUSLY

Planning a governance process for the long-term management of high-level radioactive waste is a long-term prospect. Planning ahead indefinitely is not possible, and it was not expected by the respondents. As demonstrated by the experiences of the Category A partnerships, however, opening up a governance process

³⁰ <https://www.bmu.de/download/deutschlands-energiewende-ein-gemeinschaftswerk-fuer-die-zukunft/>

to the public and allowing room for stakeholder participation is likely to require much more time and effort than originally anticipated, although its results are also likely to be better than expected.

The importance of a reflexive, flexible and stepwise governance approach cannot be emphasised enough. To paraphrase Felt et al. (2007), it remains a challenge to take the knowledge society seriously. In the case of B&C waste management, this challenge implies two concrete actions. First, **it requires an empathic attitude towards the needs and expectations of all stakeholders** in the radioactive waste and nuclear energy debate, and particularly those who are directly affected (e.g. local site communities and citizens), throughout the entire length of the process. Second, **it means taking into consideration that the way in which radioactive waste management is envisioned could be challenged and modified over time**, as argued in the description of Figure 3.

From that perspective, the authors of this report did not consider it advisable for ONDRAF/NIRAS to launch a public consultation on a new Strategic Environmental Assessment (SEA) on the long-term management of B&C waste on 1 April 2020. This was due in part to the national lockdown during the first wave of the COVID-19 crisis. It was also because the consultation was restricted to a general choice of long-term management technology: the assessment of two variations of geological disposal. The framing of the solution and the timing of the consultation could potentially hinder ONDRAF/NIRAS (and other stakeholders) from taking serious steps towards a more mature governance approach to issues relating to nuclear energy and radioactive waste. Although this report offers building blocks for such a governance approach, it will be up to ONDRAF/NIRAS and others to make use of them and act accordingly.

4.6 CONSIDERING B&C WASTE AND SPENT FUEL AS MATTERS OF CARE

This project highlights how the current assessment of the B&C waste programme and its future is not purely a matter of fact. It is also matter of concern (Latour 2004) to many and, for some, it is clearly a matter of care (Puig de la Bellacasa 2011), as explained in greater detail in this concluding section.

A 'social life' is attached to B&C waste and spent fuel. The way in which such radioactive materials are to be managed is not only a matter of established facts, but also of interests and 'concerns'. Facts and concerns are indeed intimately interrelated: 'matters of facts are processes of entangled concerns' (Puig de la Bellacasa 2011: 89). Concerns 'add reality' to facts (Latour 2004: 232). They attach and hold together matters of fact, and they help to 'enrich and affirm their reality by adding further articulations' (Puig de la Bellacasa 2011: 89).

Like all other actors involved in the management programme, ONDRAF/NIRAS produces 'matters of concern' or appreciations, strongly entangled with its matters of fact.

In some cases, situations may consist of more than the inter-related matters of facts and concerns: they are 'matters of care'. But what does this mean exactly? In any situation, our practices, discourses and engagement regarding a particular issue are likely to differ according to our answers to several crucial questions: 'Is it a fact?' 'Am I concerned?' 'Do I care?' (Puig de la Bellacasa 2011). Applied to B&C waste and spent fuel, these questions could be answered as follows: 'The waste is already here and it must be managed'; 'I am concerned by the future of these radioactive materials'; and 'I care about the way they are handled'.

Facts can be established, but they can also be unclear or disputed. Concerns and interest can differ, and possibly even clash. The notion of care entails a stronger promise of common ground, of a basis from which to start, even though caring can also be enacted in a variety of ways. Considering B&C waste and spent fuel as matters of care changes the way in which actors are engaged in the programme and the way in which they frame it. 'Caring' has three concrete consequences:

- First, and related to concern, care has strong affective ethical connotations. Concern denotes worry and thoughtfulness about an issue, while care adds a strong sense of attachment.

- Second, the more one cares, the more one will be actually engaged in the process: the individual or organisational commitment to the object becomes stronger, as does criticism against it.
- Those who 'care' develop a stronger sense of responsibility and a particular vision of the current state and future of things.

With this in mind, we advise ONDRAF/NIRAS to consider starting from the notion of 'caring' (for the waste and for its environment) in the development of its long-term governance programme. Three key messages are important in this respect, in order to assure and allow a genuine process of thinking and acting with 'care' by all actors concerned: (1) caring is not the same as managing; (2) one can never care alone; and (3) multiple forms of narratives on care and caring can co-exist.

4.6.1 CARING IS NOT THE SAME AS MANAGING: DOES ONDRAF/NIRAS REALLY CARE?

First, caring is not the same as managing. Caring does not require any legal mandate, related position or expertise. It can be highlighted by actions (what people do), promoted ethics (this is the right thing to do) or the labour of maintenance (invisible daily practices of people). There are multiple ways of caring, as well as a variety of 'carers' (i.e. people who care).

The notion of 'caring' requires a regular re-assessment of the decision-making process in view of the following concrete questions: 'Who cares, and what are their concerns?' 'What are the critical standpoints?' 'Who will do the work of care, how should it be done, and for whom?' (Puig de la Bellacasa 2011).

As a waste management agency, 'caring' about the future of B&C and spent fuel does not mean that ONDRAF/NIRAS should 'control' the entire ongoing process. It means being in charge, and 'taking care', despite all of the unexpected things that might change the initial programme.

Recommendation: Reflections on 'caring' and its consequences should start *within the organisation*. If caring is not the same as managing, what should 'caring' mean for members of the ONDRAF/NIRAS staff? Who are the people inside ONDRAF/NIRAS who 'care' more than 'being legally concerned' about the issue?³¹

4.6.2 ONDRAF/NIRAS CAN NEVER 'CARE' ALONE

In addition to the staff and management of ONDRAF/NIRAS, there are multiple committed people and organisations who could either challenge or support the programme. These individuals are just as engaged with 'caring', despite differences in the ways in which they care and the dimensions on which they focus first. Engaging other stakeholders in the governance of B&C waste implies allowing other forms of caring to enter the game.

A commitment to 'caring' entails 'remain[ing] speculative' and not letting 'a situation or a position [...] define in advance what is or could be' (Puig de la Bellacasa 2011: 96). Given that 'introducing care requires critical standpoints that are careful' (ibid.), it should not be decided in advance whether specific positions or standpoints are relevant to the programme. 'It can be said that standpoints manifest visions that have become possible by learning to care for some issues more than others' (ibid). In addition, one must 'care' for the different standpoints, keeping in mind that situations could have been different. Within the context of the long-term governance of B&C waste, the objective is not only to expose or reveal care practices and matters of concern; it

³¹ This entails maintaining reflexive practices regarding several questions: What are the employees of ONDRAF/NIRAS particularly attached to? What do they refuse to detach themselves from? Why do they refuse to be detached? How do they react to other people (outside the institution) who care? What place does the agency give to other forms of care that do not arise from within, or from legal public consultations? Is the existence of these other forms of 'care' acknowledged? Does this change the agency's vision?

is also to generate them. In turn, this means that there is no fixed future for B&C waste and spent fuel, but that there are multiple ways of caring about the futures of the programme.

The results of this research project clearly highlight the stakeholders who care³² and which dimensions matter to them.

Recommendation: We stress that ONDRAF/NIRAS should focus primarily on those stakeholders who care, and that they should not proceed from the positions that are shared by these 'carers', but from their shared uncertainties. Many socio-technical uncertainties are involved in such a programme: What are they? What should the management principles be? How should we respond to them?

4.6.3 THERE IS NO MONOPOLY ON A CARE NARRATIVE

There are multiple narratives and practices of care. Beyond recognising of the various forms of care, the challenge is to allow these forms of care to co-exist. The challenge for a governance programme is thus not a question of identifying any dominant form of care, as this would prevent other forms of care from existing or being heard. A governance programme is also not merely a way to communicate a pre-determined management programme. The future governance programme for B&C waste should not be the reflection of any single dominant narrative (e.g. that of ONDRAF/NIRAS). Rather, the key question should concern how multiple care narratives can be allowed to co-exist within a single long-term governance programme for B&C waste (and spent fuel).

Recommendation: Given that ONDRAF/NIRAS never cares alone, it could mobilise other potential supporters to allow the various narratives to co-exist. Could there be a leading role in this process for the 'independent pluralist body', as advanced in the Transposition Law? Could such co-existence be established by setting up regular official 'meeting points' where the concerns of critical 'carers', official 'carers' or 'concerned others' meet? Could AFCN-FANC play a part in arranging these meeting points (e.g. by organising a meeting point for 'matter of care' on safety issues)? Could a Nuclear Provisions Commission (or a revision thereof) do the same for economic issues? In line with the earlier recommendation to organise multiple debates in multiple interconnected arenas (see Section 4.4), these agencies should not replace existing meeting points, but provide additional ones that are distinct from ONDRAF/NIRAS. Regardless of the path that is chosen, these actors thus do contribute to the decision-making process and long-term governance programme proposed by the agency.

4.7 IN CONCLUSION

Planning a governance process for the long-term management of high-level radioactive waste is a long-term prospect. For this reason, the importance of a reflexive, flexible and stepwise collective governance approach cannot be emphasised enough. Such an approach should be based on multiple views of caring for this material, and it should be carried by multiple 'carers', both now and in the future. This will require an empathic attitude towards the needs and expectations of all current and future stakeholders in the debate on nuclear energy and waste.

It appears that ONDRAF/NIRAS is once again at a crossroads. In the absence of a decision in principle concerning the future of B&C waste and spent fuel, ONDRAF/NIRAS has the opportunity to show that it cares more than it

³² For example, the 45 people representing 25 different actors interviewed for WP₁; the ONDRAF/NIRAS staff members participating in WP₂; the 242 people who agreed to participate in the WP₃ survey representing agencies (control, management), administrations, pro-nuclear and anti-nuclear NGOs, and concerned citizens. As mentioned previously in this report, it should be noted that some 'carers' refuse to be involved in the decision-making process (e.g. Greenpeace or engaged citizens). These parties provide clear visions of what they regarded as desirable or undesirable, and they also generate a form of 'care' that should be taken seriously: they criticise the process from the outside and contribute to it in other ways.

manages. Caring involves assuming that socio-technical uncertainties will remain, regardless of the preferred long-term option. Caring also involves allowing *real* spaces for others who care to express what they care about and how they desire to do so. Caring does not consist of providing any pre-determined initial programme, but it does involve ensuring that B&C waste and spent fuel are being taken care of through a collective and open decision-making and governance process.

Caring for the waste and its environment calls for a paradigm shift at three levels:

- Approach the waste as matter of care. Acknowledge multiple ways of caring, and allow them to co-exist, establishing common ground by proceeding from shared uncertainties rather than from shared 'facts'.
- Start by talking about waste first, before talking about waste management solutions: establish a community of those who care about the waste, and not only those who care about a particular end-point for it.
- Engage with all stakeholders who care, and in particular those who are directly affected, including local (and on-site) communities and citizens. This should be done throughout the entire length of the process, thus inevitably spanning several decades and generations of stakeholders. Although intergenerational engagement is an ideal goal, it can be reached only by starting with the present generation in a collective and open process of decision-making and governance.

5 REFERENCES

- Barthe, Y., Callon, M. and Lascoumes, P. (2010). 'De la décision politique réversible: histoire d'une contribution inattendue de l'industrie nucléaire (française) à l'instauration de la démocratie dialogique'. *Brazilian Journal of Urban Management*. 2(1): 57-70.
- Barthe, Y., Lindhart, D. (2009). *L'expérimentation: un autre agir politique*, CSI working papers series n°13. halshs-00352411. <https://halshs.archives-ouvertes.fr/halshs-00352411/document>
- Bergmans, A., Elam, M., Sundqvist, G., Kos, D., Polič, M., Simmons, P. and Walls, J. (2008). *Wanting the Unwanted: Effects of Public and Stakeholder Involvement in the Long-term Management of Radioactive Waste and the Siting of Repository Facilities*. Final Report of the CARL project - ISBN 978-90-5728-170-9
- Bergmans, A., Sundqvist, G., Kos, D. and Simmons, P. (2015). 'The participatory turn in radioactive waste management: deliberation and the social-technical divide', *Journal of Risk Research*, 18(3): 347-363. DOI: 10.1080/13669877.2014.971335.
- Blowers, A., Lowry, D. and Solomon, B.D. (1991). *The International Politics of Nuclear Waste*. London: Palgrave Macmillan UK.
- Brunnengräber, A., Di Nucci, M.R., Isidoro Losada, A.M., Mez, L. and Schreurs, M.A. (Eds.), *Governance of Nuclear Waste Management: An International Comparison*. Wiesbaden: Springer Fachmedien. DOI: 10.1007/978-3-658-08962-7.
- Chilvers, J., Pallet, H. and Hargreaves, T. (2018) 'Ecologies of participation in socio-technical change: The case of energy system transitions'. *Energy Research & Social Science*. 42: 199-210. DOI: 10.1016/j.erss.2018.03.020.
- Cuppen, E. (2018) 'The value of social conflicts. Critiquing invited participation in energy projects'. *Research & Social Science*. 38: 28-32. DOI: 10.1016/j.erss.2018.01.016.
- FANC (2011) *Advies van het FANC betreffende NIRAS documenten: ontwerp van Afvalplan en bijhorende SEA*. Nota nr.010-149N. <https://fanc.fgov.be/nl/system/files/advies-fanc-afvalplan-2011.pdf>
- Fallon, C., Parotte, C., Zwetkoff, C., Bergmans, A. and Van Berendoncks, K. (2012). *Socio-Political Processes and Plan Management in Controversial Settings applied to the Plan for the Long-Term Management of Type B&C Waste – Summary Report*. Liège: University of Liège & University of Antwerp.
- Felt, U., Wynne, B., Callon, M., Gonçalves, M. E., Jasanoff, S., Jepsen, M., Joly, P.-B., Konopasek, Z., May, S., Neubauer, C., Rip, A., Siune, K., Stirling, A. and Tallacchini, M. (2007). *Taking European Knowledge Society Seriously*. Luxembourg: Office for Official Publications of the European Communities. https://ec.europa.eu/research/science-society/document_library/pdf_06/european-knowledge-society_en.pdf
- Kallenbach-Herbert, B., Brohmann, B., Simmons, P., Bergmans, A., Barthe, Y. and Martell, M. (2014). *Addressing the Long-Term Management of High-level and Long-lived Nuclear Wastes as a Socio-Technical Problem: Insights from InSOTEC*. InSOTEC Deliverable 4.1. Brussels: EC.
- KBS (2010). *Publieksforum 'Hoe beslissen over het langetermijnbeheer van hoogradioactief en langlevend afval?' – Eindrapport*. <https://www.kbs-frb.be/nl/Virtual-Library/2010/295082>
- Bundesrat (2016). *Verantwortung für die Zukunft: Ein faires und transparentes Verfahren für die Auswahl eines nationalen Endlagerstandortes*. Abschlussbericht der Kommission Lagerung hoch radioaktiver Abfallstoffe. Drucksache 448/16. Berlin: Deutsche Bundestag. <https://www.bundesrat.de/SharedDocs/drucksachen/2016/0401-0500/448-16.html>
English Summary: <http://www.nuclear-transparency-watch.eu/activities/radioactive-waste-management/english-summary-of-the-report-of-the-german-commission-on-the-storage-of-high-level-radioactive-waste.html>
- Laes, E. J. W. (2015). Een ethisch-hermeneutische benadering van het Belgische kernafvalbeleid. *Ethische Perspectieven*, 25(4), 288-300. DOI: 10.2143/EPN.25.4.3132140.
- Landström, C. and Bergmans, A. (2015). 'Long-term repository governance: a socio-technical challenge', *Journal of Risk Research*, 18(3): 378-391. DOI: 10.1080/13669877.2014.913658.
- Latour, B. (2004). 'Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern'. *Critical Inquiry* - Special issue on the Future of Critique. 30 (Winter 2004): 225-248.

- Meyermans, A., Cools, P., Bergmans, A. (2019). *Monitoring in Geological Disposal & Public Participation: A Stakeholder Guide*. MODERN2020 Deliverable 5.2. Antwerp: University of Antwerp. SBN: 9789057286148 <http://www.modern2020.eu/news/publication-of-the-stakeholder-guide.html>
- National Programme Committee (2015). *National Programme for the Management of Spent Fuel and Radioactive Waste*. First edition, October 2015 - Courtesy translation. Brussels: PS Economy, S.M.E.s, Self-employed and Energy - Directorate General for Energy, Nuclear Energy Division. <https://economie.fgov.be/sites/default/files/Files/Energy/National-programme-courtesy-translation.pdf>
- NEA (2004). *Stepwise Approach to Decision Making for Long-term Radioactive Waste Management. Experience, Issues and Guiding Principles*. NEA No. 4429 Paris: OECD. ISBN 92-64-02077-2. <https://www.oecd-nea.org/rwm/reports/2004/nea4429-stepwise.pdf>
- Parotte, C. (2018). *L'Art de gouverner les déchets hautement radioactifs*. Liège : Presses Universitaires de Liège – ed. Science Technologie et Société.
- Parotte, C. (2020). 'A nuclear real-world experiment: Exploring the experimental mindsets of radioactive waste management organisations in France, Belgium and Canada'. *Energy Research and Social Science*. 69: Epub 2020 Sep 2. DOI : 10.1016/j.erss.2020.101761.
- Parotte, C. and Delvenne, P. (2015) 'Taming uncertainty: towards a new governance approach for nuclear waste management in Belgium'. *Technology Analysis & Strategic Management*, 28(8), 986-998. DOI: 10.1080/09537325.2015.1044429.
- Petit Jean, M. and Brunet, S. (2017). Does Anticipation Matter for Public Administration? The Case of the Walloon Region (Belgium). *Foresight* 19 (3): 280–90. DOI : 10.1108/FS-10-2016-0049.
- Puig De La Bellacasa, M. (2011). 'Matters of care in technoscience: Assembling neglected things'. *Social Studies of Science*. 41 (1): 85-106. DOI: 10.1177/0306312710380301.
- Röhlig, K.J. (2019). The ENTRIA Project (2013-2018). First Steps towards Sociotechnical Radioactive Waste Management Research in Germany. In: Brunnengräber A., Di Nucci, M.R. (Eds.), *Conflicts, Participation and Acceptability in Nuclear Waste Governance. An International Comparison Volume III*, p. 311-322; Energiepolitik und Klimaschutz. Energy Policy and Climate Protection. Springer VS, Wiesbaden. DOI: 10.1007/978-3-658-27107-7_15
- Sabatier, P. A. (1988). An advocacy coalition framework of policy change and the role of policy-oriented learning therein. *Policy sciences*, 21(2-3), 129-168.
- Schröder, J., Bergmans, A., and Laes, E. (2015). Advanced research, lagging policy: nuclear waste governance in Belgium. In: Brunnengräber, A., Di Nucci, M.R., Isidoro Losada, A.M., Mez, L. and Schreurs, M.A. (Eds.), *Nuclear Waste Governance*, p. 141-155; Energiepolitik und Klimaschutz. Energy Policy and Climate Protection. Springer VS, Wiesbaden. DOI: 10.1007/978-3-658-08962-7_6.
- SKI (2004). *Transparency and Public Participation in Radioactive Waste Management*. RISCOS II Final Report. https://cordis.europa.eu/docs/projects/files/FIKW/FIKW-CT-2000-00045/67373851-6_en.pdf
- Turcanu, C., Perko, T., Schröder, J. and Abelshausen, B. (2018). *The SCK-CEN Barometer 2018. Nuclear technologies and society: a survey among the Belgian population*. Mol: SCK-CEN. [https://publications.sckcen.be/portal/en/publications/the-sckcen-barometer-2018\(79527b1c-1ffc-4cf1-8cb2-5614dc6536b9\).html](https://publications.sckcen.be/portal/en/publications/the-sckcen-barometer-2018(79527b1c-1ffc-4cf1-8cb2-5614dc6536b9).html)
- Van Berendoncks, K., Bergmans, A. (2012). *Internationale vergelijking van besluitvormingsprocessen omtrent geologische berging*. Axe 4 rapport 'Processus socio-politiques et Gestion de plan en univers controversé'. Brussel & Antwerpen : ONDRAF/NIRAS & UAntwerpen. ISBN 978-90-5728-434-2
- Weible, C. M. (2006). An advocacy coalition framework approach to stakeholder analysis: Understanding the political context of California marine protected area policy. *Journal of public administration research and theory* 17 (1): 95-117.
- Zwetkoff, C. (2012). *Projet ONDRAF. Axe 1: le processus décisionnel, du plan au projet*. Liège : ULg.
- Zwetkoff, C. and Parotte, C. (2013). Un programme participatif et son évaluation procédurale. Le projet Plan Déchets pour la gestion à long terme des déchets conditionnés de haute activité et/ou de longue durée de vie. In *La participation à l'épreuve*, édité par Peterlang, 3:157-77.