



FANC

FEDERAL AGENCY FOR
NUCLEAR CONTROL

20
YEARS

of protecting the people
& the environment

ANNUAL REPORT

2022

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FOREWORD FRANK HARDEMAN, DIRECTOR GENERAL



Frank Hardeman, Director General of the FANC

In September 2021, the FANC celebrated its 20th anniversary. However, due to the COVID crisis, the anniversary celebrations had to wait until March 2022. After all, we did not want this special anniversary to pass unnoticed. On the contrary, we wanted to celebrate it together with all our colleagues and stakeholders. It ended up being a unique occasion to honour and thank all our colleagues for their efforts, on the one hand, and to exchange insights with our stakeholders in a more informal context, on the other. We were honoured that our responsible Minister, Annelies Verlinden, insisted on attending in person.

We also welcomed our Board of Directors, members of the Scientific Council for Ionising Radiation and the Medical Jury - partners we often work with - operators and former directors.

We were delighted to welcome a number of international colleagues and stakeholders too. As such, we received Annemiek Van Bolhuis, the Chair of the Management Board of our Dutch colleagues at the Authority for Nuclear Safety and Radiation Protection (ANVS), and representatives of our fellow regulators from France and Finland. Nina Cromnier, the Managing Director of the Swedish nuclear regulator SSM and Chair of HERCA (Heads of the European Radiological protection Competent Authorities) was also present and participated in one of the panel discussions organised for the occasion. Ghislain D'Hoop, former Belgian ambassador to the International Atomic Energy Agency (IAEA), also contributed to the discussion with his long-standing expertise on the international level. The event was chaired by VRT journalist Luc Pauwels.

Our anniversary event was also the perfect occasion to look back on 20 years of protecting the population, the workers and the environment, but above all an opportunity to look ahead. In recent years, the FANC has not only invested in its mission to inform the public, but has also continuously honed its experience and skills to remain a reference source in the field of nuclear safety, security and radiation protection. The many challenges we face today show how important it is to be able to maintain the necessary expertise in the FANC's many areas of activity.

This again became very clear during the panel discussions with a number of pioneers within various scientific disciplines in Belgium. Dr Michaël Dupont, radiologist at the hospital group CHU UCL, Dr Sarah Baatout, head of the radiobiology department at SCK CEN, Jan Sterck, Chief Technical Officer specialising in decommissioning at ENGIE Electrabel and Amke Lescur, doctoral student at UGent and SCK CEN Academy, were guided by our in-house moderator Simon Coenen into a discussion on the many challenges they face in a rapidly changing context. Within this context, the FANC aims not only to regulate and control, but also to guide and inform. Thus, in 2022, the FANC examined the possible long-term operation of the Doel 4 and Tihange 3 nuclear reactors, adapted the operating licence of the permanently shut down Doel 3 reactor to the new situation, and informed local stakeholders about the next steps in the decommissioning process.

Besides being an anniversary year for the FANC, 2022 was, of course, a dark year for Europe. Rafael Grossi, the Director General of the IAEA, could not attend our celebration on 29 March and, this, of course, had everything to do with the war that had broken out in Ukraine a month earlier. Thanks to its many contacts with national and international partners, including the IAEA, the FANC was able to closely monitor the potential impact on civilian nuclear facilities and the radiological situation on the ground, while accurately and independently informing the public. The events in Ukraine reaffirm the extent to which radiological monitoring, international contacts and the continuous improvement of the nuclear and radiological emergency plan are, and remain essential.

2022 was therefore a year of mixed feelings.

"Without @FANC AFCN & other nuclear regulators, we would not have a nuclear industry, because they forge the foundations on which crucial public confidence is built." - @rafaelmgrossi, DG @iaeaorg #FANC20



Although he could not be there in person, the IAEA Director General Grossi did record a touching anniversary message for the FANC.

FOREWORD JIHANE ANNANE, PRESIDENT OF THE BOARD OF DIRECTORS



Jihane Annane, President of the Board of Directors of the FANC

Over the past year, several avenues were explored regarding the future energy supply of our country. The FANC also received a lot of questions on this subject. The FANC is open to various options, but cannot develop proposals on its own initiative. First and foremost, a conclusive agreement is needed between the federal government and ENGIE Electrabel, the operator of Belgium's nuclear power plants. If both the policymakers and the operator are willing to go ahead with nuclear power generation in our country, then it is up to ENGIE Electrabel to

submit a well-argued 'safety case' to the FANC. After all, the operator is primarily responsible for the safety of its facilities. Only when the FANC can inspect and analyse such a well-developed plan, it will be able to make a judgment on nuclear safety.

The federal government's desire to extend the operating period of the two most recent nuclear reactors, Doel 4 and Tihange 3, by ten years, constitutes an important challenge for the future: on the one hand, the FANC must ensure the safe continued operation of these reactors and, on the other, it must ensure the safe shutdown and decommissioning of the remaining reactors. The decommissioning project will affect a wide range of activities. Both safety and security aspects will have to be monitored. The decommissioning of nuclear reactors will involve radioactive waste. This will lead, among other things, to an increase in the number of transports of radioactive materials when the waste has to be removed from the sites. The FANC's transportation department will have to maintain its expertise to ensure that all transports are carried out correctly.

The fissile materials and certain types of waste will first remain stored at the sites of the nuclear power plants for many years, before they can be permanently removed and processed for disposal. The temporary storage must, of course, continue to take place in safe conditions. In addition, the storage of the waste on the sites also entails a security risk, so the security of the storage facilities will have to be ensured long after decommissioning.

In the coming years, the FANC will also have to help assess the safety of the long-term management of high-level and/or long-lived waste. On 22 November 2022, our country opted for deep disposal as the final solution for this type of radioactive waste. Although this is only a decision in principle and all the details have yet to be worked out, it is an important step. As Belgium has taken a clear position on the policy, specific avenues can be explored and responsibility is not passed on to future generations.

On the occasion of the FANC's 20th anniversary, I would also like to make a warm appeal to the next generations to continue to opt for a scientific career with added value for society. The mission of an organisation, such as the FANC is much broader than the regulation and monitoring of nuclear reactors. It is also being at the forefront of new nuclear technologies and innovations in medical applications, such as the production of new isotopes that help detect and fight cancer. More than a "watchdog", the FANC also provides guidance and information to the various sectors working with applications of ionising radiation. In recent years, through an increasing number of contacts with the public and other stakeholders, the FANC has positioned itself as the primary contact point in Belgium for nuclear safety and security, safeguards and radiation protection.

GOODBYE RAVENSTEIN, HELLO MARQUIS!



WE HAVE
MOVED



NEW ADDRESS

Markiesstraat 1 bus 6A • Rue du Marquis 1 bte 6A
1000 Brussel • 1000 Bruxelles

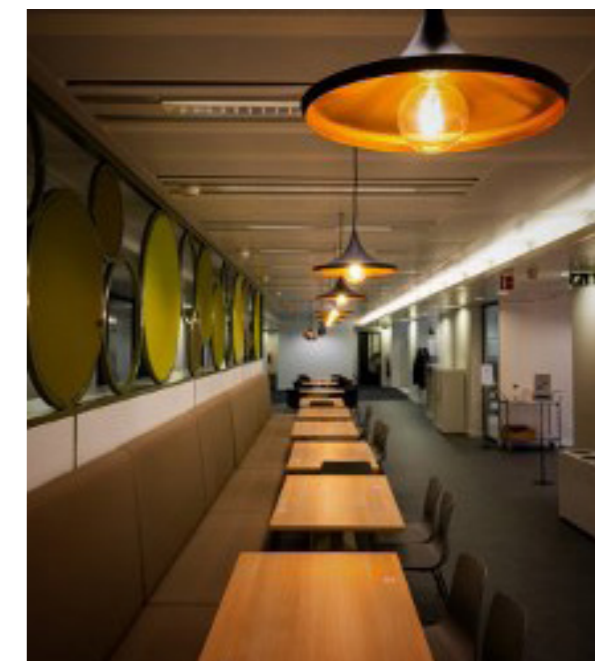
On 31 December 2021 we closed the doors of our office building on the Ravenstein street for the last time, after 20 years. We swapped our familiar workplace for a spot in the Marquis Building. We are now all on the same floor, which only enhances the cooperation between our various services and departments.



ALEXANDRE ELJABRI
reception manager

“The new building is ideal: modern, practical and spacious. It offers comfort and a pleasant atmosphere. I am delighted with my new workplace. It is a haven of peace. Not only is it quieter and more spacious than before, the reception area is bathed in light.”

The relocation to our new premises also meant new IT equipment. As such, we switched to a new, more modern and powerful intranet and migrated all our documents from SharePoint2010 to SharePoint2019.



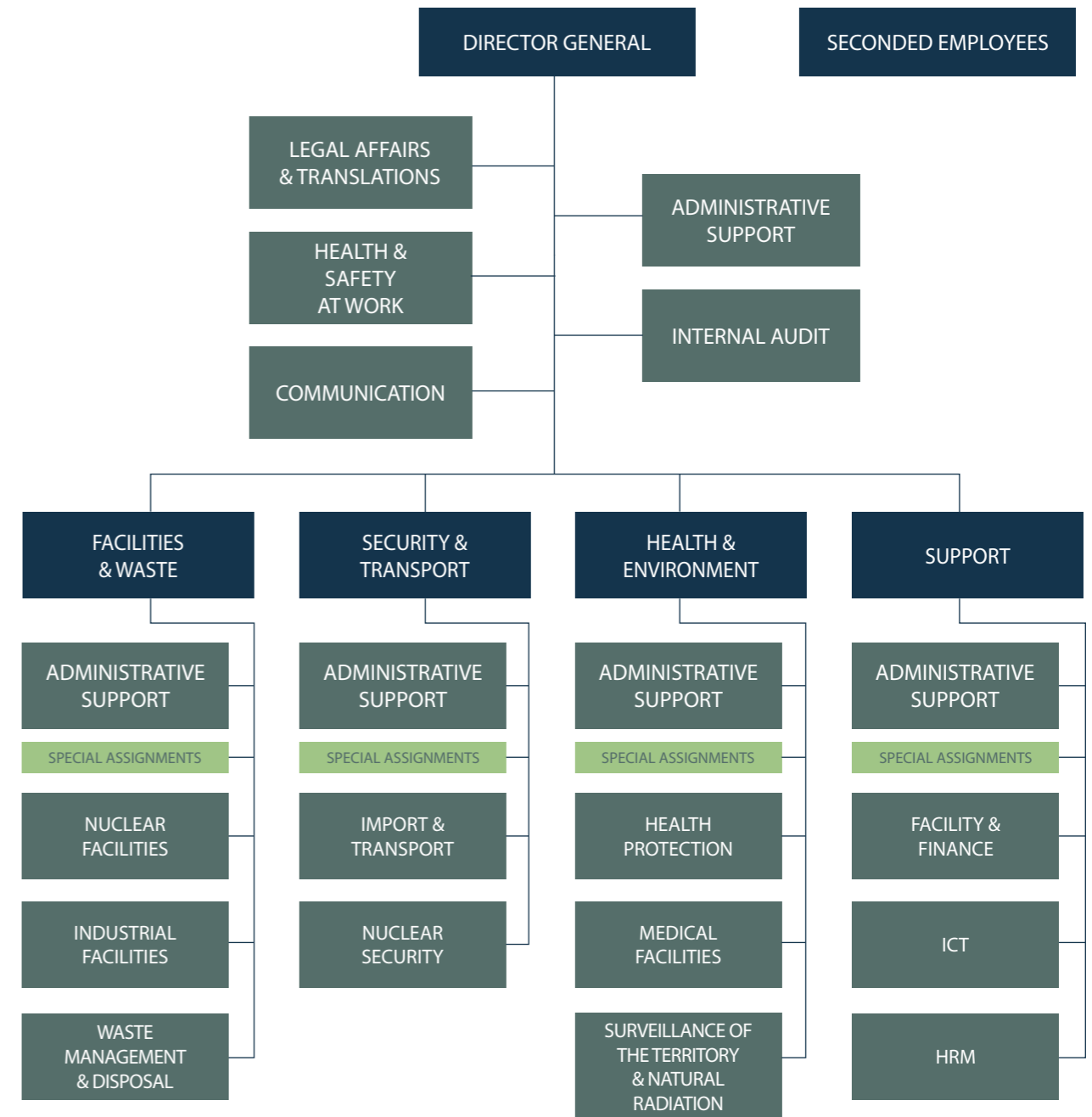
New desks, chairs, monitors, sitting areas: modern and practical, a leap forward.



FEDERAL AGENCY FOR
NUCLEAR CONTROL

To mark our 20th anniversary, we also designed a new corporate identity with an updated logo. We express our mission, vision and values in the words of our brand. The FANC logo is more than just a nice design to give the Agency an emblem. It symbolises our brand promise to protect the health of the population, the workers and the environment. The associated symbol is a key element of the FANC's identity. It represents the Agency's dynamics and movement. The symbol represents an atom; the three orbits symbolise the three values of the FANC revolving around the nucleus.

ORGANISATION CHART



SABINE ROUSSEAU
administrative assistant at the Monitoring of the Territory & Natural Radiation Service

“Before the FANC was created, I was already administrative assistant for TELERAD at the government Service for the Protection against Ionising Radiation. So I experienced the creation of the agency and all of the reorganisations and adjustments since then.”



MANAGEMENT AND ADVISORY BODIES

Government Commissioner Thomas STERCKX

The Government Commissioner has inspection powers, meaning that he verifies whether the decisions of the FANC are in accordance with the laws, regulations and policies laid down by the competent minister. He or she also performs the role of representative of the Minister of Finance and, consequently, is also in charge of monitoring decisions with budgetary and financial implications. The Government Commissioner is appointed by the Minister that is responsible for the FANC.

Board of Directors

The Board of Directors of the FANC supervises the management of the Agency. The Board of Directors is responsible for the strategic management of the organisation, the financial follow-up and relationships with the partners. Members of the Board of Directors are appointed on account of their special scientific or professional qualities. Members of the Board of Directors are appointed by Royal Decree for a period of six years.

Four new board members were appointed on 23 September 2022. Elodie Belleflamme, Veroniek De Mulder, Jan Schaerlaekens and Sara Speelman took over the torch from Emmanuelle Dardenne, Joost Germis, Joeri Hens and Annelies Vandevelde, whose mandates had expired on 6 January 2020.



Mrs. Elodie Belleflamme
Master in Environment, Development and Cultural Change

Has experience as a political consultant in energy and climate.



Mrs. Veroniek De Mulder
Master of Industrial Sciences in Chemistry, Postgraduate Business Administration and Bachelor of Law

Many years of experience in public financing and the relationships between administration, responsible ministers, citizens and businesses and, in particular, in government communication. Has affinity with the FANC's area of activity.



Mr. Jan Schaerlaekens
PhD in Applied Biological Sciences, Bioengineer in Environmental Technology

Many years of experience as a political adviser in cases relating to nature, environment, energy and nuclear matters.



Mrs. Sara Speelman
Civil engineer in energy, option general techno-economic energy knowledge

Knowledge in the field of nuclear energy and the risks associated with ionising radiation.

Several members of the Board of Directors are also members of the Audit Committee or Strategic Committee. The Board of Directors met **9** times in 2022. The Audit Committee met **12** times and the Strategic Committee held **3** meetings.

MEMBERS

Jihane ANNANE (Chair)
 Thierry BASTIN
 Elodie BELLEFLAMME
 Marc BOEYKENS
 Philippe BOUKO
 Johan DEHAES
 Veroniek DE MULDER

Toon DIRCKX
 Martial PARDOEN
 Frédéric PIRARD
 Mathieu RAEDTS
 Jan SCHAERLAEKENS
 Sara SPEELMAN
 Sven VANEYCKEN

AUDIT COMMITTEE

Philippe Bouko
 Marc Boeykens
 Mathieu Raedts
 Sven Vaneycken (Chair)

STRATEGIC COMMITTEE

Thierry Bastin
 Toon Dirckx
 Martial Pardoën (Chair)

Scientific Council

The Scientific Council for Ionising Radiation is an independent body that includes members with nuclear expertise appointed by the Minister. The scientific members of this Council are persons chosen for their specific knowledge, or experience in nuclear science, or nuclear safety. They have competences or experience in at least one technical-scientific field that is of interest to assessing nuclear safety, nuclear security and radiation protection at the different stages of the nuclear cycle, including the final stage of this cycle, and in the various applications where ionising radiation is used.

Among other things, the Council provides advice on the licensing of large nuclear facilities. The Scientific Council also follows the evolution of the knowledge on nuclear safety, security and radiation protection.

MEMBERS

Pascale ABSIL
Marc BLEUS
Pascal CARLIER
Bernard DECKERS (honorary member)
Ellen DE GEEST
William D'HAESELEER (Chair)
Pascal FROMENT
Paul GIELEN
Michel GIOT (honorary member)
Serge GOLDMAN (honorary member)
Didier HAAS
Karin HAUSTERMANS
Henri LIBON
André LUXEN
Gaëtane METZ
Ernest MUND (honorary member)
Jacques PIRSON
Nathalie REYNAL
Leo SANNEN (honorary member)
Nathal SEVERIJNS
Hubert THIERENS
Stefaan VANDENBERGHE
Hildegarde VANDENHOVE
André VANDEWALLE (honorary member)
Hans VANMARCKE
Kim VERBEKEN
Jean VEREECKEN (honorary member)

REPRESENTATIVES OF THE SAFETY AUTHORITY

Frank HARDEMAN (FANC)
Audrey HERMANS (FANC)
Michel VAN HAESDONCK (Bel V)
Frederik VAN WONTERGHEM (FANC)
An WERTELAERS (FANC)

Medical Jury

The Medical Jury is an advisory body of the FANC and is composed of representatives of the Agency, and others chosen for their scientific competences. The main remit of the Medical Jury is to advise on recognition applications (for occupational physicians and radiation physicists) and licence applications (for users). The jury can issue both generic advice and advice on individual cases.

There are separate juries for three different disciplines: a jury for occupational physicians, a jury for radiation physicists and a jury for practitioners who use devices and/or radioactive products in the context of radiotherapy, or nuclear medicine.



"The advantage of proton therapy is that we can irradiate target volumes very accurately, thereby keeping the surrounding healthy tissue protected. This is an advance for both the health and radiation protection of the patient."

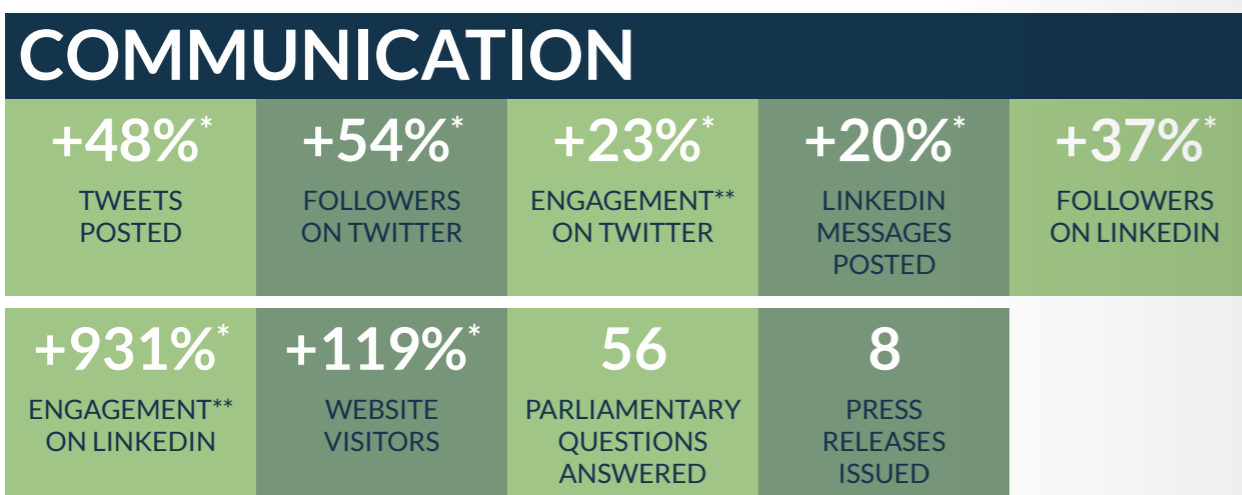
MEMBERS

Kristof BAETE
Ria BOGAERTS
Nico BULS
Benoît COLLETTE
Martine DECLEIR
Antoine DELOR
Caro FRANCK
Xavier GEETS
Anne-Sophie HAMBYE
Karin HAUSTERMANS
François JAMAR
Myriam MONSIEURS
Kathelijne PEREMANS
Vera PIRLET
Alex RIJNDERS
Peter SMEETS
Ulrik VAN SOOM
Chris VERBEEK
Dirk VERELLEN

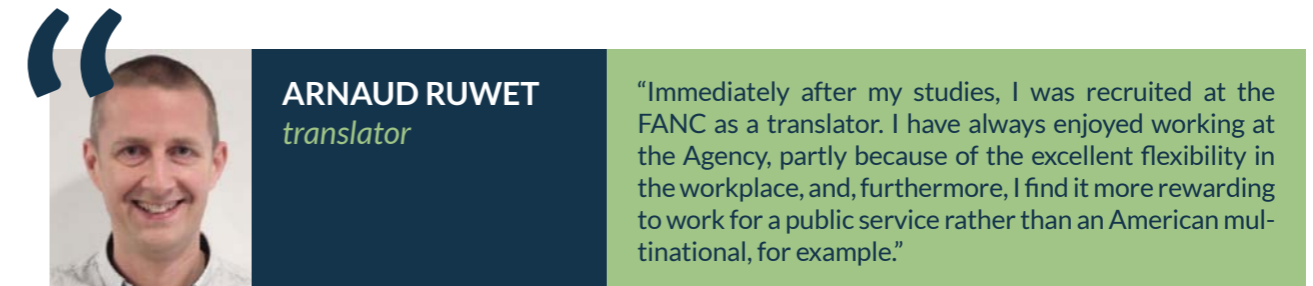
FANC REPRESENTATIVES

An FREMOUT
Karen HAEST
Sophie LÉONARD
Marleen VANDECAPELLE
Petra WILLEMS

2022 IN FIGURES



*compared to 2021 - **sum of all user actions (likes + comments + shares)



REGULATING

Number of publications in the Belgian Official Gazette in 2022:

	Technical regulations	Royal Decrees	Ministerial orders	Calls / recognitions	Laws	
Q1	10	3		1	1	
Q2	2	4		2		
Q3	3	8	1	3	1	
Q4	1	3		3	2	
Total	16	18	1	9	4	48

2022 IN FIGURES

LICENSING, INSPECTING, ENFORCING

8,780 LICENCES
ISSUED

73 LICENCES
REFUSED

DISCIPLINE	#LICENCES ISSUED	#LICENCES REFUSED
Nuclear security	4,740	72
Transport	402	/
Radiation protection in medical applications of ionising radiation	1,922	1
Medical facilities	1,353	/
Monitoring of the territory & natural radiation	/	/
Basic nuclear facilities (large installations)	40	/
Industrial facilities	323	/
Management of radioactive waste	/	/



ERIC HERMAN
transport expert

“What I find most exciting about my job is the cooperation, the many contacts and the wealth of information.”

INSPECTIONS

421

INSPECTIONS
CARRIED OUT

53

of which were reactive inspections
(in response to an incident)

DISCIPLINE	#INSPECTIONS CARRIED OUT (TOT.)	#REACTIVE INSPECTIONS	#CROSS- INSPECTIONS*
Nuclear security	34	6	/
Transport	131	9	/
Radiation protection in medical applications of ionising radiation	23	7	8
Medical facilities	90	18	3
Monitoring of the territory & natural radiation	13	1	1
Basic nuclear facilities (large installations)	28	6	1
Industrial facilities	91	6	1
Management of radioactive waste	11	/	/

*Carried out together with one or more nuclear regulator(s) from abroad or with another government agency

ENFORCEMENT ACTIONS

102

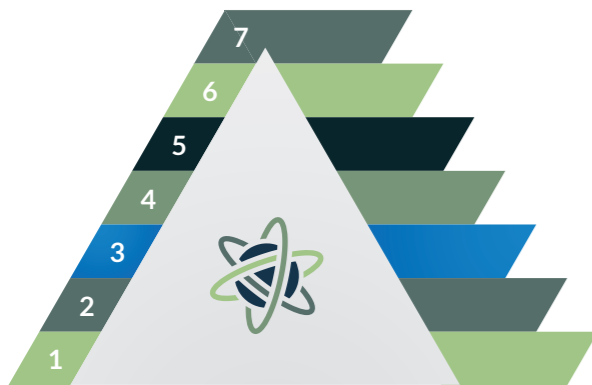
enforcement actions (all measures imposed by nuclear inspectors to ensure nuclear safety, security and radiation protection)

DISCIPLINE	#ENFORCEMENT ACTIONS
Nuclear security	/
Transport	/
Radiation protection in medical applications of ionising radiation	95
Medical facilities	6
Monitoring of the territory & natural radiation	/
Basic nuclear facilities (large installations)	1
Industrial facilities	/
Management of radioactive waste	/

INCIDENTS IN 2022

Events involving sources of ionising radiation that have real or potential effects on human and environmental safety are classified on the International Nuclear and Radiological Event Scale (INES scale). The scale has seven levels, ranging from level 1 (Anomaly) to level 7 (Major accident, such as Chernobyl and Fukushima Daiichi).

The events classified on the INES scale vary widely. They may include the loss or theft of a radioactive source, an employee of an industrial company exposed to radiation, problems during radioactive transports, an accident involving a nuclear reactor or research reactor, and so on.



- The events with the highest impact (levels 4 to 7) are referred to as accidents.
- The events in levels 2 to 3 are referred to as incidents.
- Events in level 1 are referred to as anomalies.
- Events with no safety significance are classified at level 0 or in other words below the scale.
- Events that are unrelated to nuclear safety are not given an INES classification (e.g., an employee of a nuclear power plant has become unwell and is taken away by ambulance).

28 MARCH INES-1
Tihange 3
One of the diesel engines unavailable

INES-2 5 MAY
Petrochemical company
Subcontractor briefly exposed to radiation during gamma ray * inspection of a welded pipe

16 AUGUST INES-1
Belgoprocess
Complete outage of ventilation in a building in which containers with (historical) radium-containing waste are handled

INES-1 19 AUGUST
Tihange 2
Error during recalibration of measuring chains**

3 OCTOBER INES-1
Tihange 3
Faulty operation of a relief valve and turbine-driven pump in the auxiliary feed-water system

INES-1 24 NOVEMBER
SCK CEN
Missing and incorrect labels and erroneous content description in the transport document during an outbound transport

*Industrial radiography is a very useful tool for the non-destructive inspection of materials and/or structures that may affect the safety of industrial facilities (petrochemicals, metal structures, welding sites, etc.). Indeed, defects in such material could have serious consequences for the population, workers and the environment. As such, industrial radiography, which uses a radiation source, is used to ensure reliable control. When the radiation source is a radioactive source, we speak of gammagraphy.

**To ensure the safe operation of a reactor, many parameters are continuously measured and monitored, including the neutron current (the number of neutrons emitted per second) of the reactor. The neutron current is measured by several measuring chains that must be recalibrated from time to time.



INCIDENT IN PETROCHEMICAL COMPANY

The quality of critical conduits, such as gas lines and pressurised pipelines is checked regularly, using various inspection methods. One such method is gammagraphy, which uses radiation from a radioactive source to obtain a radiographic image of welds in the conduits, among other things.

On 5 May 2022, a subcontractor was briefly exposed to radiation from the radiation source used during the gammagraphy inspection of a welded pipe at a petrochemical company's site. The radiation dose received by the worker remained below the regulatory reference levels and no direct effects were observed in the worker. The population was not exposed to radiation at any time, and the source used remained completely intact. There was therefore no risk to humans and the environment.

On 10 May 2022, two FANC nuclear inspectors visited the site to reconstruct the events and draw up an action plan to prevent such incidents in the future. The analysis showed that the incident resulted from a human error. The subcontractor did not follow all of the stipulated safety procedures. The FANC classified the incident as level 2 on the INES scale, given that a worker was exposed to ionising radiation.



Lessons learned

- Companies using gammagraphy must regularly check the operation of all of their radiation monitors and personal dosimeters.
- Specific attention should be paid to the training of temporary workers, e.g. by subjecting them to a practical test in the radiation bunker, making them additionally aware of the absolute necessity of an active measurement* of the radiation source and of the monitoring of their personal dosimeter, before, during and after the industrial radiography.
- Site inspections should be carried out regularly in order to verify that active measurements of the radiation source are actually performed.

* Active measurement means measuring the radiation level every time the source is approached.

RESEARCH REACTOR BR2 MALFUNCTION

© SCK CEN

The Belgian Reactor 2 (BR2) at SCK CEN in Mol is a material testing reactor. Since the start-up in 1962, it has been one of the most powerful research reactors in the world. The research reactor is also a global producer of radio-isotopes, radioactive substances used in nuclear medicine to diagnose and treat certain diseases, including cancer.

At the end of a cycle of the BR2 on 11 October, an anomaly was detected on one of the pumps, after which SCK CEN staff conducted an inspection on 14 October. They found that a spring holder of a check valve on a reactor had broken off in the primary cooling system. The object, about the size of a carton of milk, got swept along with the current and could not be recovered despite several inspections of the inside of the primary system. It is also unclear exactly when the spring holder broke off.

As a precaution, the reactor was not restarted, as the incident obviously had a potential impact on nuclear safety. The spring holder could cause damage to the primary cooling circuit, the control rods could be blocked by the object, valves could become blocked, or the fuel could only have limited local cooling.

SCK CEN then drew up a safety case to justify the continued operation of the reactor while there was an object in an unknown location in the primary system. SCK CEN demonstrated that the object had to be in a location where it could do little harm, that any effects were detectable, and that this detectability could be further improved. Moreover, all possible effects had already been described in existing accident analyses. This led the FANC to conclude that the incident had no significant impact on nuclear safety.

At no time was there any danger to the population, the workers or the environment. The FANC classified the event as level 0 on the INES scale, but SCK CEN needed the FANC's approval to restart the reactor. This approval finally came on 19 December. SCK CEN has taken various additional measures to prevent similar problems in the future, and to further reduce the residual risk. In addition, SCK CEN must regularly submit additional reports to the FANC.

ENHANCED MONITORING OF THE TIHANGE NUCLEAR POWER PLANT

Following a number of incidents in 2021 and 2022, the FANC decided in October 2022 to place the Tihange nuclear power plant site under 'enhanced monitoring'.

The incidents were unlikely to pose a threat to the public health, the workers or the environment, but from the FANC's on-site inspections and analyses of the various incidents, there did seem to be an issue with the safety culture at the site.



Photo by Jacob Lund Photography from Noun Project

The FANC can carry out an enhanced monitoring when the condition of an installation or the safety culture at the site is not sufficiently up to standard. Specifically, the FANC increases its supervision by raising the frequency of the inspections and controls, together with its technical subsidiary Bel V and by monitoring certain activities more closely.

At Tihange, specific attention is now focused on two aspects:

- **Procedures**
The mandatory 'step-by-step procedures' are not always applied.
- **Pre-job briefings**
For certain activities, workers must be better informed in advance of the risks and concerns.

The enhanced monitoring runs initially until February 2023 (final discharge of Tihange 2 reactor). After that, the FANC will determine what follow-up is required, based on the results.

INTERNATIONAL ACTIVITIES

To make progress, the FANC constantly takes a critical look at its expertise in the field of the protection against the risks of ionising radiation. This is why we also maintain close contact with major international organisations:

- IAEA - International Atomic Energy Agency
- NEA – Nuclear Energy Agency
- ENSREG – European Nuclear Safety Regulators Group
- WENRA – Western European Nuclear Regulators Association
- HERCA – Heads of the European Radiological Protection Competent Authorities
- EACA – European Association of Competent Authorities
- ENSRA – European Nuclear Security Regulators



Lydie Evrard
Deputy Director General and Head of the Department of Nuclear Safety and Security at the IAEA

“The IAEA organises about 1,000 events every year. Our activities are very diverse. In 2022, the IAEA’s main focus was the assistance we provided to Ukraine.”



Petteri Tiippana
Director General of the Radiation and Nuclear Safety Authority of Finland (STUK)

“Together we are better. We produce better work, accumulate more knowledge, and know more together than as individual regulators.”



Olivier Gupta
Director General of the Autorité de sûreté nucléaire of France (ASN) and President of the Western European Nuclear Regulators Association (WENRA)

“Our relationship with the FANC goes way back and is a source of cross-fertilisation of experiences, not only with respect to the reactors, but also with regard to the approach to our inspections as regulators in general.”



66th IAEA General Conference, September 2022

INTERNATIONAL COOPERATION

A good example of international cooperation are the so-called ‘cross-inspections’. These imply that nuclear inspectors from one organisation accompany those from a foreign organisation, in order to learn from each other and discover the differences in approach. In 2022, the FANC participated in **14 cross-inspections**.

In the medical sector, among others, the FANC and the Dutch Authority for Nuclear Safety and Radiation Protection (ANVS) organised a number of such exchanges last year. In Belgium, the FANC inspectors were joined by ANVS colleagues at the inspection of the nuclear medicine department of the Jessa Hospital in Hasselt.



Linda Janssen-Pinkse is an inspector at the ANVS and participated in the cross-inspection: “An important similarity I see, is that radiation expertise is vital in both countries. One difference is that here, the expertise is brought in externally to the hospital, while in the Netherlands it is integrated and part of the hospital.”



FANC inspector Jolien Berlamont likes to exchange experiences: “On certain issues that we know very well in Belgium, we would also like to have their opinion. There are many evolutions, so we also want to know how they deal with them. In any case, it is good to have a fresh perspective from colleagues abroad. Moreover, it also gives us the chance to walk along with them in the Netherlands and exchange information about our way of working.”



Cédric van Caloen

Public & International Affairs Expert at the FANC

“Establishing and maintaining good relations with other regulators strengthens the confidence of the Belgian population in the FANC as a regulator.”



From left to right: Rony Dresselaers, Frank Hardeman and Cédric van Caloen



In May, our colleague Daan Van der Meersch took two colleagues from the ANVS to the Ghent University, where ionising radiation is used for scientific research. The three inspectors found the exchange instructive and inspiring.



In turn, our colleague Nathan Lemahieu headed to the Borssele nuclear power plant with colleagues from the ANVS Arnout Koppert and Marcel van Berlo. Arnout Koppert: "It was nice to have someone from the FANC along for our inspection. Nathan is an inspector of the Doel nuclear power plant, and was able to point out the differences and similarities of the plants to us." Nathan Lemahieu: "At the FANC, we are always looking at how we



can improve our working methods, which is why we are only too happy to accept invitations from our colleagues abroad for such transparent exchanges. For me, it is very instructive to experience how the ANVS inspects and, of course, as an engineer, I also find it particularly interesting to see how things are done in other nuclear power plants."

Sometimes there are also joint inspections, where several countries conduct their own inspections at the same location. That was the case in 2022, for example, in the Dutch town of Petten. It is home to Curium, a producer and supplier of medical isotopes for nuclear medicine. The isotopes are used to diagnose and treat cancer, among other things. Curium is licensed to transport the isotopes they produce abroad. This means that there are daily transports across various countries to get the isotopes to the hospitals. These transports obviously have to be safe and have to respect the rules of every country they cross.

On 2 December 2022, the Belgian (FANC), Dutch (ANVS) and French (ASN) nuclear safety authorities organised a joint inspection to investigate whether Curium had taken all the necessary safety measures for a shipment to Italy. Among other things, they checked that the isotopes were properly packed and whether the driver was appropriately protected against the radiation from his cargo. Joint inspections with another country are organised frequently, but because the transport in this case had to pass through three neighbouring countries, it was a unique opportunity to carry out the inspection with the three regulators involved. It was also interesting for Curium itself, as it gave the company a clear picture of the differences in terms of legislation per country.

"In Belgium, some 45,000 transports of radioactive substances take place every year," says Eric Herman, nuclear inspector in the transport department of the FANC. "We conduct 2-3 inspections every week, both in the medical and transport sectors. An inspection consists of three parts. First we check the documents, transport licences and approvals. Then we check the equipment required for the persons transporting hazardous materials. Finally, we also check whether the cargo is compliant with the regulations, by performing measurements and a check of the labelling and marking of the packages."

The audit on the competence management and human resources at Bel V, the FANC's technical subsidiary, was also carried out in 2022 by an international and multidisciplinary team. Participants included the *Chef du Bureau des Ressources humaines* of the French *Autorité de sûreté nucléaire* (ASN).

INFORMING & RAISING AWARENESS

For 20 years, we have maintained constructive relations with our stakeholders. We inform and sensitise the public and the field on a wide variety of topics. We approach the public and translate our, often technical, messages into practical tips and information on a human scale.



Aurélie Mathieu
veterinarian

“It is essential to properly inform (future) veterinarians about radiation risks. The veterinary medicine sector has evolved significantly in recent years. There are more and more applications of ionising radiation and the devices used, such as CT scanners and Cone beam CT scanners (CBCT), are constantly evolving. As the name suggests, CBCT uses a cone beam, and offers a higher image resolution with a lower radiation dose.”



The use of dental x-ray equipment is subject to specific regulations and licences. It is therefore essential to inform and advise dentists. Our colleagues Katrien Van Slambrouck and Alexandra Janssens met them in early October at Dentex, the trade fair for the dental sector.



Our colleague Jolien Berlamont attended the Belgian Society of Nuclear Medicine (BELNUC) symposium in Antwerp on 7 May 2022. There, she discussed the proper disposal of radioactive substances used in medical treatments.



Medical radiation physics is a vital and essential part of modern medicine. Among other things, a medical radiation physicist ensures that an inventory is kept of the radioactive substances used in the facility, of the devices emitting ionising radiation within the facility and the radiotherapy and nuclear medicine equipment present.

Facilities with one or more radiotherapy installations were required to have a medical radiation physics service in place by 1 October 2021. One of the main objectives of the regulatory reform was to make the operators accountable with regard to medical radiation physics. By strengthening the role, coordination and visibility of medical radiation physics at hospital level, new medical technologies and projects will be approached in an integrated way rather than in parallel between different services.

The FANC monitors how medical radiation physics services perform their missions. One year after the implementation of the new legislation, the FANC and a number of delegates from the hospitals in question shared their initial observations and experiences.

In Belgium, the FANC also cooperates with numerous other government bodies. For example, the cooperation between the Agency and the FPS Employment, Labour and Social Dialogue (ELSD) was officially enshrined in a Royal Decree at the end of 2022. This decree stipulates the exchange of data and information between the two bodies. On the one hand, the FANC provides information to the FPS ELSD on the exceeding of the legal dose limits for workers, accidental contamination and irradiation of workers and situations that may lead to exceeding the legal dose limits in workers. On the other hand, the FPS ELSD for its part, provides findings and useful information in the field of radiation protection or nuclear safety observed at workplaces, to the FANC. Both bodies exchange specific information and advice within the framework of cross or joint inspections and regarding regulatory projects, inspection practices, campaigns and guidance documents on the well-being of workers, in the context of occupational activities involving a risk of exposure to ionising radiation.

Similar cooperation agreements already exist between the FANC and the NIHDI (National Institute for Health and Disability Insurance), the FPS Public Health and the FASFC (Federal Agency for the Safety of the Food Chain).



MARYSE WATHELET
administrative assistant at
the Health Protection service

“Conviviality, mutual aid and positivity are for me the key words that describe the FANC.”

INFORMING & RAISING AWARENESS



Our colleagues Karen Haest and Marleen Vandecapelle also visited the medical radiation physicists in late April during the annual symposium of the Belgian Hospital Physicists Association (BHPA).



In September, together with a host of (inter)national partners, our colleague Petra Willems organised a 'Train the Trainer' workshop on radiological and nuclear incident preparedness and response for emergency medical services.



Petra Willems also informed a mum-to-be about the risks of ionising radiation to her unborn child during the BabyDays fair in Ghent (March 2022).

PETRA WILLEMS
theme coordinator
health risk assessment

“The FANC is often mentioned in one breath with nuclear power plants. But certain medical applications, such as an X-ray or a scan, also involve the use of ionising radiation. We want to avoid unnecessary radiation exposure of women during pregnancy.”



Our colleague Katleen De Wilde gives training to employees of companies in the waste and recycling sector. There is a real chance they will come across a radioactive substance, in which case it is crucial that they know exactly what to do.



On 23 September, the nuclear reactor Doel 3 was permanently shut down. Our colleague Cédric Nazé is project manager at the FANC for the shutdown and decommissioning of Belgium's nuclear reactors. Together with ENGIE Electrabel, and our colleagues Nathan Lemahieu and Frederik Van Wonterghem, he met with local residents, local authorities and other key stakeholders a week before the final shutdown to brief them on the plans for the near future.



Due to the rocky soil, the municipality of Burdinne suffers from elevated radon levels. At the end of September, our colleague Boris Dehandschutter organised an information evening for concerned local residents, in cooperation with the municipality of Burdinne. Boris explained the risks and provided information on the possible solutions.

LONG TERM OPERATION (LTO) DOEL 4 & TIHANGE 3

Much ink has been spilled over the past year on the nuclear phase-out, or possible extension of the operating life of a number of nuclear reactors in our country. Although energy supply issues are not part of the FANC's remit, we were regularly asked for our advice on nuclear safety in the various proposed scenarios.

On 17 January, at the request of the federal government, the FANC issued a report on the possible extension of the operating life of the most recent reactors, Doel 4 and Tihange 3. The analysis showed that an extension was possible in terms of nuclear safety, albeit subject to the necessary updates to the facilities. In consultation with the General Directorate of Energy of the FPS Economy, the FANC drew up a global overview and integrated planning of everything that had to be done in order to make the extension possible in time.

As the operator of nuclear power plants, ENGIE Electrabel is the primary responsible party for the safety of its facilities. This means it is up to ENGIE Electrabel to submit a so-called 'LTO dossier' (Long Term Operation), with an accompanying action plan, to the FANC. Such a plan describes how the operator plans to improve the safety design, how he will handle the obsolescence of his facilities and which human factors he will take into account in the future. Indeed, sufficient human and financial resources must be available to extend the operating life of a number of reactors, on the one hand, and decommission the remaining reactors, on the other.

On 18 March, the federal government did actually decide to keep the two most recent reactors open for another 10 years. This was followed by negotiations between the government and ENGIE Electrabel to flesh out the modalities for the extension. Over the summer, these talks led to a 'non-binding letter of intent'. Further agreements still need to be made regarding the government's participation in the management of the reactors, the future disposal of the radioactive waste, timing, and so on. The FANC can only make a concrete statement on the safety issues when it receives the safety case for the LTO.

At the regulatory level, the FANC already worked on preparing the LTO project. Through a Royal Decree of 3 July 2022, the entry into force of certain regulatory requirements was adjusted, with a view to the extended operating life of Doel 4 and Tihange 3.

FINAL SHUTDOWN OF DOEL 3

A milestone in Belgian nuclear history

On the night of 23-24 September, our country witnessed a symbolic moment. Doel 3 was the first of Belgium's seven nuclear reactors to be permanently shut down.



Our colleague Nathan Lemahieu, who is responsible for monitoring the safety at the Doel site, was there when the reactor was shut down. "On a technical level, the reactor shutdown is no different from the annual shutdown for maintenance. The procedures are not new, and were followed correctly," Nathan explained. "Because in this case it was the very last shutdown, it was of course a special moment for the operational teams. They stopped the reactor in complete safety."

For the FANC, the first permanent shutdown also leads to various new activities. "From now on, in addition to monitoring the safe operation of the three other nuclear reactors at the Doel site, we will also follow up on site preparation activities for the decommissioning of Doel 3", Nathan says.

Decommissioning power reactors is a new experience for our country and is a major challenge, but Belgium already has experience in decommissioning other nuclear facilities, including those at the former FBFC International and Belgonucleaire sites and the Thetis (UGent) and BR3 (SCK CEN) research reactors. Although the decommissioning of power reactors is of a very different order of magnitude, the FANC has been comprehensively preparing for this project in recent years.

Safety aspects

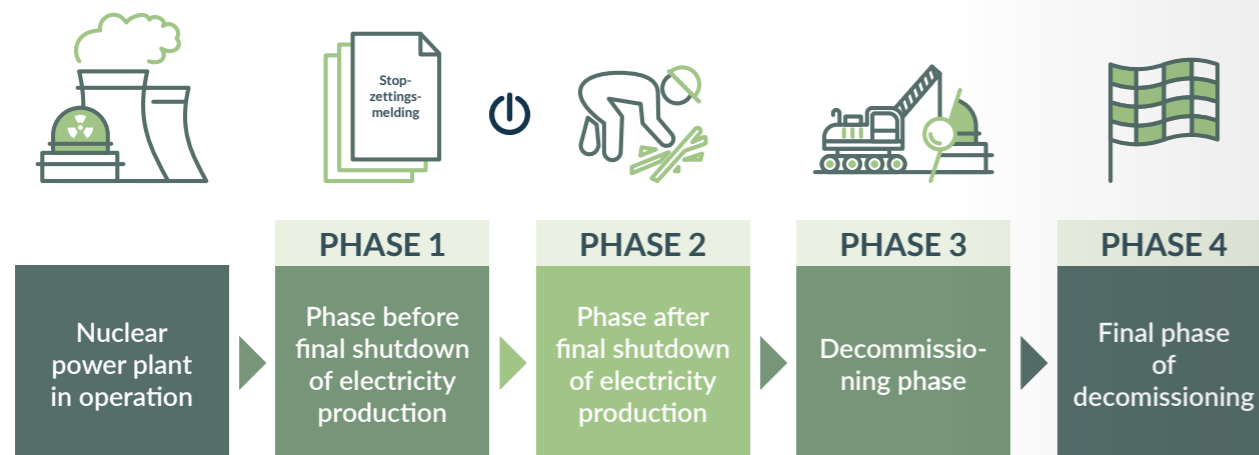
Spent fuel represents more than 99% of a nuclear power plant's radiological inventory. As such, from the moment the reactor is shut down and the spent fuel is removed and stored in containers, the radiological risk to the surrounding area drops dramatically. The second significant decrease in risk is during the actual decommissioning, when highly radioactive materials, such as the internal components of the reactor vessel, are removed.



© ENGIE Electrabel

At Doel and Tihange, spent nuclear fuel is stored in so-called 'dual purpose casks', which could also be used for transport in the future. In May, the FANC's transport department exchanged experiences about this type of container with colleagues from the Swiss nuclear regulator ENSI.

The FANC monitors safety throughout the shutdown and decommissioning processes. It will conduct both safety analyses and on-site inspections. This is already done in the first place through the licence. During the licensing process, a risk analysis is made of all of the planned actions and their impact is studied. On-site inspections are then carried out in order to verify whether the safety measures in place meet the expectations.



Next steps

Between the shutdown of the facility and the publication of the decommissioning licence, there is a transitional period, or 'post-operational phase'. It is estimated that this phase will take about five years for Doel 3. During the post-operational phase, ENGIE Electrabel will continue to operate under its operating licence and some preparatory work for decommissioning may already be carried out. For all actual decommissioning activities, ENGIE Electrabel must wait for the decommissioning

licence. Buildings on the site which are not related to nuclear activities, such as the administrative buildings, may of course be demolished earlier.

Based on similar projects abroad, the decommissioning phase is expected to last about 15 years. At the end of the process, the FANC will verify that the site is completely free of radioactive contamination, so that it can be released and possibly used for other purposes.



KEVIN GOVERS
radioactive waste expert

"It is nice to see that young people are working on the decommissioning. It is one of the major challenges of the coming years."

MONITORING RADIOACTIVE DISCHARGES

Large nuclear facilities need a construction and operating licence issued by the FANC. The licence includes conditions for the emission of residues. The discharge limits must be set at the lowest possible level and be compatible with the legal limits of ionising radiation to which humans and the environment may be exposed. The bottom line is that the permitted discharge limits have to be so low that they can only result in a fraction of the legal limit for the most exposed local population.

The day-to-day operation of nuclear facilities generates two types of radioactive substances: liquid and gaseous. The liquid residues primarily come from the process circuits, for example the circuits for the treatment of primary coolant in the nuclear power plants. In addition, liquid substances come from sanitary liquid waste (showers, sinks, etc.) and cleaning water from floors in the nuclear areas. Liquid waste and cleaning water do not normally contain any radioactivity, but are still treated as potentially radioactive. The gaseous substances come from certain process circuits that ensure, for example, the degassing of primary coolant in the nuclear power plants. The general ventilation of nuclear buildings also results in gaseous discharge. The air in these buildings must be continuously refreshed by forced ventilation. The volumes of air emitted to the outside depend on the volume of the buildings and the ventilation flow rates. The liquid and gaseous substances are first purified, before there is any contact with the outside world, using physico-chemical processes to capture as much radioactive material as possible. Some substances are stored in tanks until they are no longer radioactive.

Prior to the discharge, the plant operator checks that the radioactivity levels of the substances are in compliance with the licence. An additional check is performed at the discharge point. On each pipeline (for liquid discharges) and on each chimney (for gaseous discharges) there are radiological measuring devices that analyse in real time the characteristics of the substances passing through them and transmit them to the operator's control desks. As soon as one of the monitored parameters is in danger of being exceeded, the discharge is interrupted.



Equipment for the permanent monitoring of gaseous discharges at the Tihange nuclear power plant



River water collectors installed in containers of TELERAD river beacons

On top of all the control mechanisms of the plant operator, the FANC also performs various checks:

- There are TELERAD monitoring stations at the points of potential radioactive discharges. These beacons activate an alarm at the FANC in the event of abnormal emissions at a nuclear facility.
- The operator must provide a report of all discharges to the FANC on a monthly and annual basis.
- The FANC conducts an annual inspection on the radiological impact of the facilities. In doing so, the Agency checks whether the operator uses the appropriate measurement systems and whether they are properly maintained, and checks whether the data provided by the operator matches the data from the measurement systems.

The checks may or may not be announced and can take place at any time (day, night, weekend, holiday, etc.).

DOEL & TIHANGE



The Tihange nuclear power plant along the Meuse River

The FANC's most recent report on radioactive discharges from the Doel and Tihange nuclear power plants covers the year 2021. In 2021, discharges from the Tihange nuclear power plant remained in compliance with the licence conditions. No exceedances of the limits were observed. Under normal operation, the Tihange nuclear power plant has no measurable radiological effect on the environment. Its effect on the atmosphere and the environment is negligible or not even measurable. Only traces of naturally occurring radioactivity were detected in the area. The radiological situation of the air in the vicinity of the nuclear power plant is excellent. The Tihange nuclear power plant has no radiological impact on the surrounding soil and has no significant radiological impact on the Meuse River.

Also in Doel, emissions from the plant remained in line with the 2021 licence requirements and no exceedances of the limits were recorded during the year. The radiological impact of the nuclear facilities on the atmosphere and the environment is negligible or not measurable. Only traces of mainly natural origin can be found near the Doel nuclear power plant. The nuclear power plant has no measurable radiological impact on the surrounding air quality, on nearby soils or on the Scheldt River.



SARAH RADULOVIC
expert on radioactivity
in the environment and
natural radiation

"The TELERAD network is constantly evolving."

NUCLEAR EMERGENCY PLANNING EXERCISE AROUND TIHANGE NUCLEAR POWER PLANT

On 25 and 26 October, the radiological measuring cell of the National Crisis Centre (NCCN), led by the FANC, held a large-scale crisis exercise in the provinces of Liège and Namur. The focus was on rapid and accurate measurements and optimal cooperation between the different services in the event of a radioactive release at the Tihange nuclear power plant site. Thanks to these large-scale exercises in the field, the various bodies are prepared, should a real nuclear or radiological incident occur in our country.



cell could rely on the logistical support of the municipality of Engis. The mayor made the local sports hall available to the researchers.

If a nuclear accident occurs, it is important to quickly and accurately map the radioactivity levels over a wide area and estimate the impact on the population and the environment. Initially, the measuring teams go on site, subsequently helicopters are often used with measuring equipment attached to them, in order to determine radioactively contaminated areas in a wider perimeter. Nowadays, drones are also used. Drones are more useful for screening smaller areas, such as specific plots of land or agricultural land. An additional advantage of drones is that they can also fly above the site in question. During this exercise, all measurement methods were tested.

The radiological measuring cell consists of the FANC, the Civil Protection, the Ministry of Defence, the Federal Agency for the Safety of the Food Chain (FASFC), the nuclear research centre SCK CEN and the National Institute for Radio-elements (IRE). For this exercise - and in real situations - members of each of these bodies, at the request of the National Crisis Centre, go to the base camp on the site, and to the NCCN headquarters in Brussels. At the operating base, the radiological measuring



The measurement data are then forwarded to the FANC colleagues in Brussels for analysis. In real crisis situations, an evaluation cell is also set up to propose protective measures for the population and the environment to the government, but that aspect was not covered during this exercise.



Minister of the Interior, Institutional Reform and Democratic Renewal, Annelies Verlinden was also present at the base camp during the exercise and concluded, "It is the things we do most often that we do best. And the fastest. Because speed is an essential factor in crisis management. That is why it is important to practise regularly. All of the services separately, but also - and most importantly - all together. Thanks to such exercises, everyone knows what is expected of them, and what to expect of others. Because in times of crisis, you have to be able to fall back on automatisms."



Thibault Vanaudenhove from the FANC coordinated the emergency planning exercise: "We organise exercises every year, but due to the COVID crisis it had been a while since we had practised in the field. Moreover, this exercise was more extensive than usual, because we also wanted to test coordination and communication between the various stakeholders. Normally, every organisation involved conducts internal exercises to test its own crisis management, but this time there was a large-scale deployment of all those involved in the field."

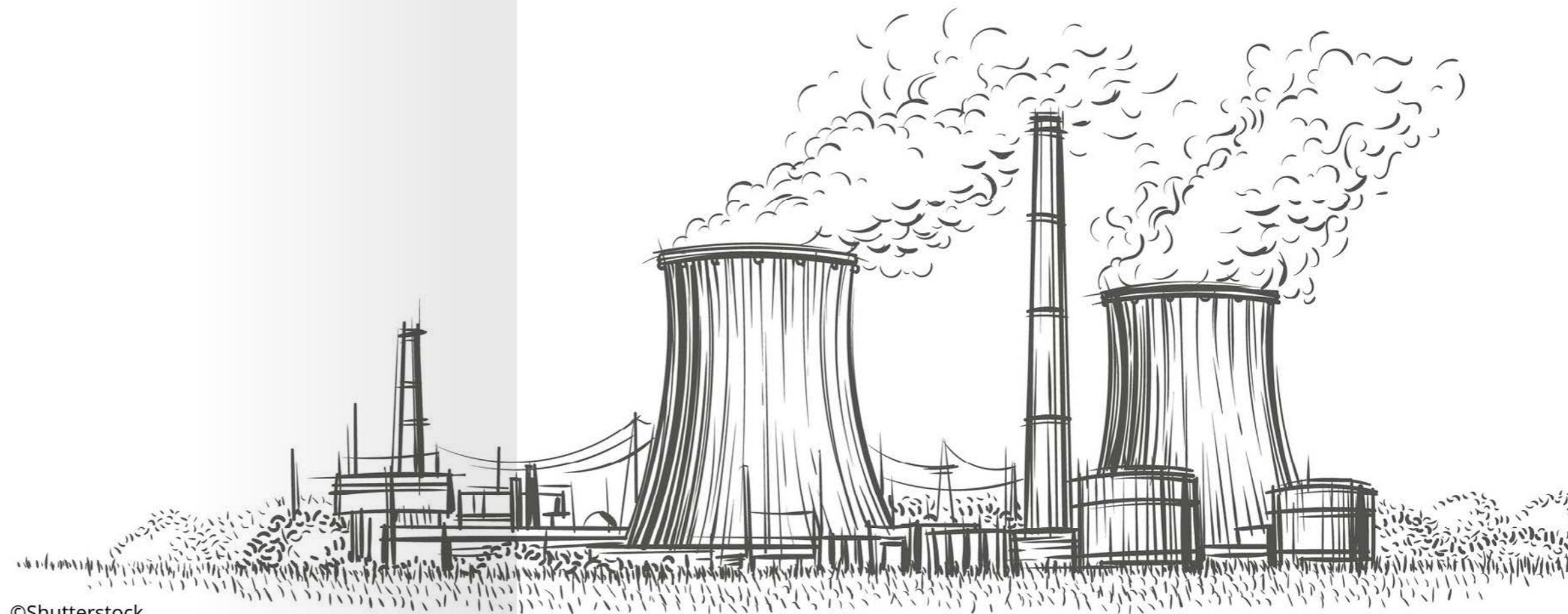
ALL PHOTOS AND FOOTAGE OF BELGIAN NUCLEAR SITES NOW BANNED

On 28 January 2022, an extension of the law of 23 March 2020 on blurring images of nuclear facilities and critical infrastructure entered into force for nuclear security purposes. This law had come to require disseminators of satellite images on the Internet to blur images of nuclear power plants and other sensitive infrastructures. Indeed, the FANC considers the dissemination of such images a risk to public safety.

Since the publication of the law of 23 March 2020, aerial photographs of nuclear and other critical facilities cannot be distributed and used without blurring. The extension of 28 January 2022 goes one step further. The main changes are:

- Extension of the legislation to all types of image recordings. Creating, publishing, exhibiting, selling, distributing or reproducing images from the nuclear sites without permission is prohibited.
- Since 28 January 2022, FANC inspectors are also allowed to draw up their own official reports if they find a breach of the legislation.
- The operator of the nuclear site may take photos or recordings of the site, but conditions may be imposed regarding the use and distribution of these images.

Anyone who wishes to do so, can apply in advance for an exceptional permission from the Minister of the Interior to take photographs and/or make recordings. The minister's office then asks the FANC for advice on the application. There is also the possibility to grant permissions that are valid for a longer period, rather than for a single image shot. This may be useful for journalists and professional and amateur photographers, for example.



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GOT NUCLEAR INSIDERS?

What is an insider threat?

An 'insider threat' is the risk that someone within an organisation would use his/her authorised access to inflict damage on his/her own organisation. This may be theft of proprietary information and technology, as well as damage to company facilities, systems or equipment. It may also involve the actual or potential endangering of employees, or other actions that could lead to the organisation's normal activities/tasks being compromised.

As a confidential advisor, the insider poses a unique problem for security systems. The incident at Doel4 in 2014 made Belgium an experience expert on this matter, as in all likelihood it was sabotage from within.

On 5 August 2014, the nuclear reactor Doel 4 was automatically shut down due to a lack of lubricating oil near the steam turbine. Further investigation revealed that the steam turbine's oil reservoir was emptied, because someone had opened the valve on the evacuation pipe, which rapidly drains the lubricating oil to an emergency reservoir in the event of fire. As there were strong indications that the valve had been deliberately opened, suspicion quickly arose that it was a case of malicious intent. The operator ENGIE Electrabel filed a civil complaint against unknown persons and the federal prosecutor's office opened a judicial investigation. At the beginning of 2022, the federal prosecutor's office concluded the investigation without consequence, as it had insufficient evidence to identify the perpetrator(s) and therefore to prosecute anyone.

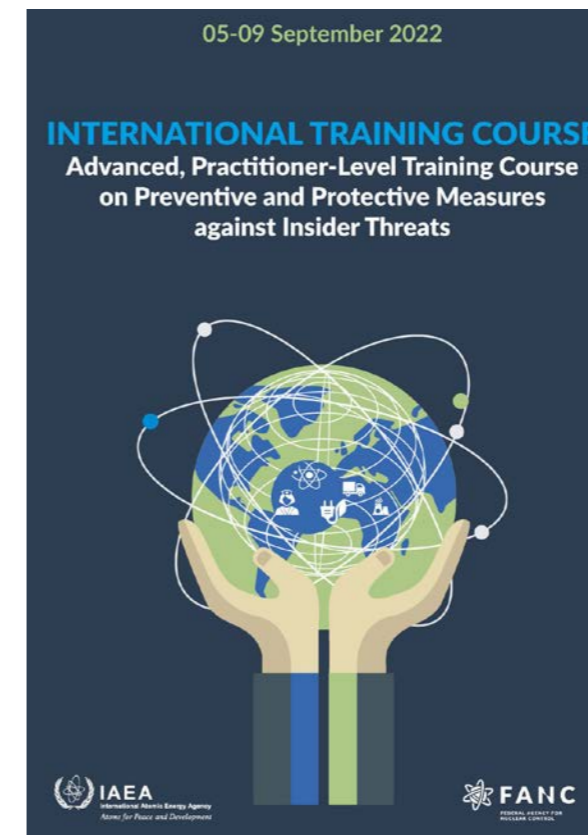
To prevent a similar incident from recurring, the FANC imposed a series of additional security measures on all Belgian nuclear power plants immediately after the incident.

The measures included:

- the installation of additional cameras;
- changes to the access badge system;
- an extension of the so-called 'four eyes' principle, which stipulates that nuclear power plant workers can only enter certain areas together with one or more colleagues.



From 5 to 9 September 2022, the FANC, in cooperation with the International Atomic Energy Agency (IAEA), organised an international training course on preventive and protective measures against insider threats. The classes were given by people from the IAEA, INTERPOL, FANC and other Belgian bodies and partners from 14 other countries. A total of 59 people from as many as 28 countries participated in the training.



Meanwhile, the FANC also set up the 'Insider Threat Mitigation' working group, together with a number of international partners. A dozen member states meet on a regular basis to work out a focused strategy for combatting insider threats at nuclear and radiological facilities.

CYBERSECURITY

Cybersecurity is critical for businesses and government organisations. As organisations responsible for public safety, managing personal data and protecting national interests, government organisations are prime targets for cyber-attacks. This became apparent once again in 2022 when the local governments of Antwerp, Diest and Zwijndrecht fell victim to cyber-attacks.

A successful cyber-attack can lead to loss of sensitive data, financial loss and reputational damage. It can even lead to the disruption of essential services provided by the government, such as health care and public safety.

As such, government organisations must adhere to strict cybersecurity protocols and measures to protect their systems from cyber-attacks. This includes regular monitoring of systems and networks, using strong passwords and two-stage verification, and implementing advanced security software to detect and repel threats. Moreover, regular training and attention of staff on cybersecurity protocols and risks is essential to raise awareness and ensure compliance.

Cybersecurity is therefore a fundamental part of how government organisations operate. The FANC also continuously invests in cybersecurity to ensure the safety of society and the protection of sensitive information. For example, in 2022, we implemented several additional technical solutions and measures to meet the challenges of the continually evolving cybersecurity landscape.

The FANC also invested in the security of its 'real' biotope in 2022: we spent more than €450,000 on securing the premises in our new office building.

SECURITY OF RADIOACTIVE MATERIAL

The FANC is working on a set of new measures for securing radioactive materials. The project was christened 'RAMAS', which stands for 'RAdioactive MAterial Security'. The new measures are based on international recommendations and aim to prevent illegal possession, theft, sabotage or misuse of radioactive materials. There is also a focus on the sabotage of premises and the unlawful storage, theft, sabotage or dissemination of protected information.

All types of radioactive materials have been classified into 5 categories and security measures are imposed for the 3 highest categories. The operator must draw up a security plan, which the FANC must then approve. The operator also needs to appoint a radiation protection officer.

Some examples of security measures include:

- Radioactive substances should only be stored and used in a secure area.
- The security level of the area depends on the amount of radioactive materials present.
- The number of persons with access to the secure area must be kept to a minimum.
- Only authorised persons are allowed to pass the security barriers.
- In some cases, a safety certificate is required.

Every new application for a construction and operating licence will from now on also have to be accompanied by a security plan, submitted at the same time. Approval of the security plan will then take place simultaneously with the issuing of the licence. The security measures must be in place before the start of the operation.



Existing operators are subject to a number of transitional measures. They must submit their security plan after the entry into force of the Royal Decree, within a deadline that depends on the radiological risks associated with their activities. Facilities that were classified within Category A (highest risk) have 18 months to do this, Category B facilities get 24 months and Category C facilities get 36 months. After that, the FANC has one year to approve the plan. Within the year of approval, the operator must also actually install the security systems.

Publication of new legislation

The project had been talked about for some time, but only actually started in November 2020. A first series of information sessions for stakeholders (the medical sector, industry, large nuclear facilities) was organised in the spring of 2022. In June, the FANC published an initial text on its website, which stakeholders could comment on until mid-September.

A second stakeholder information session followed in autumn. This session provided an opportunity to meet with security officers, address their key observations, get feedback from the sector and clear up any misunderstandings.

MARTINE LIEBENS
transport expert

“I came to the Agency from one of the ‘original’ government services, the Service for the Protection against Ionising Radiation. I think we have become much more professional over the years. We have a very high level of knowledge and competence within our organisation, which characterise the FANC”.

In 2023, the FANC will organise a training course on the subject in cooperation with the International Atomic Energy Agency (IAEA), and the intention is to repeat it regularly afterwards. By spring 2023, the draft RD and various accompanying technical regulations should be ready. The Royal Decree would then finally be published in the spring of 2024.

LICENCE RECUMO INSTALLATION FOR SCK CEN RESEARCH CENTRE

The nuclear research centre SCK CEN was granted a construction and operating licence for its new RECUMO facility on 21 January. With this licence, SCK CEN aims to purify the highly radioactive residues from the production of medical radioisotopes of the Institute for Radio-elements (IRE), thereby reducing their storage on the IRE site in Fleurus.



**MINISTER
ANNELIES
VERLINDEN**
*minister responsible
for the FANC*

“The FANC is really top-notch and known worldwide for its expertise.”



The National Institute for Radio-elements (IRE) is mainly active in the production of medical radioisotopes (primarily molybdenum-99 and iodine-131). These are radioactive substances used to detect and treat cancer. The substances come from uranium targets that are first irradiated by SCK CEN and then treated by the IRE.

However, the production of radioisotopes leads to radioactive residues. The uranium residues are stored at the IRE’s site in Fleurus, but the maximum authorised storage capacity was almost reached there. As an interim solution, the IRE was authorised in 2019 to increase the maximum amount of uranium residues at its site, but to a limited extent. Thanks to the partnership between SCK CEN, the IRE and the Belgian state, a structural solution has also been found for the already existing, and the future uranium residues. The IRE will take these residues from its production process with uranium targets to SCK CEN to extract the still usable uranium. The uranium can then be reused, for example for new targets, as well as for other applications. This reduces the stored amount of uranium residues.

The RECUMO project is being implemented under the supervision of the FANC. The FANC imposes nuclear safety and security standards and monitors strict compliance with these standards.

BELGIUM HAS OPTED FOR DEEP DISPOSAL AS THE FINAL SOLUTION FOR HIGH-LEVEL AND/OR LONG-LIVED WASTE

Spent nuclear fuel and radioactive waste must be managed responsibly and safely in both the short and long term. For the management of high-level and/or long-lived waste, the FANC is an advocate of deep disposal. On 22 November 2022, Belgium effectively opted for that solution. Although this was only a decision in principle and all the details have yet to be worked out, the FANC considers it an important step. Because Belgium has taken a clear position on the policy, specific pathways can be studied and responsibility is not passed on to future generations.

The Royal Decree was a suggestion of ONDRAF/NIRAS, the National Agency for Radioactive Waste and Enriched Fissile Materials. Between April and June 2020, ONDRAF/NIRAS submitted the principle of deep disposal for consultation with the population and a number of competent authorities, including the FANC. After analysing the proposal, the FANC indicated that it supported the principle of deep disposal, but still had some substantive comments, which were included in the final decision.

As such, the FANC wants the work to be done step by step and at each stage it wants to check whether all conditions are met to move on to the next step. In addition, the FANC attaches great importance to the participatory process. Engaging in dialogue with all stakeholders and with citizens in particular is a sine qua non for this project. Finally, the reversibility of earlier decisions is also important according to the FANC.

Currently, deep disposal is the safest solution for managing high-level and/or long-lived waste, but if science and technology allow for better options in the future, it should be possible to include these in the final decision.

High-level and/or long-lived waste is currently stored in temporary, above-ground facilities. These are safe, but do not constitute a final solution. They are intended only as a transitional measure pending disposal.

The Royal Decree of 22 November 2022 is therefore an important step, but no concrete decision has yet been made. Future plans for deep repositories will require the submission of safety cases to the FANC. Only when the FANC can conclude from these cases that the proposed system is safe, a licensing procedure can be initiated. It will take quite some time before an operational repository is possible.



SILVIA FIORE
expert on large nuclear facilities

“Projects such as managing spent fuel and radioactive waste are very important. We will be closely involved in these projects in the coming years.”

BELGIUM MEETS THE INTERNATIONAL OBLIGATIONS REGARDING THE SAFE MANAGEMENT OF SPENT FUEL AND RADIOACTIVE WASTE

The “Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management” (or the Joint Convention for short), is an international treaty governing all aspects of spent fuel and radioactive waste management.

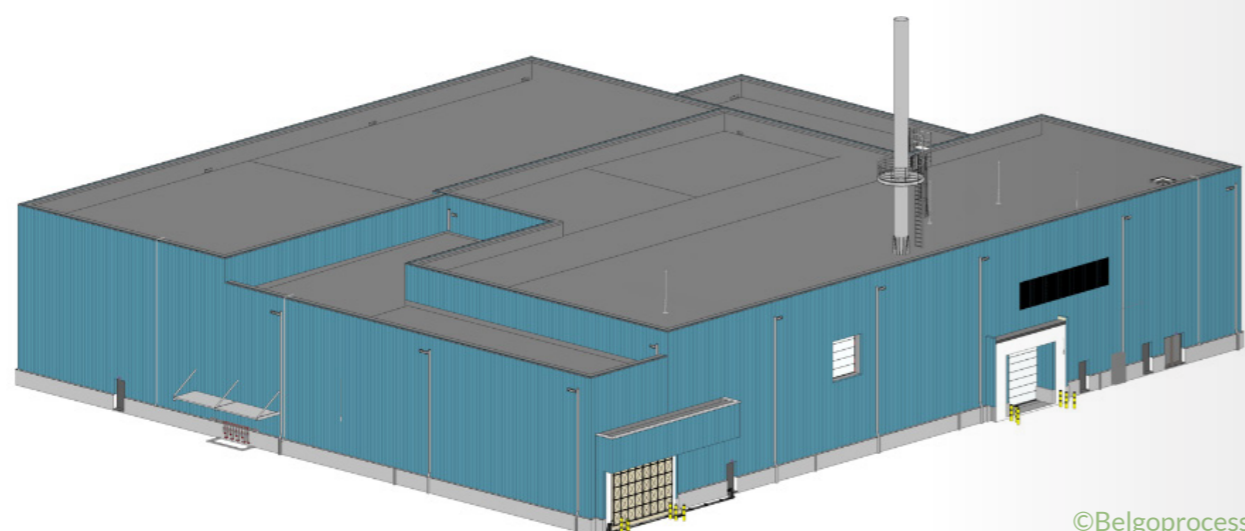
The convention has been in force since 2001, and since then all participating countries must submit a report every three years explaining what measures they have taken to meet the convention’s obligations. All reports are subsequently discussed among the participating countries at ‘review meetings’. That peer review took place for the 7th time in 2022, from 27 June to 8 July.

The most recent Belgian report was submitted to the International Atomic Energy Agency (IAEA) in October 2020. At the review meeting in summer 2022, a delegation from the FANC, its technical subsidiary Bel V and the National Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) gave a presentation on the Belgian situation. An evaluation group of 11 other countries then reported on Belgium’s achievements and challenges.

The evaluation group praised Belgium’s programme for managing spent fuel and radioactive waste. They called it high quality and noted that Belgium had fulfilled all of its obligations under the convention. In particular, the agreement between Belgium and the Grand Duchy of Luxembourg to manage very limited quantities of waste from Luxembourg in Belgium, including disposal, was regarded as a good practice and an example for other countries. The report also praised the efforts of the Belgian authorities to improve the regulatory framework and clarify interactions between the FANC and ONDRAF/NIRAS. The development of a robust nuclear and radiological emergency plan was also well received. The challenges mentioned by the evaluation group were in line with what the Belgian delegation itself had highlighted during its presentation. Among other things, they saw future challenges in large-scale projects, such as the construction and commissioning of new storage facilities at Belgoprocess in Dessel, the preparations for the decommissioning of nuclear reactors and other facilities, and the clean-up of the historically radium-contaminated Umicore sites in Olen.

BELGOPROCESS APPLIES FOR A LICENCE FOR A NEW RADIOACTIVE WASTE STORAGE FACILITY

Belgoprocess in Dessel is responsible for the processing and storage of radioactive waste and the clean-up of decommissioned nuclear facilities and sites. On 7 April 2022, Belgoprocess submitted an application to the FANC for the expansion of its facility, with a new installation for the reception and storage of unconditioned* radioactive waste. The new building will be called 'ROC' or '165X' and will be built on Site 1 at Belgoprocess (Gravenstraat 73, 2480 Dessel).



©Belgoprocess

The primary objective of the project is to create sufficient and appropriate storage capacity for unconditioned waste that is already present at the Belgoprocess sites, or that will still be produced by Belgoprocess, or that comes from third parties. The waste in question will be temporarily stored pending further processing. In addition, measuring equipment for performing radiological characterisation and non-destructive analyses can also be housed in the building. In this context, the design also includes a temporary buffer storage for conditioned waste.

As part of the processing of the licence application, the FANC organised a public survey from 28 October 2022 to 27 November 2022.

*Conditioning radioactive waste means encapsulating processed radioactive waste in a solid, water-resistant medium (such as cement or glass) to make it suitable for further treatment, transport, storage and disposal. The purpose of conditioning is to encapsulate the waste so that radioactive substances cannot spread into the biosphere.

APPROACH TO HISTORICALLY CONTAMINATED SITES

There are a number of sites in Belgium that are radiologically contaminated due to past industrial activities. More specifically, these are the sites related to the phosphate industry: the banks and river bed of the Winterbeek and Grote Laak rivers, the (phosphorus) gypsum landfill sites, etc. In addition, some landfill sites from the steel and non-ferrous industry, the sites linked to the former radium extraction in Olen and the sites contaminated by artificial radioactive substances from the nuclear industry are also historically contaminated.



The contamination levels at these different sites are often limited and do not pose acute risks. A majority of the sites are contaminated with radium, which specifically poses a risk of exposure to radon, a radioactive and heavy gas that is the decay product of radium, in homes and businesses located in the area. Radon gas can be harmful to the health in the long term. Construction is not prohibited there, but appropriate preventive measures against radon must be taken and radon concentra-

tions must be monitored. Moreover, protective measures must be observed at the sites in question when excavation work is carried out, especially to prevent workers from inhaling or ingesting radioactive substances. In addition, the FANC ensures that no radioactive material is moved or further dispersed during works.

For years, the FANC has provided additional monitoring of the water, sediment and soil quality of the rivers in the Nete basin (Molse Nete, Grote Laak and Grote Nete). As a member of the European Atomic Energy Community (Euratom), Belgium is regularly monitored by the European Commission. It conducts audits of all member states' monitoring systems and ensures that these are aligned. Two inspectors from the Commission recently came to examine the situation in Belgium and, more specifically, the radioactivity monitoring of the Molse Nete and its banks, the quality of the research laboratories where analyses are carried out on behalf of the FANC (SCK CEN and IRE) and the way the FANC reports on the results of its monitoring programme. The Euratom report from March 2022 concluded that the situation is correctly monitored by the Belgian authorities and that the labs are performing adequate and efficient work. In 2022, the FANC spent a considerable part of its annual budget – as much as €2.2 million - on analyses and studies as part of its radiological monitoring programme.

With regard to soil contamination, detailed regulations already existed at the regional level, but they did not apply to radioactive contamination, since radioactivity is a federal competence. Therefore, the FANC had been working for some time on specific regulations to be able to identify those responsible for remediation in the case of radiologically contaminated sites. This is important to ascertain who should pay for and perform the soil investigation and any remediation or management measures. Because radioactive contamination is almost always accompanied by other contamination, for example by heavy metals, the federal approach had to be consistent with the regional approach. On 20 November 2022, the law on the management of soils contaminated by radioactive substances was finally enacted. The new law is a crucial step in protecting the public and the environment from radiological risks. Although the radiation effects are currently limited and regular radioactivity measurements by the FANC show that there is no danger to the public health, it may still be important to further remediate these soils in the long term. Only then can they be reused for other purposes.

WAR IN UKRAINE



On 24 February 2022, a Russian military offensive into Ukrainian territory heralded the start of the war between Ukraine and Russia. On various occasions, the fighting also raised concerns about Ukraine's nuclear facilities.

Ukraine has 15 active nuclear reactors in four different locations, the former Chernobyl site, a number of waste storage sites and some research centres. Since the start of the conflict, the FANC was repeatedly informed of the many events occurring at these sites (bombings, military occupation, etc.) and of repeated power outages.

Although nuclear power plants produce their own energy, they require a constant supply of external electricity for their cooling and safety systems. When a power plant is disconnected from the grid and connected to emergency diesel generators, the clock starts ticking. This is because the diesel generators provide emergency power for an average of 10 days, and in war zones there is no guarantee that new diesel supplies will get to the site.

To evaluate possible consequences for the population and the environment in Belgium, the FANC continuously monitors the situation, together with its technical subsidiary Bel V, the nuclear study centre SCK CEN, the Royal Meteorological Institute (RMI), the Ministry of Defence, OCAD, the CBRNe cell and the National Crisis Centre (NCCN). SCK CEN and the RMI provide the FANC with dispersion scenarios. In the event of a radioactive release, the RMI can make a three-day projection of the data.

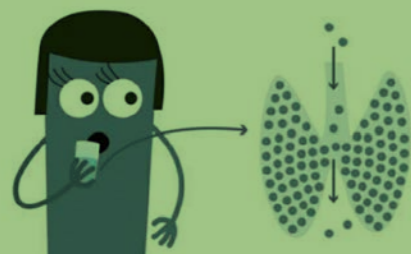
Throughout this unprecedented crisis, TELERAD monitoring stations have already played a crucial role in the radiological monitoring of the situation. Up until now, no abnormal increase in radioactivity levels has been measured in Belgium. In addition to our own 254 TELERAD monitoring stations, the European Union has a radiological monitoring data exchange platform between participating countries, called EURDEP (European Radiological Data Exchange Platform). There are also monitoring stations on Ukrainian territory, and via this channel the FANC analyses daily radioactivity values around the Zaporizhzhia nuclear power plant. At key moments, such as in the event of a pow-

er failure at one of the nuclear sites in Ukraine, the FANC informs and advises the National Crisis Centre.

At the European level, there are regular contacts with nuclear regulators from other countries through various platforms, such as the European Nuclear Safety Regulators Group (ENSREG), the Heads of the European Radiological Protection Competent Authorities (HERCA) and the Western European Nuclear Regulators' Association (WENRA). The FANC also receives regular updates from the SNRIU, the Ukrainian nuclear regulator.

Besides the radiological monitoring of the

crisis, the FANC also attaches great importance to regularly informing the public, the media and parliament. As such, the FANC set up a specific info page on the situation in Ukraine on its website, which is constantly updated with important new information. In addition, the various government departments involved in our country also worked closely together from the onset of the war, collecting all relevant information on the website info-ukraine.be.



The radiological situation has not had a dramatic impact (yet), but the situation remains dire for the Ukrainian people. We sincerely hope that they will soon be able to live again in a safe and peaceful Ukraine.

IODINE TABLETS

Due to the fear of a nuclear accident in Ukraine and repeated nuclear threats from the Russian President Putin, people in Belgium collected iodine tablets en masse from pharmacies. In the event of a nuclear incident involving the release of radioactive iodine, taking stable iodine, in addition to other protective measures, such as sheltering, is an effective way to protect the thyroid gland. Iodine tablets are available free of charge in any Belgian pharmacy. Having a stock of them at home is a good reflex to prepare for a possible nuclear incident, but in the context of the war in Ukraine, there is absolutely no benefit in taking iodine tablets just like that. Indeed, there is nothing to suggest an imminent danger to the Belgian public and, moreover, stable iodine must be taken at the right time to have the desired effect. The competent authorities provide the necessary recommendations to this end.

There was also some concern about the shelf life of the iodine tablets with production dates from 2010-2011, but an analysis by Sciensano showed that those concerns were unjustified. The packaging of iodine tablets only shows the production date, not the expiration date. Iodine tablets have a shelf life of at least 10 years. After 10 years, a stability study is conducted by Sciensano. In May 2022, iodine tablets with production dates between October 2010 and June 2011 were tested. The analysis showed that the tablets still met the strictest drug safety standards until at least 5 May 2023. The shelf life is retested every year. This is actually just a precaution, as iodine tablets are a highly stable product and have a very long shelf life if they are stored correctly: in their original packaging, at room temperature and protected from moisture and light.

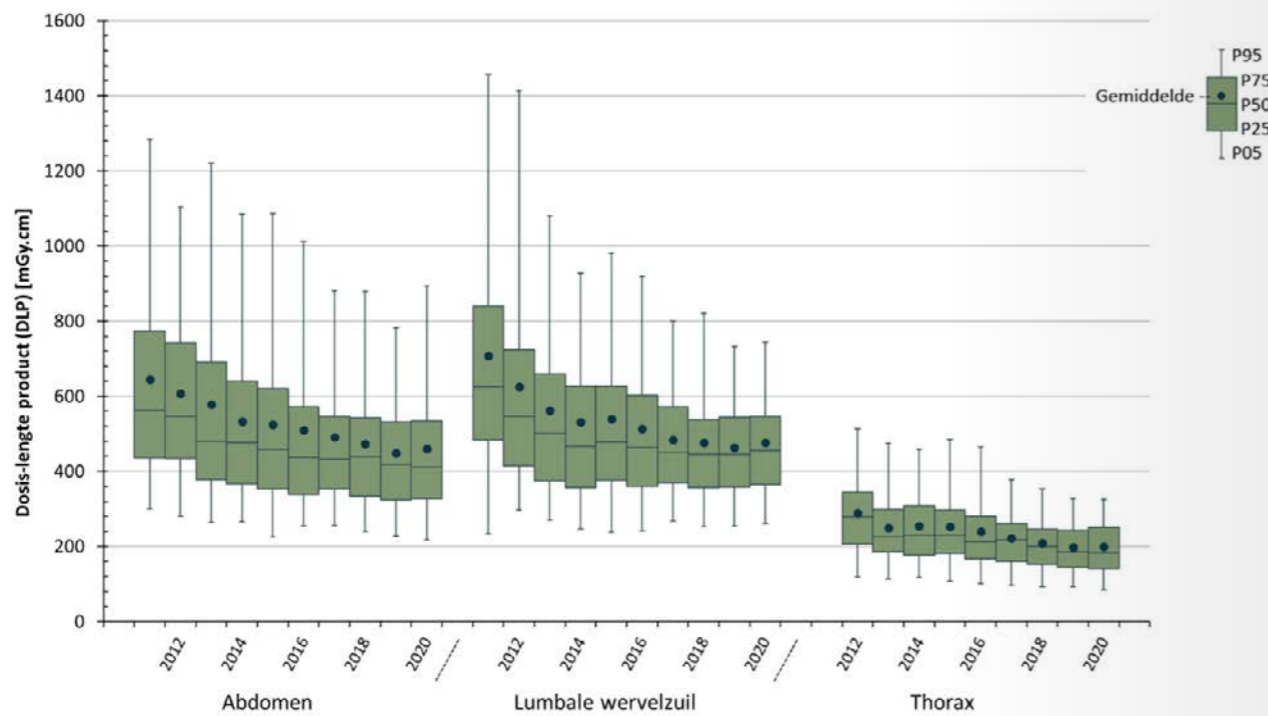
LOWER RADIATION DOSE DURING MEDICAL IMAGING, FOR EVEN BETTER PATIENT PROTECTION

The average radiation dose to which patients are exposed during a medical examination has decreased significantly over the past decade. Since 2011, medical centres that use radiology equipment have been required to regularly submit an overview of the radiation doses to the FANC. This concerns ionising radiation from CT scanners, mammography and certain cardiological examinations, among others. At the European level, Belgian medical centres are doing well in terms of paying attention to patient radiation protection. At the same time, they also ensure the preservation of high quality imaging.

Around 400 medical centres in Belgium take part in the dose studies. After each analysis period, the FANC sends a personalised report to the medical centres. That way, they can see how they are doing in relation to the other Belgian centres, and can optimise their procedures, where necessary. The dose studies also make it possible to identify the impact of the changes they make and how scientific and technological developments (image quality, equipment renewal, etc.) also have an impact on the radiation dose. For example, the dose studies show once again that the evolution towards digital imaging, compared to the previous film recordings results in lower radiation doses.

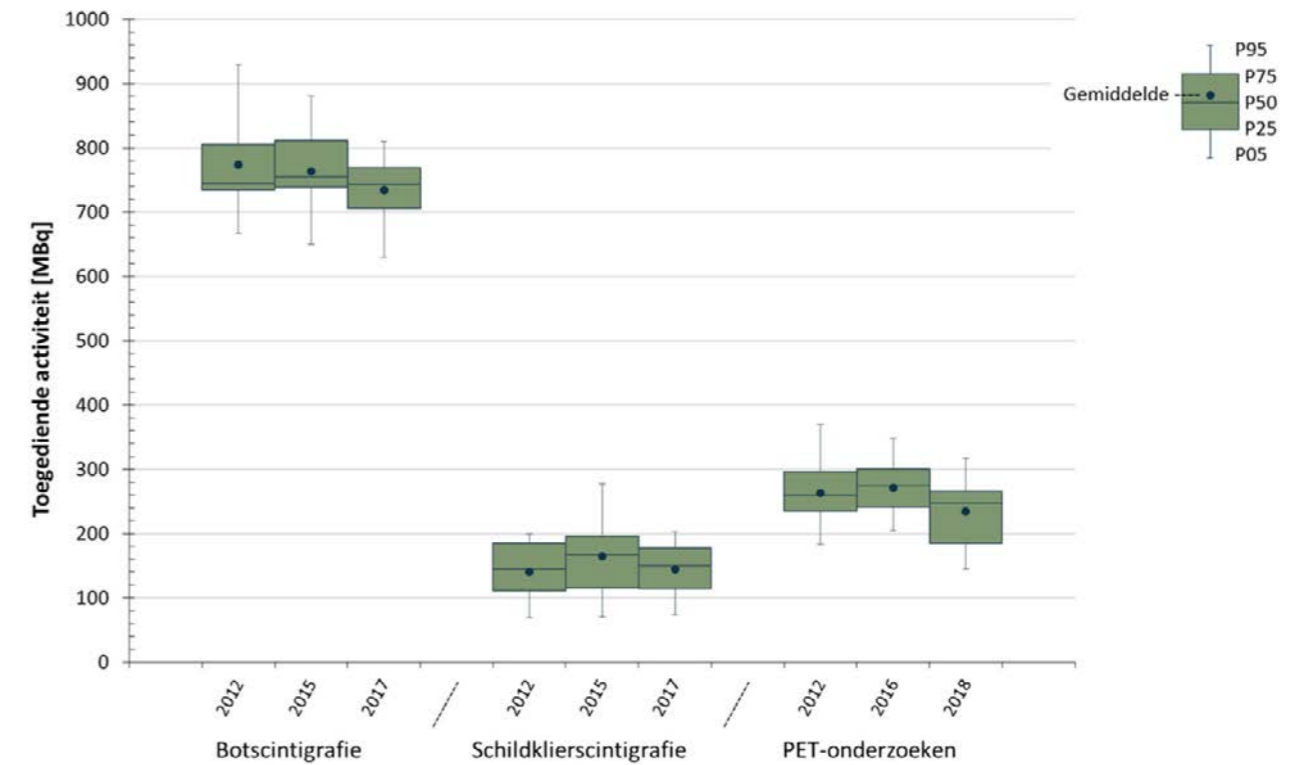
Results

Half of the patients' exposure to ionising radiation comes from CT scanners. The results of the dose studies show that the average exposure dose per CT examination has fallen by as much as 30% to 55% over the past decade. Some examples:



The effective dose cannot be measured directly, but can be derived from physical (measurable) quantities. One of these is the dose-length product (DLP, expressed in mGy.cm). Because this unit of measurement also takes into account the scan length, it is the best indicator to evaluate the dose impact of a CT scan, according to numerous scientific sources.

Between 2015 and 2019, the FANC also analysed the radioactivity administered in imaging in nuclear medicine. This showed that the national and international standards are also well respected in that field, and that a similar effort is made to minimise medical exposure to ionising radiation without sacrificing image quality. Some examples:



For a nuclear medicine examination, the dose to the patient can be calculated from the radioactivity of the substance administered during the examination, expressed in megabecquerels (MBq). How the radioactive substance spreads in the body depends on its properties and the metabolism of the patient.

The total number of medical imaging examinations performed every year is not decreasing, but the radiation dose per examination has thus decreased noticeably. With a view to continuous improvement, the FANC regularly reviews and adapts its procedures to respond to current challenges in the health care sector involving ionising radiation. The numerical data also contribute to testing the theory against practice and help the FANC in its mission to protect the population against the risks of ionising radiation.



KAREN HAEST
*theme coordinator
 radiotherapy*

“Over the past 20 years, the medical sector has evolved tremendously. We now visit the field more often and consult with our stakeholders, which used to be less the case in the past.”



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