Belgoprocess
Sustainability Report
2017
Ambitions on course

The remediation of the old sites has been high on Belgoprocess’ agenda for about 5 years.

Dismantling ponds is a challenging job

With the ponds in Building 2, Belgoprocess has a tricky dismantling job ahead on Site 1.

A job for the robot

‘The radiation dose in the basins is so high that every operator can only work in the building for 10 hours per year’, is how Rony Cools describes the situation in certain basins of the Chaud.

Site 1 dismantling programme on track

INSAP 1 (Industrial and Remediation Plan Site 1) is going full steam ahead.

All-time low radiation level thanks to safety culture

Belgoprocess last year recorded the lowest-ever radiation level among its staff.
KNOWLEDGE CARRIERS
A dynamic network of know-how and expertise
Belgoprocess is acclaimed worldwide for its knowledge in the field of nuclear dismantling and waste processing.

IPM
Monolith Production Facility essential for sustainable radioactive waste disposal
After a decade of preparation, Belgoprocess began construction work on the IPM this year.

INDUSTRIAL WASTEWATER
Too pure for the sewers
Wastewater that is too clean to be discharged into the sewers. It sounds absurd. Especially when a nuclear firm makes such a claim.

COMMERCIAL CONTRACTS
A win-win deal
In 2017, Belgoprocess again processed waste from other countries as part of its commercial operations.

PACEMAKER
Medical waste: good riddance
Belgoprocess handled large quantities of radioactive waste from the manufacturing and medical industries in 2017.

FIVE-YEAR PLAN
A roadmap for the professional execution of our projects
Belgoprocess has finished drawing up a new five-year plan for the period 2019-2023.
2017: Ambitions on course

Dear reader,

In 2013 Belgoprocess made a priority of the remediation of site 2 and the modernization of site 1. And with success, because today, five years later, we are well on course with our ambitions. In the meantime, Belgoprocess also managed to achieve the lowest radiation level ever among its staff.

‘A few years ago, together with NIRAS, we drew up the long-term vision for the sites of Belgoprocess’, says Nele Roobrouck, chairwoman of the board of directors. ‘For site 2, this mainly means a remediation plan to clean up and dismantle the site as much as possible. For site 1 there are also a significant number of investments programmed in addition to the dismantling of old installations.’

‘In 2017 the work continued at a strong pace’, adds CEO Wim Van Laer. ‘Old sheds were dismantled and the use of robots was introduced for the dismantling of highly radiating installations. In 2017, 2 new decommissioning licenses were obtained so that the stated ambitions can also be realized in the coming years. In
addition, new realizations are being worked on. On-site the construction of the Plant for the Production of Monoliths (IPM) was started. In this installation, Belgoprocess will prepare and post-condition the waste for disposal at the category A waste site, which NIRAS will exploit from 2023.

FUTURE

The past years have been mainly dedicated to the elimination of installations and waste from the past, but the focus is always directed to the future. ‘2018 is an important year’, explains Roobrouck. ‘A new five-year program is being prepared for the years 2019-2023. Decontamination and dismantling of the sites and the old installations will also become priority number 1. In addition, various investments and studies are required
to continue to comply with the latest legislation. And naturally Belgoprocess must make preparations to be ready when NIRAS will exploit the disposal of low and intermediate level waste. Belgoprocess would like to provide the necessary support and offer our many years of experience.’

‘Thanks to all these remediation and decommissioning assignments, we have accumulated a great deal of new knowledge’, adds Van Laer. ‘We have already given the example of the robots. You can read all about this later in this sustainability report. But we are also working hard on the improvement of thermal techniques for waste processing. In addition, strong emphasis is placed on the development and sharing of technical knowledge; amongst others with the creation of knowledge networks. All this knowledge is used for the processing of the Belgian waste and the remediation and dismantling of the old installations. In addition, we can also use this knowledge for other projects at home and abroad. In fact, we often develop extra knowledge in those projects. For instance, our project for a plasma incinerator in Kozloduy.’

‘All this has contributed to the fact that Belgoprocess has grown steadily in recent years. We have 300 employees today’, says Roobrouck. ‘In addition, there are about 100 other employees from various partner companies. In order to realize our objectives for the period 2019-2023, we will need the deployment of these people more than ever.’

SAFETY

Belgoprocess also meets the ambitions in terms of safety. The priority task of Belgoprocess is and remains to safeguard society from the risks of radioactive waste. Of course, this also means that the employees themselves must be protected to the maximum extent against the risks of working with radioactive waste. That is why employees are continuously monitored. Last year, Belgoprocess measured a total dose load of 54 mSv. Per employee this amounts to an average radiation of 0.17 mSv. Never before have such low values been measured. ‘True’, according to Van Laer. ‘We are proud that we can present the lowest figures for collective dose ever. For us it’s obvious we make these efforts. This is what society rightly expects from us. In fact, social engagement is in the DNA of Belgoprocess. We are always seeking to contribute to the finding of solutions for radioactive waste. A good example of this is the processing of radioactive sources. There are also things that are unexpected, such as pacemakers (see p. 54).’
Chaud

A job for the robot
The radiation dose in the basins is so high that every operator can only work in the building for 10 hours per year, is how Rony Cools describes the situation in certain basins of the Chaud. And so Belgoprocess bought a remote-controlled robot for the further dismantling of the Chaud. By using a remote-controlled demolition robot, the operators can limit their intervention.

Removing the Chaud is one of the main dismantling operations within INSAP 2 (Industrial and Remediation Plan for Site 2) and a highly complex project. The Chaud is situated on Site 2 and dates from the nineteen sixties. The building measures roughly 45 metres by 12 metres and is divided into two rooms holding 13 basins, four small ones and nine large ones. The SCK (Nuclear Research Centre) used to collect its effluents in those basins. When Belgoprocess embarked on the remediation and dismantling of the Chaud in 2013, the building was well stocked with 25-litre flasks and 200-litre barrels of radioactive effluents. It took two years to empty the basin room and clear up all the waste. The actual dismantling began in 2015 with the removal of all the pipes, lighting fixtures, and the decontamination of the walls. It soon became clear that the building was heavily contaminated on the inside. ‘In basins K5 to K8 we measure values of 1 mSv per hour’, Rony Cools explains. ‘Whereas the operating limit is 10 mSv per year. This means that every operator can only work here for up to 10 hours per year. This is obviously impracticable. Fortunately we found the solution with the new demolition robot. We are currently testing the machine, and later we will send it into the Chaud.’

When Eurochemic was dismantled, spots of 320 mSv were measured at the time, yet operators went in, which is remarkable.

Rony Cools: ‘That’s right. The radiation level in Eurochemic was far higher in some places, but also concentrated in certain spots. That makes it ‘easy’ to tackle by letting operators take one-hour turns accurately grinding and cutting on the spot. By the end of the day, the spots have been removed. In the Chaud, however, the contamination is not confined to a few spots, but covers the whole basin (in K5-K8). Therefore such high doses cannot be tackled hands-on.’
And so you send a robot into the building.

Rony Cools: ‘Yes, but don’t picture it as a ‘human’ machine. Our robot is an electro-hydraulic appliance on caterpillar tracks that can be fitted with a milling head, pick hammer and face milling cutter. These remote-controlled demolition machines are already widely used in the industry, and have also been successfully pressed into service at the Fukushima disaster site in Japan. The advantages are obvious: the time an operator spends in the heavily contaminated basins is greatly reduced, a robot can remove far more material than an operator in the same time span, and a robot can work the whole day instead of four hours (given the physical strain involved in this kind of work, an operator can only spend 2 x 2 hours per day in contaminated buildings, Ed.). We will use the robot in the Chaud to dismantle the four heavily contaminated basins. By way of preparation, the machine will first be tested in a less contaminated basin. The robot will tackle the worst contamination, and after that our operators will enter the Chaud to continue dismantling under acceptable risk.’
‘I have led the Dismantling team for 26 years now. The Chaud is by far the most difficult dismantling job in my career.’

Rony Cools

Why can’t this robot do the entire dismantling?

Rony Cools: ‘Because the appliance is only suited for the heavy-duty work. For instance, the robot cannot reach the corners, so that is something that has to be finished by hand. In any case, with such a machine you can only achieve an acceptance level of radiation, but never enough to release a building. For that you still need the experience and expertise of professionals. Even after the work has been done with the robot, the dismantling of the Chaud remains an extremely delicate undertaking. Let me put it this way: I have led the Dismantling team for 26 years now, and this is by far the most difficult dismantling job in my career.’

Belgoprocess already had such dismantling robots in use. Why aren’t those robots adequate?

Rony Cools: ‘The existing robots are too big to handle the decontamination of the basins. Even with the new robot, the decontamination work will be no straightforward matter. That is why we are not only testing this one in a less contaminated basin, but first in the lock leading to building 234D, which is virtually a copy of a basin in the Chaud. The operators will have the opportunity to try out the machine in non-contaminated conditions, which is really necessary. The drawback of using the robot in the basins is that the operator cannot see what the robot is doing. For that reason, the new robot is being fitted with cameras and microphones, because we not only want to see, but also hear what the robot is doing. For example, from the sound of the grinding we can hear whether we need the robot to apply more pressure or less. Our younger operators in particular are very skilful in operating the robot. Probably because this is a generation that grew up with computer games and joysticks.’

What will you do with the new robot once the work in the Chaud has finished?

Rony Cools: ‘Depending on the type of contamination, the machine will deployed on other dismantling projects. This is no straightforward matter, though. Moving the machine to another building constitutes a transport of radioactive material, which is subject to strict safety rules. Such a transport costs time and money, although I have no doubt that it pays to invest in such a demolition robot. There are several more tricky dismantling jobs waiting for us, and robotization ushers in a new era in dismantling. The fact that we have to carry out fewer operations to handle the highest radiation doses means not only a radical reduction of the risk, but saves a lot of time as well.’
Solid Waste Pond

Dismantling ponds is a challenging job

The dismantling team
With the ponds in Building 2, Belgoprocess has a tricky dismantling job ahead on Site 1. These contaminated ponds are some of the last structures of the old Eurochemic plant. ‘Because of the many surprises, this dismantling project remains a challenge’, says team leader Maarten Deckx.

Belgoprocess finished dismantling the Eurochemic plant in 2014. Building 1, the actual production plant and the biggest building, was totally demolished, but a few buildings were left standing: Buildings 2, 3 and 4, as well as Buildings 5 and 22. We recounted the dismantling of Buildings 5 and 22 in last year’s sustainability report. Today, Building 2 is next in line. There are four ponds in this building: the SWP (Solid Waste Pond), the RP (Reception Pond), the SP (Storage Pond), and the MTP (Mechanical Treatment Pond). In those ponds, which date from the nineteen sixties, all sorts of radioactive substances were received (RP), stored (SP and SWP) and treated (MTP). The ponds became heavily contaminated by those activities. Belgoprocess has been preparing the dismantling of those ponds for years, but this is no easy task at all, given the many irregularities which the dismantling team has already encountered.

SWP

‘As the name suggests, Eurochemic used this pond to collect solid radioactive waste in. This waste was immersed in water as an additional safety precaution. Water shields radiation. When we started work on the SWP, a lot of the water had already evaporated, leaving just a gelatinous layer of silt. As simulation tests in the laboratory showed that, after heating, very little of this thick viscous substance would be left, we consciously chose to let all of this silt dry in a controlled manner in a ventilated sealed room. This allowed us to reduce the final volume of radioactive waste’, Maarten Deckx explains. The question is, however, whether any radioactivity has been released into the ambient air as a result of evaporation. ‘No’, Maarten Deckx reassures us. ‘Like most of the buildings, Building 2 is under negative pressure. This means that the air pressure inside the buildings is lower than outside. Air always flows from a higher to a lower pressure area, in the same way as water always flows from high to low. Under negative pressure, air cannot flow outwards, only inwards. As an extra safety precaution, the ventilation system is fitted with a filtration unit that captures the radioactivity. This means that the evaporated liquid did not pose a risk.’
1 SIEVERT PER HOUR

The dismantling operations in the SWP are now in full progress. At the same time, work is under way in the other ponds. Preparation works are being carried out in the MTP. As in the SWP, a layer of silt needs to be removed and processed. Work in the RP at first seemed to progress more smoothly, until a spot of no less than 1 sievert per hour (1 Sv/h) was discovered in a pipe in a concrete wall between the bonds. In a first attempt to remove that spot, contamination in the MTP and RP increased to an unacceptable level. We are currently getting prepared for a second attempt.

‘Our operators protect themselves against that radioactive contamination by wearing a pressure suit with full face mask. Obviously that makes the work much harder’, team leader Maarten Deckx adds. According to this operational schedule, we work two hours in the morning and two hours in the afternoon. In between, we do other work that requires no respiratory protection. During this period (called the grey period), training sessions are given, small equipment is maintained, and the necessary preparations are made for the next operation.

The heavily contaminated spot between the MTP and RP turned out not to be the only problem: once we began removing the lining, far more sections emerged from behind the lining than expected. We also found water between the lining and the concrete, and laboratory analyses showed that the liquid was contaminated. Further investigation will be needed to find out where exactly that water comes from. This means more delay. ‘Incidents such as this are typical of the whole project’, says Maarten Deckx. ‘Once you think you’re well on the way, another surprise comes up. This doesn’t make a proper planning any easier. Especially as safety is at all times more important than a deadline. In any case, this project is part of INSAP. Our aim is to finish the dismantling of the ponds in the next five-year period.’
Buildings 123Y and 123F

Site 1 dismantling programme on track

Bert Van Nooten
NSAP 1 (Industrial and Remediation Plan Site 1) is going full steam ahead. As part of this modernization programme, Belgoprocess prepared the dismantling of Buildings 123Y and 123F during the past year. The work on this hangar and arched hall at first looked to be a piece of cake, were it not for the fact that it involves the dismantling of MAVA units (units for the processing of intermediate level solid waste), and that underneath Building 123Y there is a tank containing radioactive effluents that is difficult to get at.

‘This assignment is of a different order than, for example, the dismantling of the Chaud on Site 2 (see page 10)’, says operations engineer Bert Van Nooten, who manages the project. ‘Both 123Y and 123F are free-standing buildings with a limited number of connections to other installations. However, every dismantling job calls for careful preparation and the utmost caution. Moreover, every dismantling or remediation project has its own particular risks and safety requirements. The preparations (utilities, ventilation, etc.) turned out to involve far more work than initially anticipated. In a dismantling project, we remove all contaminated materials and wall sections by grinding, scabbling, shaving or plasma cutting. This produces a lot of dust, which has to be constantly exhausted to keep the area safe to work in. This requires a ventilation system that not only filters the air that is extracted to the chimney, but is also capable of handling large amounts of dust without the filters becoming clogged. The system must also be redundant, which means that if a malfunction occurs and the ventilation risks shutting down, a backup ventilation system takes over automatically. To do this, we had to remove the old ventilation system and install a new one that is suited to the dismantling operations. An additional complication was that the ventilation had to remain continuously operational during those works. That took extra time.’

Buildings 123Y and F date from 1978 and are remnants of the former Eurochemic reprocessing plant (in 2014, Belgoprocess demolished the last stone of the Eurochemic reprocessing plant). Building 123Y is constructed of concrete slabs, measures 15 metres by 77 metres, and is divided into six units. One unit was used to reduce low-level solid waste. Among the items that were processed there were contaminated glove boxes. In other units, intermediate-level non-combustible solid waste (MAVA) was sorted and processed. Building 123Y initially retained its function when Belgoprocess was set up in 1984 as successor to Eurochemic. In recent years, however, 123Y was only used for storing barrels containing concrete rubble from Eurochemic...
awaiting final release after sampling in the concrete spec. ‘This is not precarious material’, says Van Nooten. ‘In order to carry out the actual dismantling, however, it all has to be removed. As for the dismantling proper, the challenge lies primarily in the units where intermediate-level solid waste was processed and where the glove boxes were reduced.’

Building 123Y holds another perilous job. There is a tank with radioactive effluents in a room underneath the building. These effluents represent waste water from the operations that were carried out at the time in the units on the ground floor. Radiation readings show that this tank is highly contaminated. ‘We know what the problem is, and we also know the solution, but it is again an extra challenge for a building that apparently presents few complications as far as dismantling is concerned. The tank has to be removed, and the only way to get to the basement is through a manhole. We will have to break up the concrete floor carefully, as the tank is made of polyester. It could get damaged by falling chunks of concrete. In any case, we will empty the tank first, but there will always remain some sludge. We will have to lift the tank in its entirety out of Building 123Y, whereupon it will be taken to PAMELA for processing. Removing the tank will undoubtedly be the trickiest part of this dismantling operation.’
Adjoining Building 123Y is Building 123F, an arch-shaped hall 11 metres wide and 24 metres long, which was always used for storing tools and raw materials. Until recently, it mainly contained all sorts of non-contaminated waste, but Belgoprocess has since cleared everything away. The hall is now ready for dismantling. ‘This can be a quick job’, Van Nooten believes. ‘Like any arch-shaped hall, Building 123F is constructed of steel plates according to a simple design. After decontamination, dismantling will essentially involve taking down the steel structure. This is far easier than decontaminating a concrete structure. We have also learnt a lot recently from dismantling halls 270L and 270M on Site 2. It took us only two months to disassemble 270L, and that was much bigger.’

Belgoprocess plans to finish dismantling 123Y in three years. The plan today is that Building 123Y, after the units have been dismantled, will not be demolished, but may be used, for example, as storage room for tools and equipment needed for the further dismantling of Zone B, in accordance with the investment and remediation plan on Site 1 (INSAP 1).

INSAP 1

Up to 2030, 300 million euros will be invested in the further modernization of Site 1. A lot has already happened. We have had the demolition of Eurochemic, and the upgrade of the PAMELA and CILVA installations. There is still much to be done: the dismantling of Building 5/22 and several ponds (p. 16), the construction of IPM (p. 36), and a new wastewater treatment plant. This is just a selection from the modernization programme for Site 1. ‘We need to prepare Belgoprocess for the challenges that lie ahead’, says Van Nooten. ‘We have taken yet another hurdle with the dismantling of Buildings 123Y and F.’
Dosimetry

All-time low radiation level thanks to safety culture

Rudi Dresselaers
Belgoprocess last year recorded the lowest-ever radiation level among its staff. 95 percent of the workers were exposed to levels below 1 millisievert. 20 millisievert is the legal limit. ‘There are a number of reasons for this all-time low’, Rudi Dresselaers and Paul Gielen of the Safety department explain. ‘But as in all divisions of the company, our efforts in the area of safety are paying off.’

The figures clearly bear this out as we look at how the collective radiation exposure for the 300 employees of Belgoprocess has evolved. In 2013, the overall radiation exposure was 146 mSv (millisievert); in 2014 it had fallen to 142 mSv, right down to 96 mSv the following year, and in 2016 it was just 90 mSv. This downward trend was emphasized last year when the Safety department closed its readings at an overall exposure level of just 53 millisievert, which is an all-time low. How should we interpret this figure? Belgoprocess has 300 employees. If you divide the exposure level (53 mSv) by the number of employees (300), you get the average exposure per employee: 0.17 mSv. In practice this means a radiation exposure of less than 1 mSv for 95 percent of the workforce. The maximum individual dose was 2.95 mSv. Five years ago that was still double. In comparison, a CT scan at a hospital exposes the patient to a dose of 8 to 9 mSv. Remember that the legal limit is 20 mSv per year for occupationally exposed workers. Belgoprocess’s own internal regulations actually set the limit at half that figure: 10 mSv per year. ‘That means less radiation than having a CT scan twice a year’, as Paul Gielen, Safety Manager, explains the extremely strict standard.

How do you account for the downward trend, and especially last year’s all-time low exposure level?

Rudi Dresselaers: ‘The radiation exposure is obviously linked to the operations on the site. Working in an area with a high radiation field results in a higher dose than in a building with low background radiation. But if the radiation field or the contamination level is too high in a particular plant, we use remote-controlled techniques to do the work. Last year, we worked hard preparing for the dismantling of the Chaud, a building from the nineteen sixties where radioactive effluents were stored. Contamination in the Chaud pervades the whole building, and the background radiation is too high. As it is too risky to send people in there, we will use remote-controlled techniques to do the work. This means that our people will remain outside the building, and will not be exposed to radiation. This is shown in the readings.’

Paul Gielen: ‘At the same time, we should not underestimate the importance of our safety culture. A few years ago, Belgoprocess carried out an assessment of safety behaviour. Individual behaviour is just as essential to safety as technical and organizational safety measures. The purpose of that exercise was to get a
better idea of our safety culture. The eventual outcome was an action plan: Think Differently, Act Differently. Our people have become more aware of their behaviour, and safety has become more than just rules and technical measures. It is an attitude, a work ethic, and today we are reaping the benefits of that policy. That, too, is what we can conclude from the low radiation exposure.'

Critics might, however, respond by saying: ‘Yes, but Belgoprocess is doing the dosimetry. They are monitoring themselves. How reliable are those figures?’

Rudi Dresselaers: ‘We can easily refute that argument. Belgoprocess is an approved dosimetry service. This means, among other things, that the dosimetry is accredited with ISO-17025 and approved by the FANC. The accreditation means that the environmental monitoring has for many years now been carried out in a scientific way by competent personnel working in complete independence. Our monitoring methods have therefore been scientifically validated.’

‘The use of remote-controlled techniques is a major step forward in terms of radiation exposure limitation’
Rudi Dresselaers
Paul Gielen: ‘ISO-17025 is actually a quality label for credibility and reliability. To keep this label, we must keep up our efforts. There are rigorous checks, and audits are conducted on a regular basis. But we are keen to make those efforts. Protecting man and the environment against the risks of radioactive waste flows is absolute top priority for Belgoprocess. It is no accident that our Safety department numbers more than 70 staff. That is a quarter of the total workforce. And our efforts are paying off.’

You also carry out environmental measurements in Mol and Dessel. Are those readings well below the limit too?

Paul Gielen: ‘The results of those readings are negligible. We don’t express them in millisievert, not even in microsievert, but in terms of nanosievert, which is one-millionth of a millisievert. What we are reading here is simply natural background radiation.’

The Chaud has already been mentioned, but now preparations are under way for the dismantling of Building 5/22, a remnant of Eurochemic containing heavily contaminated tanks. Is this a high-risk dismantling job?

Rudi Dresselaers: ‘We use the ALARA procedure for all operations. ALARA stands for As Low As Reasonably Achievable. This means that the radiation exposure of our people is limited to the level that is reasonably achievable. For this purpose, we base ourselves on studies, plans, experience etc. to estimate the working
time and the dose to which the worker will be exposed. When we arrive at an unacceptable level, we look for ways to achieve an acceptable level. If that does not succeed, we deploy remote-controlled techniques. On the basis of the ALARA studies for 5/22, we already know that the dismantling operation will essentially be a remote-controlled affair.'

Is there still much room for improvement in terms of radiation exposure reduction?

Rudi Dresselaers: 'There probably is; working by remote control is a major step forward, and investment in robot technology or other remote control techniques could in particular cases give progress in terms of dosimetry. However, a robot is not suitable for every kind of work, and it is very expensive. When we use the ALARA procedure, the term 'Reasonable' also covers economic considerations. Today, doing everything by robot would be economically unreasonable. Moreover, after a career in dismantling, the robot itself eventually becomes radioactive waste too.'

Paul Gielen: 'Our work must not become a contest. It's like the weather: if tomorrow we get the hottest day ever, then the next day is bound to be colder again. Not cold, but colder. Same thing here. If next year we measure a higher radiation exposure, that does not necessarily mean that we performed less well. Probably we will measure higher levels next year precisely because today they are historically low and because certain more critical operations are scheduled. In any case, our radiation exposure level will remain well below the legal limit as well as below our own limit, as in fact it has been for many years already.'
Knowledge carriers

A dynamic network of know-how and expertise
Belgoprocess is acclaimed worldwide for its knowledge in the field of nuclear dismantling and waste processing. That knowledge has been carefully built up over more than three decades, and has become its main capital asset. By designating knowledge carriers, Belgoprocess wants to streamline all of this know-how and expertise even better.

In 2016, Belgoprocess began rolling out a company-wide management system to monitor all installations and buildings throughout their life cycle. In practice, this so-called ageing management system involves a digital inventory listing all overhaul operations, inspections, sensitive components, technological innovations, maintenance works etc. according to a standardized method. This gives Belgoprocess a continuously updated and harmonized general overview of the condition of the installations and buildings, so that action can be taken quickly, easily and safely if any problems occur. In other words, knowledge was streamlined to improve the day-to-day operation. Belgoprocess repeated this exercise last year with its human capital. ‘Belgoprocess is a knowledge-based company’, Ken Goeyvaerts explains. ‘Since its inception in 1984, Belgoprocess has constantly invested in the development of techniques, tools, strategies, safety measures etc. to limit and process radioactive waste. Thanks to this know-how and expertise, Belgoprocess has become an international expert in nuclear waste processing. Nevertheless, all this knowledge and experience is not simply generated by the computer with a few mouse clicks; it is to be found in our people, staff members who have been with us for many years, but also in young employees with a particular specialism. In order to map this knowledge, we took a ‘photo’ a few years ago. This gave us a good idea of who has what expertise, as well as the knowledge gaps that needed to be filled. Last year, on the basis of this analysis, we launched the pilot project ‘Technical
Network’, called Knowledge Network here, in the technical department of Belgoprocess. For this purpose, we appointed knowledge carriers in Belgoprocess, specialists responsible for the specific skills of a particular discipline. These knowledge carriers are expected to further define and update their expertise and make it transferable to other departments. We also expect them to engage in independent study, attend seminars, help think about ways to gather and share knowledge, and what the best ways are to learn from each other. The purpose of all this is of course to make all the knowledge that exists in Belgoprocess into a far more dynamic whole, a vibrant network in which knowledge is cultivated and stored, so that we can turn this know-how to good account more easily.’

WORKFORCE

The Knowledge Network is also linked to the staff and recruitment management of Belgoprocess. If someone retires, or an employee is absent for a long time, the Knowledge Network shows exactly where there are gaps in knowledge and/or expertise. In this way, current employees can be far better prepared for a new position in the company, and job vacancies can help to target the right profile more accurately. ‘The Knowledge Network gives us an overall picture of our expertise, and enables us to proactively optimize our workforce and also to install back-ups so that we are no longer dependent on a few experts. The Knowledge Network has also improved communication. Naturally there has always been consultation between the various departments, but before they used to sit together when there was a problem. Today, however, they meet even if there is no particular problem, but now with knowledge issues on the agenda. Meeting topics include how to respond to remarks from the FANC or how best to handle tenders. As you can see, potential difficulties and/or future challenges are anticipated. It should therefore come as no surprise that we have rated this pilot project favourably.’

TECHNICAL KNOWLEDGE CARRIERS

For now, the Knowledge Network project is confined to the technical department of Belgoprocess, along with a few external employees and the fire safety department. In other words, there is no systematic consultation in place yet for process-related knowledge carriers. ‘Their way of building knowledge differs significantly from ours’, Goeyvaerts explains. ‘What it means more or less is that the knowledge of technical engineers is highly specific, whereas process engineers focus on the process aspect. That gives a different knowledge flow. Until last year, Knowledge Network was a pilot project which we first wanted to roll out in the technical department. However, this does not preclude us from involving process engineers in the Knowledge Network in a next phase. I believe that, ideally, we should eventually have knowledge carriers for all nuclear disciplines and for the maintenance of the installations.’
Monolith Production Facility essential for sustainable radioactive waste disposal
After a decade of preparation, Belgoprocess began construction work on the IPM this year. IPM stands for Installatie voor de Productie van Monolieten or, Monolith Production Facility, an essential link in the surface disposal of low and intermediate level short-lived waste. ‘The importance of the IPM cannot be underestimated in relation to the safe and sustainable disposal of radioactive waste’, says project engineer Dirk Van Houdt.

The story of the IPM already began in the late 1990s when the federal government held a survey among the Belgian cities and municipalities to sound out their willingness to dispose of radioactive waste on their territory. It should be pointed out that, today, nowhere in Belgium is radioactive waste disposed of, only stored. Storage is a temporary way to manage radioactive waste safely; disposal is a sustainable long-term solution. Today, we are seeing a rapid development in the solutions for disposal, yet this took years of preliminary study and consultation.

CAT PROJECT

In 2006, the then federal government finally decided to build the surface disposal plant for low and intermediate level short-lived waste in Dessel, on the border with Mol. The project is called cAt (category A waste), and NIRAS (National Institute for Radioactive Waste and Enriched Fissile Materials), the parent company of Belgoprocess, is executing the contract. The project consists of several parts: the disposal site proper with an accompanying administrative building, a quay and an access road for the supply of building materials, the caisson plant, a communication centre, several test rigs, and the IPM. NIRAS is responsible for the construction of the IPM, while Belgoprocess will take care of the operation. ‘The category A waste will arrive at the IPM in metal barrels that will be placed in a caisson, a concrete box’, Dirk Van Houdt explains. ‘These
caissons are then filled with mortar to form a monolith, a sealed, stable block which safely encapsulates and isolates the waste. The caissons can hold three types of waste: standard barrels, non-standard barrels, and bulk waste. The monoliths are eventually disposed of. Our job is to produce around 26,000 monoliths over a period of 30-odd years.'

'The supply of the raw materials needed was thought over carefully', says Dirk Van Houdt. 'Bulk goods should preferably be shipped over the nearby canal. NIRAS had already commissioned the construction of a landing quay to allow ships to moor near the site. The idea is to offer a practicable alternative to transportation by road in order to spare the town centres of Dessel and Mol as much as possible.'

NIRAS and Belgoproccess began construction work on the IPM this year. ‘We already started studies for the project back in 2007’, Dirk Van Houdt recounts the background of the project. ‘We appointed a team, and
The IPM building will be put up on the west side of Site 1 and will have a separate entrance during the construction phase.

until 2014 we were busy drafting blueprints, writing safety reports, and especially making the most detailed calculations of everything, recalculating, testing, checking, double-checking, and obtaining the necessary permits. When it comes to safety, we leave nothing to chance.‘

By 2014, most of the preparation work was completed; Belgoprocess received planning permission, and a public tender was put out for the construction of the IPM. The IPM and the caisson plant should both be operational by 2021, while the disposal plant will only be ready in 2023. ‘That gives us a run-in period of two years’, says Van Houdt. ‘Time enough to get started up, overcome teething problems, and build a buffer so that disposal can begin smoothly in 2023. The planning is being closely monitored, because once the building is completed and the operating licence is confirmed, a temporary solution can be offered for Belgoprocess’s tight storage capacity.’
We have to make 26,000 monoliths over a period of 30 years. So the IPM will bring more jobs.

Dirk Van Houdt, project engineer

QUALITY GUARANTEED

In order to guarantee the quality of the end product - the monolith - the IPM will have a 'mortar lab'. This laboratory will oversee the stages of production from the arrival of the raw materials to the shipment of the monolith to its final destination. 'We will inspect all incoming raw materials, such as cement, sand and the necessary additives. We will then test the liquid mortar for fluidity, binding time, air content, etc.', Dirk Van Houdt explains. 'This will give us the guarantee that the end product will be up to standard.' The pressure tests on the hardened test pieces will subsequently show whether the mortar-filled monoliths are suited to their task.

'The most crucial choice of raw material is probably limestone', Dirk Van Houdt concludes. 'This makes the monoliths immune to ASR (alkali-silica reaction) so that they can be disposed of safely.'

There is more in the pipeline. NIRAS is investing in a visitor centre next to the disposal site to replace the Isotopolis visitor centre. This visitor centre will offer benefits from an educational as well as from a tourist and economic (employment) perspective. 'The IPM will also bring more jobs', Van Houdt adds. 'I guess we will need about 20 extra people to operate the facility. Today, the construction of the IPM in itself already provides a fair amount of temporary employment. Not only do we have a contractor and its staff working on the site, but also an engineering firm and an external technical inspection service, a safety coordinator, and the FANC (Federal Agency for Nuclear Control). Again, when it comes to safety, we leave nothing to chance.'
Industrial wastewater

Too pure for the sewers

Alexander Lodewyckx and Tom Van Roy
Wastewater that is too clean to be discharged into the sewers. It sounds absurd. Especially when a nuclear firm makes such a claim. Yet this is in fact the case at Belgoprocess. That is why Belgoprocess is building a new installation to store and neutralize its industrial wastewater. Once neutralized, the water is discharged into the Nete in Mol.

Belgoprocess distinguishes three kinds of wastewater: radioactive suspect wastewater (see text box), industrial wastewater, and rainwater. At Belgoprocess, industrial wastewater and rainwater are discharged separately. The rainwater can not be discharged into the wastewater sewers. At Belgoprocess, the rainwater is infiltrated into the soil locally as much as possible. We will now focus on the industrial wastewater. This water comes mainly from the boilers, the air compressors and the reverse osmosis installation. The water from the steam process and the air compressors is too pure and too voluminous to be discharged into the

**RADIOACTIVE SUSPECT WASTEWATER**

The discharges of purified wastewater from the nuclear operations of Belgoprocess have for many years now remained well below the legal limits and permitted values. Belgoprocess is allowed to discharge up to 60,000 m³ purified wastewater in the Nete in Mol each year. In 2017, Belgoprocess discharged 25,728 m³ purified wastewater (or 43% of the permitted value). The weighted radioactivity discharged amounted to 0.425 GBq (gigabecquerel), whereas Belgoprocess has a permitted limit of 150 GBq/year. ‘We have achieved a substantial reduction in the amount of wastewater that we discharge in the Nete, and the quality of that wastewater has improved as well’, says Sandra Vanarwegen, environmental surveillance officer.

The new five-year plan 2019-2023 (see p. 60) contains a study for the construction of a new wastewater treatment plant on Site 1. Wastewater treatment currently takes place on Site 2, but as part of INSAP Belgoprocess wants to centralize its operations on Site 1.

The new wastewater treatment plant is not expected to reduce discharge values any further. The reason is that Belgoprocess already has low discharge values, and has remained below one percent of the permitted limit for several years running. This good score is achieved because the present wastewater treatment plant is already state-of-the-art with activated carbon filters and ultrafiltration. Although from a technological point of view the new wastewater treatment plant will not produce any spectacular improvements, it will be perfectly suited to our future needs. It will also be more logical from an organizational perspective, as the untreated water will no longer be transferred to Site 2 for purification.
public sewers. Yes, you read that correctly: too pure for the sewers. ‘We use demineralized water for our two boilers’, project engineers Tom Van Roy and Alexander Lodewyckx explain. ‘This demineralized water is produced by decalcifying drinking water. Drinking water contains a lot of calcium, which is a problem. Like in your home, this calcium is deposited inside the pipes, so that the boilers cease to work properly and high maintenance costs are inevitable. The minerals in the water also damage the boilers. To filter calcium and minerals out of the drinking water, a reverse osmosis installation was set up. This installation turns drinking water into demineralized water.’ The wastewater from the reverse osmosis process is in fact drinking water with a higher calcium concentration; it is this water, together with the discharge from the boilers and the drainage from the air compressors, which we discharge as industrial wastewater.

Why mustn’t this industrial wastewater be discharged into the sewers?

Alexander Lodewyckx: ‘The municipal sewerage network is connected to a public wastewater treatment plant (WWTP). In the WWTP, the wastewater is biologically purified until the quality is good enough to be discharged into a waterway. The waste in this wastewater is actually food for the bacteria living in the WWTP. If our industrial wastewater is discharged in large quantities into the sewers and mixes with the sewage, the waste in the sewage becomes too diluted. The bacteria living in the wastewater treatment plant of the public sewerage network can’t find enough food and eventually die, putting the biological water treatment process in jeopardy. Belgoprocess produces one million litres of industrial wastewater each month. Discharging that much water could affect the composition of the wastewater and could make the water treatment less efficient.’
You are currently building an installation to collect this water. Where is the industrial wastewater being discharged now?

Tom Van Roy: 'In the past, this industrial water was discharged directly into the soil (groundwater), which is now against VLAREM regulations. As part of our modernization programme, we decided to build a 5 m³ buffer tank to collect this water in; this buffered water is then transferred to a much larger existing tank of 1,000 m³. In this larger tank we can add bases and/or acids to this industrial water; once this water has attained the right pH value, it can be discharged in the Nete in Mol. To do so, we will transfer the water to our Nete basins on Site 2. The pipelines have yet to be laid.'

So most of the industrial wastewater comes from the production of steam and the air compressors? What does Belgoprocess use those installations for?

Tom Van Roy: 'The boilers provide heating to the whole site, but we also need steam for our particular operations. Belgoprocess also uses steam to transport radioactive liquids. Suppose you want to transport a radioactive liquid from tank A to tank B. You could use conventional liquid pumps, in which case the engineers would risk unnecessary radiation exposure during maintenance and repairs. For transporting radioactive liquids between tanks we prefer to use the maintenance-free steam jets. These steam jets work like a venturi and are powered by steam. Reliable and simple. We use the air compressor to power our tools: pick hammers, milling cutters, sanding machines, measuring instruments, etc. We also use compressed air for seaming certain barrels. Why not electricity? Air compressors have overload protection, which is beneficial for safety.'
Belgoprocess also uses steam to transport radioactive liquids from tank A to tank B by means of steam jets.

Alexander Lodewyckx and Tom Van Roy

These instruments are used in the controlled area. Doesn’t the condensation from the compressed air become contaminated by radiation?

Alexander Lodewyckx: ‘No, that’s impossible, because we drain off the water outside the controlled area, and for certain applications even hundreds of metres away. This means that this condensation never enters the controlled area and therefore cannot become contaminated. Moreover, the radioactive and industrial wastewaters are strictly separated.’
A win-win deal

Commercial contracts
In 2017, Belgoprocess again processed waste from other countries as part of its commercial operations. ‘With these commercial projects, we offer solutions to foreign customers and at the same time utilize the available capacity of our installations. A win-win situation’, says Mieke Roos of the Business Development department.

The contacts and contracts for processing waste from other countries required many years of preparation. In June 2006, the Belgian government had already decided to allow Belgoprocess to handle foreign waste under strict conditions. This was followed by a two-year period in which Belgoprocess and NIRAS worked out procedures and rules to comply with government requirements and strict safety and environmental regulations. All the paperwork and preparations took a further two years to complete.

Nevertheless, those efforts were important. By processing only Belgian radioactive waste, installations such as the CILVA incinerator would be left underutilized. In economic terms, this means that the investment is not paying off. By attracting business from other countries, Belgoprocess increases its efficiency. It also contributes to the preservation and expansion of its expertise and know-how.

CONTRACTS

And so negotiations were conducted in recent years with foreign companies, resulting in three contracts. An agreement was concluded with a German customer to process 120 tonnes of medical waste; a contract with the Dutch company NRG concerns the processing of 21 m$^3$ low and intermediate level historical waste, while a contract was concluded with the Romanian firm Mate-Fin to process 72 tonnes of low-level waste from a Romanian nuclear power station. The processing of this waste will naturally cover several years. ‘We process approximately 180 tonnes of domestic waste and 30 tonnes of foreign waste each year’, Roos explains. ‘After processing, the waste is shipped back to its country of origin. The secondary waste, generated by the processing of waste, such as protective clothing, is also returned to the country of origin. We have negotiated clearly defined agreements which stipulate that nothing from the waste batches must remain on Belgian soil.’ It is not surprising that the Dutch NRG (Nuclear Research and consultancy Group, the Dutch counterpart of
the SCK•CEN (Belgian Nuclear Research Centre) has turned to Belgoprocess, given its proximity and the fact that the Netherlands has no processing plant of its own for that particular type of radioactive waste. But what about Nuclitec in Germany and Mate-Fin in Romania? Both these firms can have their waste processed closer to home, and yet they choose Belgoprocess. ‘Our greatest strength is that we are familiar with virtually every kind of waste’, Roos explains. ‘As successor to Eurochemic, Belgoprocess has helped to usher in the nuclear age. Know-how has been developed here since the nineteen sixties. Belgoprocess also played a pioneering role with the dismantling of the former Eurochemic plant. When we started on this operation in 1989, Eurochemic was the first nuclear reprocessing plant in the world to be dismantled. Naturally this involved all sorts of waste, for the processing of which we developed techniques and installations over the years. It was also this country’s policy to opt for the central processing of radioactive waste at Belgoprocess. This means that Belgoprocess has - or had, seeing that certain batches of waste have already been processed and the installation dismantled - installations and the know-how to process virtually any kind and type of waste. This has put Belgoprocess on the map as an international expert in nuclear dismantling and waste processing, and allows us to offer international customers a wide range of solutions.
These international contracts are important for us too. The great advantage of central waste processing is that we have a solution for virtually every kind and category of radioactive waste. The downside is that we lose out in terms of efficiency. For certain installations there is simply not enough waste to keep them running continuously. But by sourcing waste from other countries, we can improve the cost-effectiveness of our installations and contribute to the preservation and further expansion of our expertise. In other words, a win-win deal.'

PLASMA

Another promising international commercial project is the plasma furnace which Belgoprocess built in Bulgaria in partnership with the Spanish firm Iberdrola Engineering and Construction. A plasma furnace is equipped with a plasma torch that can reach temperatures of up to 5,000 °C, incinerating or melting down everything. In a plasma furnace, all kinds of mixed combustible and non-combustible waste can be incinerated or melted down at the same time without prior sorting. An ideal solution for processing problematic and complex historical waste batches. Plasma technology is not new, but Belgoprocess has perfected the technology with a number of innovations. The main innovation is the tilting technology, an invention for which Belgoprocess received a patent. The tilting mechanism allows the incinerated waste to be checked and poured safely into steel barrels. The waste then hardens into a chemically stable slag, ready for direct storage. This represents a significant increase in efficiency and safety. ‘After earlier successful tests, the plasma furnace in Bulgaria was brought into operation at the end of May to process the first batches of radioactive waste’, Roos explains. ‘Certain countries have already expressed an interest in this technology, although no agreements have been concluded yet. Now that the plasma furnace has become operational, we expect that we will be able to market our expertise in this area. Plasma technology is in fact the best available technology today to dispose of historical batches of mixed waste, and Belgoprocess holds an important patent for this process.’
Medical waste: good riddance
Belgoprocess handled large quantities of radioactive waste from the manufacturing and medical industries in 2017. One of the waste batches contained a special item: a pacemaker. ‘The older generation of pacemakers contains plutonium’, says Robin Tuerlinckx. Processing this ‘special’ radioactive waste is of course in keeping with Belgoprocess’s role as public service provider.

During the past few years, Belgoprocess sought to give more prominence to its role as public service provider. Over the last five years, Belgoprocess handled quite a number of waste batches which often had been stored for many years - albeit in accordance with the legal and technical requirements - on university premises, industrial sites and/or military bases. Take, for example, decommissioned radioactive sources, old lightning conductors or radium paint, which was used not so long ago to make luminescent watch dials. Medical vaults of hospitals also hold such special waste batches that are awaiting processing. Belgoprocess has been sourcing waste from the medical sector for several years now. Last year, a special item was found among that waste: a pacemaker, a device that supports the heart function. ‘The current pacemakers are no longer sources of radioactivity’, says Robin Tuerlinckx, who is in charge of special waste at Belgoprocess. ‘However, the older generation of pacemakers used plutonium for power supply. Plutonium 238 has a half-life of 88 years. This means that a pacemaker keeps working in the patient’s body for the rest of his life - and often longer - without requiring maintenance or replacement. Which of course was a tremendous advantage.’
Yet it also held a serious risk?

**Tuerlinckx:** ’The source used does indeed have a very high specific activity of more than 17 Ci/g. I should point out that we normally express radioactivity in Becquerel, but for very high levels we use Curie per gramme. Plutonium is also an alpha emitter, which means that the radiation can easily be contained. The pacemakers were encased in titanium so that virtually no radiation was released, and the patient ran no risk whatsoever. The titanium casing could even withstand the impact from a bullet.’

Is there much other radioactive medical waste still awaiting processing?

**Tuerlinckx:** ’We have a clear view of the absolute majority of the waste that is still left, and hospitals are handling it safely pending processing. The historical radium waste from the medical sector is more difficult to inventory. Radium needles were commonly used before by doctors. As we were clearing up the historical waste on Site 2, we came across a receptacle containing radium needles with an accompanying letter from a doctor thanking a hospital for the radium that was supplied to him. This would be totally unthinkable today.”
Yet it is one example of how that material became disseminated among the medical profession. Another story is of a nurse who found a straight metal rod in the hospital and used it to draw straight lines with. A reading showed it to be a radioactive source. People at the time were insufficiently aware of the danger of radioactivity. Radium, for example, is one million times more radioactive than uranium, yet it was regularly used by general practitioners until the nineteen eighties.

Suppose a doctor retires, and his children come across radium needles while they are clearing up his surgery; unaware of what they are, they throw them in the dustbin. Surely this must hold a serious risk?

**Tuerlinckx:** ‘Definitely. That is precisely the reason why agencies such as FANC, NIRAS and Belgoprocess have joined forces to speed up the disposal of this kind of special waste. To come back to your example: as long as the radium is kept in a lead receptacle, no radiation can escape. Landfill sites and scrapyards have monitoring stations. Detectors have been set up along busy roads and on important industrial sites, such as the port of Antwerp. If someone should enter a scrapyard or the port of Antwerp with radium needles, the radioactivity will be detected right away. The FANC (Federal Agency for Nuclear Control) will then go to the site to intercept the waste and assess the risk. NIRAS is contacted, and the waste is sent to us for processing. This kind of thing happens several times a year. Very small quantities are involved each time.’

**Nuclear medicine is a medical specialism with numerous applications and many desirable effects. Will we see an increase in medical nuclear waste?**

**Tuerlinckx:** ‘No, not at all. More and more often, medical science discovers technologies that save patients from radiation exposure. Nowadays, for example, a CT scan can in many cases be replaced by an MRI scan. At the same time, nuclear technology is essential for medical research. Accurate measurements are very easy to carry out using radioactivity, for instance to find out how efficaciously a medicine is absorbed into the bloodstream. Nuclear applications have become well-established in medical research laboratories, but the hospitals themselves will generate less and less nuclear waste.’
A roadmap for the professional execution of our projects

Philippe Lannoy and Niels Huijs
Belgoprocess has finished drawing up a new five-year plan for the period 2019-2023. This detailed roadmap outlines - for the next five years - the operational framework and the financial efforts involved. ‘This plan represents the agreement we enter into with NIRAS and the government for the professional execution of our projects’, Niels Huijs, Manager Operational Activities, and Philippe Lannoy, Manager General Services, explain.

A lot of work has been done at both Belgoprocess sites over the past five years. Site 1 saw an upgrade of both the PAMELA and CILVA installations, the construction of a new multifunctional security station and an internal perimeter, and the final demolition of the former Eurochemic plant. While the works on Site 1 are essentially of an investment nature, activity on Site 2 in the last five years focused primarily on remediation and dismantling, such as the demolished 270L and 270M sheds and the disposal of waste from the Solarium. Eventually, all activity on Site 2 will be reduced to a minimum, while Site 1 will be further modernized with a view to having all operations centralized there. This is all outlined in INSAP (Industrial and Remediation Plan for Sites 1 and 2), an action plan setting out 300 million euros worth of investments up to 2030 to prepare Belgoprocess for the challenges of the future.

So the first question is: why do you still need five-year plans if INSAP already encompasses all investment and remediation projects?

Niels Huijs: ‘INSAP and our five-year plan are not separate stories. Our five-year plans are derived from INSAP, and they offer a detailed formulation of a number of projects that are described in INSAP but have not been further developed yet. The approach of INSAP is roughly as follows: what challenges are coming our way and how do we prepare for them? On that basis, a number of essential investments and remediation operations have been outlined and an estimate made of the financial cost. A five-year plan makes a selection of the most urgent projects and develops them in detail. But I understand the confusion. For many companies, five years is a time span for a long-term strategy, while for us that is the medium term, for the simple reason that most of our projects cannot possibly be completed within five years.’
What specific projects are envisaged for the next five years?
Niels Huijs: ‘For the sake of clarity I should first explain the structure of such a five-year plan. It is divided into different sections. As was already mentioned, there are the projects that will be realized over the next five years. A complete blueprint is made of those projects, along with a budget and a timetable. The construction of ROC (incoming shipments and storage centre) is one such particular project, as is the construction of a storage area for the shipments affected by ASR (alkali-silica reaction). Projects that have already started are also extensively described, such as the dismantling of the Chaud (p. 10), Building 123Y (p. 20), or the monolith production facility (MPF) (p. 36). That brings me to the second part of the five-year plan: studies. We also describe the research that precedes the implementation of investment and remediation projects. MPF, for example, was also marked as study in the last five-year plan; today it is marked as a concrete project. The studies in the new five-year plan include the construction of a new wastewater treatment plant, and the refurbishment or construction of new laboratories and offices. We also look back on the past five years, primarily in order to determine whether and how everything has been carried out that was envisaged in the previous five-year plan.’

Philippe Lannoy: ‘There is also the nuclear waste inventory. We are obliged by law every five years to draw up an inventory of all the radioactive waste on the site. This constitutes the basis for an updated cost estimate of the processing of historical waste on the site.’

Who approves these five-year plans?
Niels Huijs: ‘First, the programme is approved by the Board of Directors of Belgoprocess. As Belgoprocess carries out these activities (except for the so-called “commercial activities”) on behalf of NIRAS, this programme must also be approved by the Board of Directors of NIRAS. The large-scale investments on the sites are in fact contracted out by NIRAS.’

Who ultimately foots the bill?
Philippe Lannoy: ‘The ‘polluter pays’ principle is applied. This means that those who produce the radioactive waste must bear the cost. In the historical context (cessation of Eurochemic and transfer of the SCK waste site to Belgoprocess), the remediation of the waste (i.e. the old installations) is the responsibility of the Belgian government. Financial responsibility for this remediation of Sites 1 and 2 is covered by the federal surcharge on the electricity bill. Obviously, the five-year plans for the remediation aspect of sites BP1 and BP2 require the approval of the relevant ministers.’

Commercial activities also generate income. Are they also included in the five-year plan?
Philippe Lannoy: ‘Naturally we take that income into account, especially as we work together with NIRAS and the federal government in full transparency. In the next five years, however, we will be focusing on the Belgian programme: implementing the necessary new projects and remediating and dismantling the decommissioned installations. Believe me, the programme we have prepared is more than challenging.’
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<th>Δ EUR</th>
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<td>5,829</td>
<td>4,486</td>
<td>1,343</td>
<td>29.94</td>
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<tr>
<td>Advances received on orders</td>
<td>11,717</td>
<td>11,065</td>
<td>652</td>
<td>5.90</td>
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<tr>
<td>Debts relating to remuneration and taxes</td>
<td>5,121</td>
<td>5,469</td>
<td>-348</td>
<td>-6.35</td>
</tr>
<tr>
<td>Taxes</td>
<td>806</td>
<td>1,460</td>
<td>-654</td>
<td>-44.81</td>
</tr>
<tr>
<td>Remuneration and social security</td>
<td>4,315</td>
<td>4,008</td>
<td>307</td>
<td>7.66</td>
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<tr>
<td>Other debts</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Accruals</td>
<td>5,921</td>
<td>6,119</td>
<td>-198</td>
<td>-3.24</td>
</tr>
<tr>
<td><strong>TOTAL LIABILITIES</strong></td>
<td>54,274</td>
<td>52,500</td>
<td>1,774</td>
<td>3.38</td>
</tr>
</tbody>
</table>
## INCOME STATEMENT (IN 1,000 EUR)

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2016</th>
<th>Δ EUR</th>
<th>Δ %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING INCOME</strong></td>
<td>59,226</td>
<td>55,735</td>
<td>3,491</td>
<td>6.26</td>
</tr>
<tr>
<td>Turnover</td>
<td>58,307</td>
<td>54,989</td>
<td>3,318</td>
<td>6.03</td>
</tr>
<tr>
<td>Changes to order in progress</td>
<td>346</td>
<td>101</td>
<td>245</td>
<td>241.51</td>
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<tr>
<td>Produced fixed assets</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
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<tr>
<td>Other operating income</td>
<td>571</td>
<td>642</td>
<td>-71</td>
<td>-11.03</td>
</tr>
<tr>
<td>Non-recurring operating income</td>
<td>1</td>
<td>3</td>
<td>-2</td>
<td>-59.26</td>
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<tr>
<td><strong>OPERATING CHARGES</strong></td>
<td>58,699</td>
<td>58,595</td>
<td>104</td>
<td>0.18</td>
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<tr>
<td>Commodities</td>
<td>7,502</td>
<td>6,534</td>
<td>969</td>
<td>14.82</td>
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<tr>
<td>Purchases</td>
<td>7,467</td>
<td>7,044</td>
<td>423</td>
<td>6.00</td>
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<tr>
<td>Increase/decrease in stock</td>
<td>35</td>
<td>-511</td>
<td>546</td>
<td>-106.92</td>
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<tr>
<td>Services and other goods</td>
<td>19,393</td>
<td>18,940</td>
<td>452</td>
<td>2.39</td>
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<tr>
<td>Remuneration, social security and pensions</td>
<td>28,223</td>
<td>28,436</td>
<td>-212</td>
<td>-0.75</td>
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<tr>
<td>Depreciation and amounts written off</td>
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<td>598</td>
<td>-0</td>
<td>-0.03</td>
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<tr>
<td>Depreciation of stock</td>
<td>119</td>
<td>-7</td>
<td>126</td>
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<tr>
<td>Appropriation/use provisions</td>
<td>135</td>
<td>1,431</td>
<td>-1,296</td>
<td>-90.56</td>
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<tr>
<td>Other operating costs</td>
<td>2,729</td>
<td>2,663</td>
<td>66</td>
<td>2.46</td>
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<tr>
<td><strong>OPERATING PROFIT (-LOSS)</strong></td>
<td>526</td>
<td>-2,863</td>
<td>3,389</td>
<td>-118.38</td>
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<tr>
<td>Financial result</td>
<td>-335</td>
<td>67</td>
<td>-403</td>
<td>-598.63</td>
</tr>
<tr>
<td><strong>PROFIT BEFORE TAXES</strong></td>
<td>191</td>
<td>-2,793</td>
<td>2,985</td>
<td>-106.87</td>
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<tr>
<td>Withdrawal deferred taxes</td>
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<tr>
<td>Tax on result</td>
<td>-4</td>
<td>55</td>
<td>59</td>
<td>-107.32</td>
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<tr>
<td><strong>PROFIT OF THE FINANCIAL YEAR</strong></td>
<td>189</td>
<td>-2,736</td>
<td>2,926</td>
<td>-106.94</td>
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<tr>
<td>Transfer to tax-free reserves</td>
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<td>3</td>
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<td>0.00</td>
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<tr>
<td>Withdrawal to tax-free reserve</td>
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<td>0</td>
<td>0</td>
<td>0.00</td>
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<tr>
<td><strong>PROFIT APPROPRIATION FOR THE YEAR</strong></td>
<td>192</td>
<td>-2,733</td>
<td>2,928</td>
<td>-107.12</td>
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</tbody>
</table>