Dismantling hot cells provides a heap of experience

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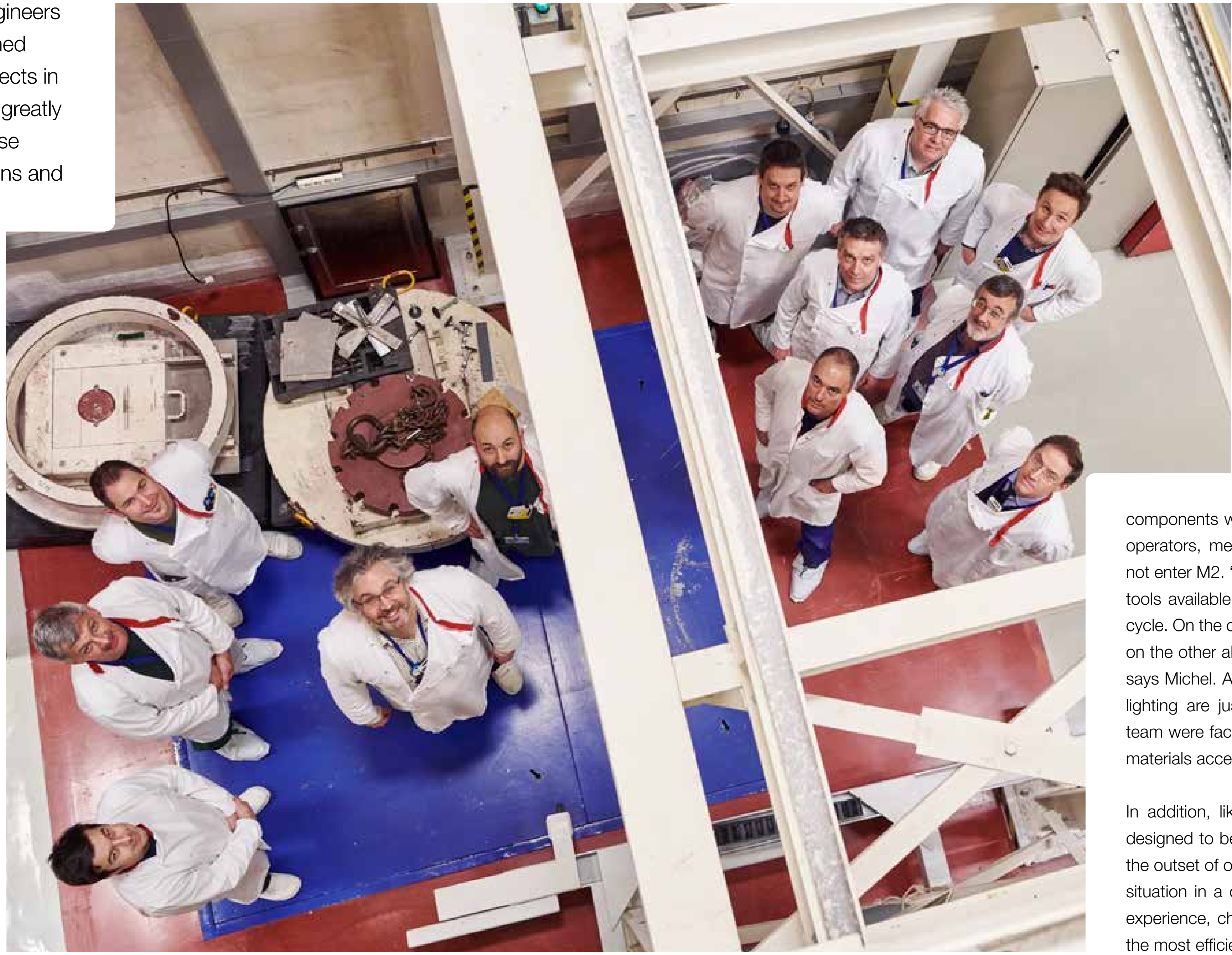
Together with their passionate team, engineers Michel Estas and Luc Ooms accomplished two large-scale, difficult dismantling projects in 2018. The experience gained increased greatly SCK•CEN’s expertise, which they can use in-house for the dismantling of installations and provides added value outside.



SCK•CEN has a unique expertise, developed by the centre thanks to the dismantling of BR3. Recently the research centre dismantled two hot cells on their site, whereby it could deepen and widen its know-how. “We make this knowledge available on a national and international level”, says Michel Estas, engineer at SCK•CEN.

HOT CELL M2: TABULA RASA

‘A screened off, ventilated room where specialists can handle radioactive substances and materials contaminated with radiation remotely using manipulators’, is a comprehensive definition of a ‘hot cell’. The term ‘bunker’ is also an apt description for hot cell M2. Indeed, the hot cell has 1-metre thick concrete walls and is lined inside with a 1-centimetre thick stainless-steel jacket. The concrete will prevent radiation from the objects handled to leave the hot cell, while the stainless steel prevents contamination from spreading.

Extreme peak values

The M2 hot cell located in the Lab for High and Medium-high Activity (LHMA), became operational in 1977. The hot cell was used for many years to carry out destructive mechanical operations on spent fuel from nuclear reactors. “This explains the extremely high beta-gamma and alpha contamination values measured. The radiation of some elements in the hot cell was comparable to the radiation in a nuclear reactor”, explains engineer Michel Estas. At the start of the project, the dismantling team even measured a peak value of 3000 Sievert per hour. Compare that to the natural background radiation to which we are exposed on a daily basis, which is 70 nanoSievert per hour (1 Sv = 1,000,000,000 nanoSv). Even once these highly radioactive components were removed, the dismantling team – a group of operators, mechanics, electricians and engineers – could still not enter M2. “The radiation level was too high. Moreover, many tools available in the hot cell had reached the end of their life cycle. On the one hand, this is due to degradation over time, but on the other also to the constant bombardment with radiation”, says Michel. A blocked access door, stuck worktops and faulty lighting are just a few examples of the obstacles which the team were facing. “The only access we had to the cell was the materials access: an 18-cm opening.”

In addition, like all installations in the past, the cell was not designed to be dismantled. Michel explains: “This means, from the outset of our mission in 2010, we had to tackle this extreme situation in a creative manner. For this, our team deployed its experience, chose the appropriate techniques and established the most efficient sequence of operations.”

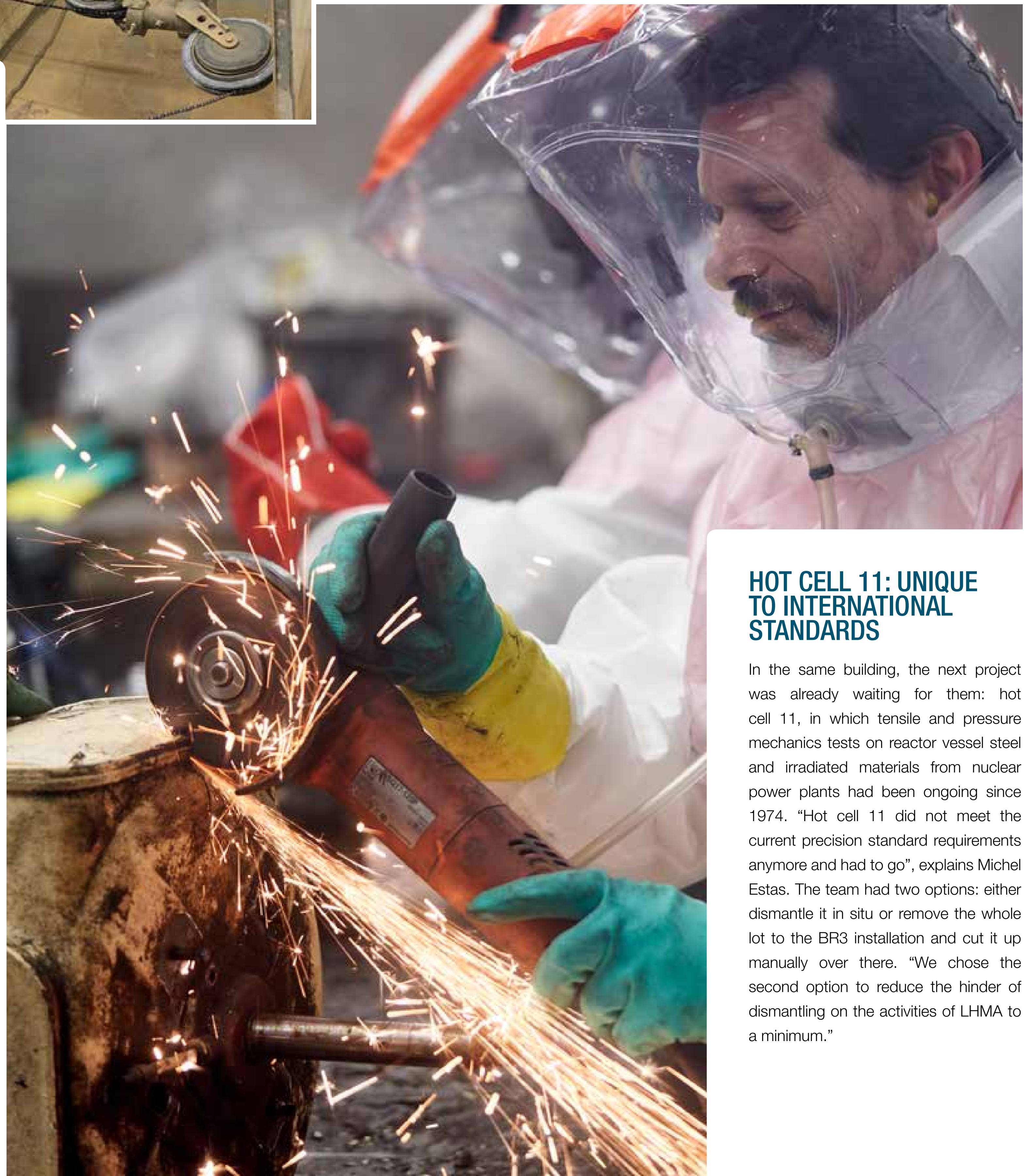
> *"The dismantling of the hot cells produced knowhow that SCK•CEN can use in-house and represents added value outside."*

Psychological threshold

The team built a copy of M2 – a so-called 'mock-up' – to be able to practice all actions. "Above the materials access of the hot cell, we built an intervention space, in which we planned airlocks to remove material from the hot cell remotely. Afterwards, we use manipulators to decontaminate the bunker with chemicals", explains engineer Luc Ooms. Accessing the hot cell – with masks and in positive pressure suits – only happened five years later. "You still have to conquer a psychological threshold to enter the hot cell", Luc goes on. "Therefore, we deemed it important that the engineers would also enter in positive pressure suits. We wanted to give the team confidence in the safety of the situation, and we got a personal feeling for the terrain."

Factor 1 million

Now, M2 is being kitted out again for future use, for experiments with nuclear fuel. In the end, 6.4 tonnes of high and medium-high radioactive material were removed from the hot cell and transferred to Belgoprocess. The radiation level dropped by a factor 2000 and the contamination level by a factor 1 million.



HOT CELL 11: UNIQUE TO INTERNATIONAL STANDARDS

In the same building, the next project was already waiting for them: hot cell 11, in which tensile and pressure mechanics tests on reactor vessel steel and irradiated materials from nuclear power plants had been ongoing since 1974. "Hot cell 11 did not meet the current precision standard requirements anymore and had to go", explains Michel Estas. The team had two options: either dismantle it in situ or remove the whole lot to the BR3 installation and cut it up manually over there. "We chose the second option to reduce the hinder of dismantling on the activities of LHMA to a minimum."

Diamond cable

The hot cell was anchored in a massive concrete slab. As a result, the hot cell weighed 14 tonnes. However, the bridge to be used to lift the whole was only designed for maximum 10 tonnes. "We had to saw the slab through horizontally. We carried out a whole range of analyses to establish the height of the cut, because we needed to find a balance between load, on the one hand, and stability of the offcut on the other. If the concrete layer were too thick, we would overload the bridge. If it were too thin, the concrete would break, and the nuclear material would be scattered all over the room. Solid calculation was therefore necessary to make it possible to go on dismantling the hot cell in BR3 safely. Once we had cut through the slab with a diamond cable, we jacked up the hot cell using a custom designed lifting system. Then, it was transferred to the cutting workshop in BR3 to cut it up further", Luc Ooms explains. "A one-off, also to international standards." Only 2% of the materials were removed as nuclear waste after processing.

New in-house knowledge

Both engineers highlight that they acquired a lot of expertise with both operations. This knowhow can be used in-house by SCK•CEN and represents added value outside. "Such complex challenges also require involvement, personal input and proactivity from all operators. This has strengthened our team spirit enormously", concludes Michel Estas.