My name is Georges Molitor. I was born in 1947 in Wiltz, but I grew up in Diekirch, where we moved to when I was still very young. My father, whose first name was Tun, was a teacher and my mother was at home to raise the children as it was usual for that time. We were four siblings. I have two older sisters and a younger brother.

Can you still remember the reservoir being built and filled at the end of the 1950s?

I have a few vague memories of it. My mum was from Esch-sur-Sûre, so we sometimes drove there. Although we could see the building site, we didn't really understand what was going on. But it was still very impressive. At first, you couldn't see anything at all. But then these pillars started springing up out of the valley.

Can you briefly describe your school years?

I went to the secondary school in Diekirch for seven years. I majored in Latin and maths. After getting my diploma in '66, I studied civil engineering at the university of technology in Aachen, where they offered specialist modules in road construction, urban planning and urban water management. At the time, we were told that urban water management was the future and that wastewater treatment plants were being built in Europe and all over the world. If you specialised in this field, you were guaranteed to get a job. So I wrote my dissertation in this area, about the design of a wastewater treatment plant. After graduating, I immediately started working for the National Roads Administration. Due to an administrative reform, a water management department (Division des eaux) had just been created there and would be responsible for the wastewater treatment plants. Since that was what I'd studied, I thought it would be a good fit for me. But I soon learned that you don't always get what you want: Like all young engineers who started there at the time, I was deployed in motorway construction. The motorway law dates back to 1967, and there were many construction sites in that area that needed staff. During the first three years of my traineeship, I was in the Directorate. I then joined the highways department (Service de la grande voirie), which was responsible for the construction of motorways. At the time, the A6 and A1 motorways were being built, with their big bridges over the Syre river and the Sernigerbaach creek and the customs hub of Wasserbillig, so I was involved in that. In 1985, once everything was finished, I moved to the water management department. This was actually because of the dam, as the work on the dam and on the alternative supply for drinking water during the draining process was just getting underway. I was involved in all this work. The reservoir was drained in 1991 and I stayed there until the spring of 1992. I then moved to another department in the district of Luxembourg city, where I stayed for about three years. I worked on some interesting things there, like coordinated preservation, which was popular at the time. I was also involved in the computerisation of some road construction contracts and the initiation of some bypass projects. In 1995, I was appointed Deputy Director. At the time, the Deputy Director was responsible for everything except the motorways which was the domain of the Director. In 2005, after about ten years, I was promoted to Director, which meant I was now responsible for the motorways as well as my other areas of responsibility.

The reservoir was drained in 1991. Can you tell us about this project and explain why it was drained?

To explain it, we would first need to explain what kind of dam we have. In Esch-sur-Sûre, we have an arch dam, which means that the arch is the main load-bearing element, and the forces or pressure from the water are distributed sideways through the arch. This is different from a gravity dam, like the one we have in Vianden, where the forces are directed vertically downwards. The ideal shape for an arch dam is a V-shaped valley. In Esch-sur-Sûre, however, the valley isn't narrow at the bottom. It is around 60 meters wide and stabilised at the base by the construction of turbines and the spillway. As

a result, the lower part behaves more like a wall, with compressive forces on the air side and tensile forces on the water side. These tensile forces on the water side caused us problems. The dam is not made of reinforced concrete, so it can't withstand tensile forces. We experienced tensile forces of about 70 bar, which caused cracks to form in the lower part of the dam. Through these cracks, water was leaking out at a rate of up to 550 litres per minute. This was not acceptable for a hydroelectric power plant, where there are electrical cables, transformers and suchlike. The reservoir therefore had to be drained to seal the dam.

Can you list the different stages of the project for us?

The first one is the draining stage, which wasn't so easy. The reservoir has a volume of 60 million cubic metres, which all had to be drained. To make this possible, we had a water level station at the mill in Bigonville and another in Heiderscheidergrund. This way, we always knew how much water was flowing in and out. We then calculated how much we needed to add to the inflowing water to complete the draining within the time we had available. We had a tough start to the year when the reservoir was drained, because there was severe flooding in January. For ten days, around 100 million cubic meters of water came down at a rate of 100 cubic meters per second. Consequently, the reservoir was filled to the brimwhen we were supposed to start draining it. Just by working the turbines, we were able to lower the water level to around 305 metres by the time the draining had been planned to start. Then the actual draining began. We were quickly back on track. But then came the second surprise: the onset of winter. The winter was so harsh and cold that a 20-centimetre-thick layer of ice formed across the entire reservoir. But this didn't stop us, and we continued to let the water drain out. Those who were there at the time will remember that the entire slope was covered with sheets of ice that broke as quickly as we let the water flow. But we also had another problem: We needed to remove the fish from the retention basin, which, of course, wasn't possible with the water frozen over. So we had to take a break and wait for the ice to melt before we could take the fish out. As a result, we ended up draining the reservoir about 14 days behind schedule. One of the biggest challenges was completing all of the planned work in one season. We were supposed to start on 1 March, and we wanted to start refilling the reservoir by mid-October. And everything else had to be done in between.

What impact did the draining of the reservoir have on nature, and how did you prepare for it? What biological restrictions were there for the project?

Removing the fish took about ten days. We expected to find around 50 tonnes of fish, but there were only 13.5 tonnes. I won't go into detail about how these fish were sorted, but we did face one problem at the end of the draining: When the Sûre flowed back into the retention basin, it would stir up a lot of biologically active sludge that would consume oxygen, potentially endangering the remaining fish. We took several measures to solve this. First, we constantly measured the oxygen levels in the water, as well as the suspended solids, to know how much of this sludge was being stirred up and was in the water. We knew this would become a problem. So we built artificial systems to enrich the water with oxygen. This involved liquid oxygen, which was gasified and introduced into the water through mats attached to the bottom. One such system was located directly behind the dam, and another in Heiderscheidergrund, where the natural flow of the Sûre begins again. This ensured that the Sûre carried enough oxygen in its natural bed for the fish to survive. Another problem we had during the draining, especially in the first retention basin, was that the water temperature had risen to 25°C due to the warm summer, so there was even less oxygen in the water. Sadly, many of the fish there didn't survive. But there was no way to avoid it. The nature conservation

authority conducted a study in the natural bed of the Sûre from Heiderscheidergrund to Erpeldange, which showed that nothing unusual had occurred and the fish there were behaving as normal.

You wrote a detailed 70-page report on the reservoir and dam project. Can you briefly explain what is in this report?

I wrote the report so that the next time the reservoir has to be drained, people would know how it was done in 1991. When we started investigating the dam, we didn't have much data available to us. So I thought it should be documented differently. The report mainly describes what we did during the draining. As mentioned, there are tensile forces at the bottom of the arch, so something has to be done to seal the joints that let water through. We started with a finite element analysis to determine which parts of the arch were under tension. During this, we identified specific sections totalling approximately 157 m² on the left bank and 360 m² on the right bank. There, we covered the old expansion joints with elastic strips so that the dam wall could be working unhindered. It could move freely, but water could no longer pass through. We have a similar situation underground, where there is also a sealing curtain in the rock. This had cracked, and we had to do something to restore it. Because this area is constantly moving, we repositioned the curtain slightly upstream, where we installed a concrete slab. Underneath it, we drilled 162 holes nine meters deep into the ground and injected them, so that we could create the underground sealing curtain there. The slab had to be made of perfectly waterproof concrete and secured to the rock with a total of 75 anchors. This sealed both the foundation and the dam wall. Next, a connection between the two elements had to be established. This was what is known as the base-arch connection, which had to be perfectly sealed, otherwise all of the preceding work would have been in vain. There was a lot of work involved, because first the buttress wedge had to ensure that the water couldn't push anything into the moving joints. We sealed the base-arch connection with the same materials that we used to seal the expansion joints, i.e. two overlapping membranes that were segmented at the supports. This way, if there was ever a leak anywhere, we wouldn't have to replace the whole thing but just the affected element. That was our plan before starting work on the dam itself. But our expert, Mr Lombardi, advised us to also examine the rock on the airside of the dam, as he had noticed cracks in the arch that he couldn't explain. So we cleared the slope of vegetation, loose stone and weathered rock – and found a surprise: a fissure that called the safety of the whole dam into question. We decided to take action with the teams there and then. On the water side, we installed an underground sealing curtain along the slope as far as we could reach. On the right bank, we built an abutment in front of the existing one to relieve it. We covered the weathered rock on the air side with a concrete slab, which you can see today in the shape of a pyramid. We used about 1,000 cubic meters of concrete there and anchored the entire structure to the rock. To prevent water pressure from building up behind this slab and endangering the whole structure again, we installed a drainage system. Finally, we secured the abutment to the rock with deep post-tensioning. We drilled 45 meters deep through the abutments and inserted tension rods through 15 holes, much like prestressing a bridge. The rods were sealed for the first 15 meters and then tensioned. The abutment was therefore secured to the rock with a total force of 5,000 tonnes. This would address the problem of the weathering of the rock and the fissure we found there.

Based on the explanations you've given us, it's clear that this was a very complex process. How did you approach it? Did you have any examples from abroad to base it on? How did you discover this method?

We looked at other dams with similar problems and got some ideas from how these issues were resolved there. The system we used in Esch-sur-Sûre actually comes from the Kölnbrein Dam in Austria. They were the first to use this technique, which involves placing the base in front of the

foundation to seal it in such a way that there is no longer any risk of something happening. We only used materials that had been on the market for at least ten years and were proven to be reliable, whether in dam construction or elsewhere. We didn't want to take any chances. At the time, many people approached us to offer their ideal solutions, claiming to have the perfect membrane to make the project a success. But we stuck by our decision, and the products we chose turned out to be the right ones in the end.

Did the reservoir play a role in your life from a tourist or a personal perspective?

Not so much from a tourist perspective, but definitely from a personal one. Taking on a project of this kind comes with enormous responsibility. It's not just about meeting the deadline for the work. We had eight months to get everything done. For the sealing, we had to drill holes in the rock using a method that would enable us to finish it on time. This method pulverised the entire rock, so everything inside the hole came out as dust. We were also working with epoxy resin, for which dust is an absolute no-go. We solved this by continuously spraying water at the drilling sites so the dust would settle immediately. In those areas where we used epoxy resin, we hung a curtain made of plastic sheeting along the dam to protect it from the other works being done simultaneously. This was also a big responsibility, because of the potential consequences if something went wrong. What would happen if the dam were irreparably damaged? This caused me a great deal of personal worry. At the time, there was a huge scandal in France that you might have heard about, involving donated blood contaminated with HIV. It eventually led to the minister resigning and the director going to jail. This left a mark on me, and I was worried that something similar might happen to me if anything went wrong with the dam.

What did your daily routine look like during the eight months of working on the project?

I was the head of a department. I delegated all of my other tasks to my staff, so I could devote myself fully to the dam project. I drove to the dam every morning and started work there at 8 AM. I didn't get home until late at night. Every day, even on weekends. Many people wanted to know about the project, so I would spend the weekends updating them. Sometimes even by showing them in person around the construction site. During this period and for several months before and after – almost a full year in total – I was constantly in Esch-sur-Sûre. I could have lived there. This was actually the case during the construction of the dam. The team from the National Roads Administration, which was involved in the construction at the time, was staying in a hotel in Esch-sur-Sûre. Travelling back and forth wasn't so easy in 1955.

Some people are worried that the dam might burst one day. Is this fear unfounded?

I would say that the dam is safe due to all the measures we have implemented. What's more, the Esch-sur-Sûre dam is the most closely monitored and controlled structure in the country. There are multiple systems in place. There are pendulums that measure the movements of the dam in relation to the foundation, and there are Distofor extensometers that can measure different movements of various parts of the concrete or between the concrete and the foundation. There are also piezometers and drainage systems, as well as probes to measure the temperature at different depths. Special wedges are included in the post-tensioning system so that we can immediately detect any reduction in tension over time and take action if necessary. All these measurements are taken automatically and fed into a computer located at the Esch-sur-Sûre facility. From there, the data is transmitted to the Department of Civil Engineering. Once a year, this data is thoroughly analysed and documented in a report, which is also sent to Coyne & Bellier in Paris for review to ensure that the dam is behaving as it should. Of course, there is always a residual risk. Including here. One of the

biggest risks is that a flood could occur that we can't control. If you compare the reservoir to a bathtub, we have an inlet, the Sûre, and an outlet, but no overflow. Ideally, we would need a surface spillway for flood relief. Since the reservoir was drained, our administration has been calling for the construction of such a flood relief spillway. Before this interview, I checked on the status, and it turns out that a draft law to build the spillway had actually been presented in the spring. The Council of State issued its opinion on 10 October, and it currently looks as though the flood relief spillway will be constructed in 2024. However, it will take around seven years to build and is expected to cost around 100 million. And there are two further risks. The first is the risk of an earthquake, with the closest seismic zone being the Eifel. We've experienced earthquakes before, but because the dam is slender, the risk due to an earthquake is not very big. The second risk is a terrorist attack. But they would need to know exactly how to bring the dam down. That's something we're not going to tell anyone.

In 1959, there was a tragedy in Fréjus, France, when a dam designed by engineer André Coyne, who also designed the dam in Esch-sur-Sûre, broke. The incident caused widespread panic. Do you know how it was handled at the time?

It was a major tragedy. The dam was designed by André Coyne, and it was built at the same time as ours, with construction getting underway as from 1955. The dam broke in 1959, when it was filled for the first time. However, this happened during a severe flood. The dam collapsed for geological reasons, namely a disruption in the bedrock. A section of the rock had come loose, causing the dam wall to collapse. Four hundred and twenty-three people lost their lives and the material damage was enormous. There was widespread panic in our country, too, because people were worried something similar could happen here. We were also close to the initial filling. The district engineer from Diekirch, who was in charge at the time, declared that our dam was safe. He and his family even moved to Esch-sur-Sûre, where he lived with his two children to demonstrate his faith in the dam's safety.

The dam has been in place since the late 1950s. There haven't been many drainages yet. Why isn't this done more often? Do you know if any other drainages are planned for the near future?

Because we are overseen by a French planning office, we comply with French legislation. They stipulate a drainage every ten years. However, it was decided in France that every second drainage can be substituted with an underwater inspection, in which divers check if the sealing measures are still flawless. The French have subsequently relaxed this rule even more, allowing every two in three drainages to be substituted with such an inspection. That's what we did. So a drainage would be due around now. However, I am not aware of any plans for one. But if this spillway is built, the water level will at least need to be lowered. It must be said that the technology available nowadays allows repairs on the dam to be carried out in the water. A kind of bell is placed on the concrete, and the water is pumped out, so that workers can enter the bell to carry out different tasks. However, these are only localised repairs, not major work like the type that had been done during the draining process.

What role does the reservoir still play in your life today?

It doesn't play an important role. The dam is just a structure like any other. I don't visit Esch-sur-Sûre more often just because I was involved in the repair work back then. But I do have some good memories of it. The work presented many challenges, all of which we managed to overcome. We had good people, good planning offices and good companies, and we had the backing of politicians. We were able to work freely without any restrictions. For example, there was no lengthy tendering process, as is usually the case for public construction projects. We drained the reservoir, and only then did we realise the extent of the work that needed to be done. We couldn't tell before that. This meant that some of the work had to be carried out differently than planned, and there was also some additional work that we hadn't accounted for. Without Minister Goebbels urging me to get started

and assuring me he would handle the procedures and approvals, I don’t know how it would have all worked out.