TVO

OL1 & OL2 Annual Outages 2012

Teollisuuden Voima Oyj - Wellbeing with Nuclear Electricity

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Careful outage work – reliable production

Nuclear safety is the number one concern at TVO's plant units. Everything we do involves maintaining a high-level safety culture, and its key factors are quality and continuous improvement. Everyone must have the right attitude and the appropriate professionalism towards work. It must always be remembered that the workers themselves are responsible for the end result. This will result in stable and safe plant operation after the work has been completed.

This year, the outages started exceptionally in April, as moisture was discovered in OL1's main generator on 24 April 2012, and ended on 6 June 2012, as OL2 was reconnected to the national grid at 00:52.

The entire generator was replaced at OL1 according to plan. Other larger work tasks included the modification of the low pressure turbines on the exhaust side, the modernisation of the condensate cleaning I&C, a leak rate test for the reactor containment, and the replacement of one auxiliary transformer. Despite the challenging start, we were able to complete the outages successfully, and the plant units are currently operating well.

The annual outage for unit 1 had a total length of 31 days. After the annual outage, the plant unit had a second, one-day repair outage.

For OL2, a short refuelling outage was scheduled for this year, and mainly inspections and testing were carried out in addition to refuelling. The annual outage for unit 2 took a little over nine days. The plant unit is now running well, which demonstrates that the work was carefully carried out.

The planning and implementation of modernisation and service during outages is a continuous learning process, and we will analyse the completed outages further in the spirit of continuous improvement.

In addition to TVO's in-house personnel, a maximum of 997 contractor personnel took part in the outage work; 887 of them were from Finland. The improvements carried out between 2010 and 2012 have further enhanced the safety of the Olkiluoto nuclear power plant, and the net electric power for both plant units has improved by approx. 20 megawatts due to the improved efficiency of the turbine plants.

I wish to thank all of those who participated in the annual outages, and I hope we can all enjoy some beautiful summer weather.

Mikko Kosonen
Senior Vice President, Production
Teollisuuden Voima Oyj

Image by Tiina Kuusimäki

PELE completed, Project 2017 started

The technical implementation of the PELE (Plant Efficiency and Lifetime Extension) project for Olkiluoto's existing power plant units is now complete. The modifications that were left over from the project's main annual outages, R110 and R211, were completed on OL1 during this year's service outage.

In the annual outage, the main generator was replaced, the condensate cleaning I&C was renewed, and the same warranty modifications on the low pressure turbines and generator cooling system that unit OL2 underwent last year were completed.

The outage work for the PELE project proceeded well and with no major technical issues. For this, we can thank our professional project teams, good outage planning, project suppliers, and other partners.

The new main generators are now in use. The measurement values for the newly installed OL1 generator are for the most part good after the repairs that were carried out to correct the looseness in the packet of stampings. Repairs on the packet on Olkiluoto 2's stator will be carried out next year.

This means that managing the open issues of the PELE project will continue for at least a year, and the warranty follow-ups will go on for several years after thereafter. The length of the project can, therefore, be extended to several years. After the warranty work that is to be performed next year, the generators can be expected to generate electricity for the next 20 years.

After the successful completion of work in the PELE project, we can safely look into the future and focus our thoughts on the following 2017 modernisation project that is already entering pre-planning. TVO's primary goal in annual outages is to maintain the plant units as good as new in terms of technical performance. The 2017 modernisation project helps us ensure the safe and trouble-free operation of the plant units, and ensures that the condition of the plant units is at its peak in order to receive a new operating licence in 2018.

Sami Jakonen
Senior Vice President, Technology
Teollisuuden Voima Oyj

Pekka Sahlberg enjoys working on the cutting edge of turbine technology.

Story by Tiina Kuusimäki

A Tale of Two Turbines

Over the years, the OL1 and OL2 power plant units have been updated to significantly increase their power output. The power increase has been achieved by increasing the steam output of the reactor, and by improving the efficiency of the power plant process. The steam turbines have played a key role in all renovations related to power output. Currently, the turbines represent the very latest developments in the field.

The commercial operation of the Olkiluoto nuclear power plants started at the turn of the 1970s and 1980s. Since then, the thermal output of the reactors has been upgraded in stages from the original 2,000 megawatts (MW) to the present 2,500 megawatts. The power increases have created a need for modification at the turbine plants, and the performance of their systems and equipment has been improved and modernised. The projects have been successful, and this has resulted in improved operational reliability and production capability for the power plant units. The net electrical output of the existing power plant units at Olkiluoto is now 880 MW instead of the original 660 MW.

From project to project

Office Manager Pekka Sahlberg has been working with TVO's turbines since 2003. – Working to improve the production capability of the plant units is very interesting. I have had the privilege to participate in the most significant modernisation projects in recent years. I have been especially involved in the evaluation of the technical solutions for the turbines, and the planning and implementation of turbine projects.

The first turbine modification was carried out in the early 1980s, when the reactor power of both plant units was upgraded for the first time. The power increase created a higher steam flow at the turbine and, for this reason, the high pressure turbines were bored out by removing blade zones. Later, in the mid-1980s, both plant units received new condenser piping and high pressure turbine blade sets. The new blade set improved the expansion efficiency of steam.

The third significant turbine modification took place between 1996 and 1998. At that time, the reactor power was increased again, and that then required increasing the size of the high pressure turbine and the surge capacity of its steam valve. The low pressure turbine blades were replaced at the same time. Turbine I&C replacement also improved the reliability and usability of the plant unit. The modernisation work was completed in phases at both plant units.

Updating the turbines for a new century

In the 21st century, there have been two large modernisation projects at the turbines so far; improving the process connection and the expansion efficiency of steam has resulted in an electrical output increase of 40

MW at both plant units with no reactor power upgrades. The modernisation started in 2005 and 2006, when the steam reheating was converted to two stages. At the same time, the high pressure turbines received new blades, and a new steam extraction line was added.

In 2010 and 2011, the low pressure turbines were replaced and the condenser pressure was reduced. – After the modifications at OL1, it became apparent that the power upgrade was smaller than expected. We searched far and wide for the causes and remedies. As a result, we decided to modify the geometry of the low pressure turbine diffusers, and to install separate flow control plates on the outer casing of the low pressure turbines. At OL2, these improvements were made during the first installation, and they were now performed at OL1, says Pekka Sahlberg.

This year and beyond

About 150 persons were involved in implementing the turbine and generator modifications at the plant unit during this year's outage at OL1. – The most significant work tasks were the turbine diffuser and generator replacements at OL1. As the outage was started early, we had to adjust our planning, but despite our expectations and being short-staffed, we were able to complete the work within a reasonable time. Thanks to the competence and experience of the supplier's key personnel, we were able to carry out the most demanding work phases according to plan, and the entire team was able to work together in order to quickly solve practical problems. I commend all the participants for our good performance, Sahlberg summarises.

New turbine plant modernisation projects have been planned for the future. – Implementing the renovation and replacement projects requires a holistic approach to the design basis and operation of the plant components, and the latest available technology. This also helps us to maintain and increase the expertise of our own personnel. Increased expertise from completed modifications has been an essential requirement for the high availability of the turbine plants. You can, in fact, teach an old dog new tricks, says Pekka Sahlberg jokingly.

Low pressure turbine work inside the turbine hall.

Petri Lavi hopes that the next operating cycle will consist of reliable, stable production.

Story by Tiina Kuusimäki

Two hundred and four hundred terawatt hours

Office manager Petri Lavi from OL1 and OL2 Operation is a happy man. The previous operating cycle brought with it some significant production numbers in the operating history of the plant units. In January, the commercial operation of OL1 exceeded 200 terawatt hours and, in April, the plant units celebrated 400 terawatt hours of combined production.

The previous operating cycle started on 10 May 2011 for OL1, and 8 June 2011 for OL2. With the exception of repairs and disturbances, both plant units operated at full power throughout the cycle. Production losses due to repairs and disturbances amounted to 294,615 MWh for OL1, and 94480 MWh for OL2. The total amount of production losses equals 18 days of production for a plant unit operating at full power. The capacity factors for the previous operating cycle were 95.2% for OL1, and 98.3% for OL2.

Planned and unplanned events

Office manager Lavi's main concern is the safe and reliable operation of the plant units, and the technical disturbances during the last operating cycle have raised concerns. – The number of plant events, both planned and unplanned, was above the norm. However, despite the exceptional number of events, there were no reactor scrams during the operating cycle. This is a positive development.

Lavi reviews the plant disturbances and their causes with other experts. – Our goal is disturbance-free plant unit operation according to a high-level safety culture, and this is why we are evaluating our activities from many different aspects. Human Performance issues, for example, have an even more important role than before.

During the last operating cycle, the production of both plant units was interrupted only once by the inspection and replacement of the reactor blow-off system valves. At OL1, production losses were also caused by the replacement of a recirculation pump motor, the inspection of measurement point supports inside the containment, and the turbine plant reheater system. In statistical terms, most of the operational disturbances were caused by problems related to the recirculation pumps and the feedwater pumps' rotary seals.

At OL2, the main concern was the higher than average vibration levels observed on the main generator's stator; they were followed very closely. – Both plant units also underwent periodic testing according to plan. All in all, there were 31 events that affected production, Lavi says.

One of the most positive issues during the last operating cycle was OL2's electrical output. – OL2's output was approx. 20 MW higher than before. The modernisation is paying off, and it must be resumed – if only to ensure the

safety of the plant unit. Previous merits are not indicative of future success. You need to keep developing no matter what, Lavi summarises.

Many types of lifecycle management

Petri Lavi says that the long-term operation of the plant units is challenging in terms of lifecycle management. – The plant units have operated reliably for over 30 years already. To maintain Olkiluoto's reputation for reliable plant units in the future, we must work to extend their technical lifetime. This can be achieved through effective maintenance and systematic equipment replacement.

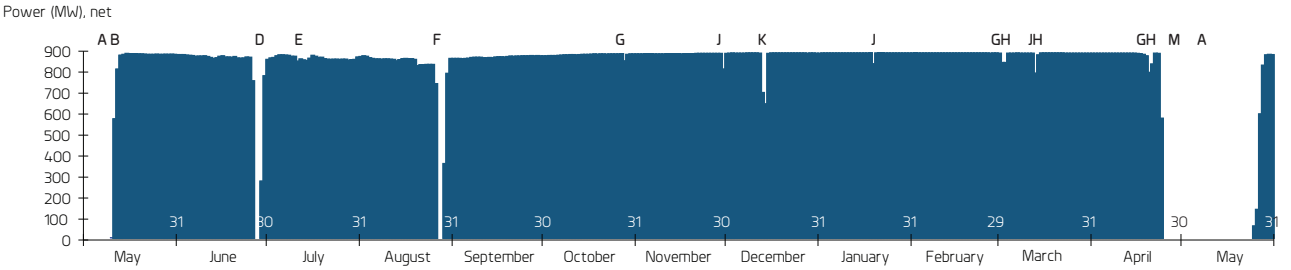
Operator competence is also a factor in the lifetime of the plant units. TVO trains new operators regularly. New employees with engineer's degrees receive approximately two years of additional training. Currently, six new operators are in training. – Recruiting new professionals is essential for plant unit operation, since there are no longer many operators on shift who have been here since the beginning, says Lavi, who himself has worked at TVO for over 20 years.

Outage activities also affect the lifetime of the plant unit and, therefore, Lavi wishes to specially emphasise the significance of the annual outages and individual employees for the next operating cycle. – Activities performed during annual outages, and the work of individual persons, are essential for the next operating cycle of the plant unit. Everyone's work is important. Careful work creates reliable production.

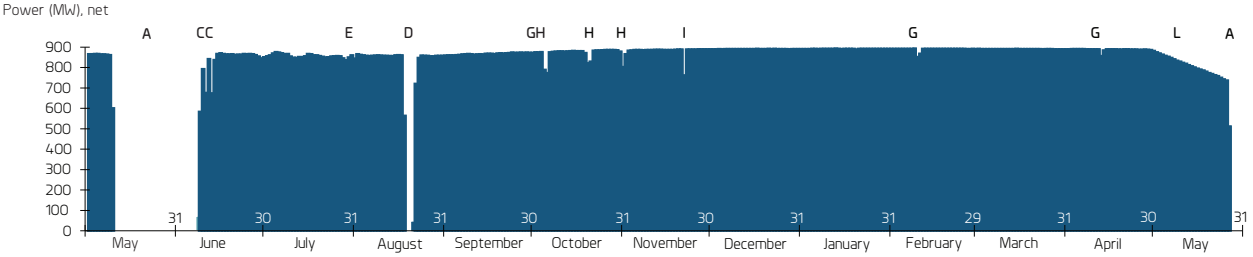
OL1 / OL2 PRODUCTION DATA

	OL1	OL2
Operating Cycle	10 May 2011–24 April 2012	8 June 2011–27 May 2012
Gross electrical energy	7,420 GWh	7, 587 GWh
Net electrical energy	7,156 GWh	7, 321 GWh
PRODUCTION LOSSES		
- due to fault	295 GWh 3.9 %	94 GWh 1.3 %
- due to power demand	0 GWh 0.0 %	0 GWh 0.0 %
- due to seawater temperature	72 GWh 1.0 %	79 GWh 1.1 %
Reactor critical	8,316 h	8,497 h
Generator synchronised	8,264 h	8,419 h
Energy availability	95.2 %	98.3 %

OL1 OPERATION 10 May 2011 to 24 April 2012



OL2 OPERATION 8 June 2011 to 27 May 2012



A=annual outage, B=repair of dump valve sealing steam leak, C=load decrease during generator tests, D=blow-off system valve inspection and repair, E=recirculation pump malfunction, F=recirculation pump motor replacement, G=periodic test, H=reheater condensate tank flange leak repair, I=closing of main steam valve, J=feedwater pump repair, K=repair of blow-off system differential pressure measurement impulse tube attachment, L=coast-down, M=warm shutdown due to a high moisture level in the generator

Moving a feedwater distributor for inspection requires special attention.

Story by Tiina Kuusimäki

The reactor service keeps him busy all year long

Maintenance engineer Teemu Harju from TVO's reactor service can breathe a sigh of relief. This year, there were no massive traffic queues at the plant gate during the outage, and the work also proceeded as planned.

During the annual outage for the OL1 plant unit, 17 control rod drives and one recirculation pump were replaced. In addition to the normal opening and closing of the reactor, eight PRM (Power Range Monitoring) probes were replaced, for example. There were also component removals and installations related to nozzle inspections.

Two faulty recirculation pumps were replaced during the refuelling outage for OL2. Unlike during normal refuelling outages on the reactor side, a feedwater distributor was also removed for nozzle inspection.

One year of active preparation

– We started the preparations for this year's outages as soon as the previous outages were completed. The preparation included budgeting, work scheduling, work planning, procedure maintenance, training, supervision, and reporting, Teemu Harju says.

Between the outages, Harju has a little less than a year to perform maintenance on the equipment and tools within his area of responsibility. – My equipment responsibility area includes the reactor pressure vessel and its internals, the control rod drives and recirculation pumps, and any special tools and equipment that are used for the service.

Teemu Harju believes that preparing well in advance is essential. – To summarise, I might say that the operating cycle is used to prepare and manage issues so that, once the outage begins, we can focus on the essential issues – doing the work, that is.

Core operation is at the core

Harju, who started work at TVO in 2007, is mainly involved in supervision tasks during the outage. – It is my task to ensure that planned work is completed effectively and safely. This year, most of the work on the reactor side followed the original planning. – In addition to our planned work, we also had to perform an extra recirculation pump replacement due to low insulation resistance.

Starting the outages early and making other schedule adjustments also caused a few problems for the reactor service. – For us, like many others, the shortage of personnel was the largest problem. Luckily, we were quickly able to secure the necessary personnel resources. Our co-operation with the contractors was quick and trouble-free.

For next year, the maintenance engineer has an area for improvement in mind. – We wish to further improve information transfer between the different worksites. This will allow us to reach even more seamless co-operation, Teemu Harju summarises, with his mind already on the next outages.

Inspection of the clearance between the rotor and stator vanes on low pressure turbines.

Story by Tiina Kuusimäki

Turbine work in capable hands

Sufficient amount of expertise and spare parts, plans prepared well in advance, and a realistic schedule with to-the-minute precision. Outage work on the turbines may begin.

Maintenance engineer **Marko Eeva** from TVO has carefully prepared for the outage work at the plant units. Before starting outage work, he has ensured the availability of the spare parts required at the turbine, and acquired the necessary worker resources. – In recent years, the generation shift in the external workforce has been a major challenge. We have been training a new generation to work at the plant unit for a number of years now. I hope that we can continue transferring the know-how in the future, says Eeva who himself started work at TVO in 2009.

Outages worked out well

Marko Eeva's major task in the outage is to plan the maintenance work to be completed on the turbine. During the outage, he works as a supervisor for the turbine service work. From a work supervisor's point of view, this year's outages succeeded well despite their extensive scope. – Starting the outage early made it more difficult to start the work, since we did not have a sufficient amount of contractor personnel. After the initial difficulties, however, we were able to complete the planned preventive maintenance and modifications according to plan.

At OL1, the largest outage work involved opening the turbines in connection with the low pressure turbine renovation (RETU) project's warranty work. Other major work tasks included inspections on the seawater and steam lines, and the service of one turbine main steam valve.

At OL2, the lower packs of three segment bearings were replaced on the low pressure turbines as part of the RETU warranty work. The most significant preventive maintenance work tasks were the condenser and condensate cleaning system service and inspections that are completed each year.

Responsibility and experience make an expert

Marko Eeva finds that no major improvements are required in terms of future outages. – Although our organisation operates based on long experience, I myself have many things to learn. I believe that I will encounter many interesting and demanding work tasks in the future.

Maintenance engineer Eeva finds that abnormal situations provide young people with an excellent opportunity to learn how to quickly react to changes in challenging situations. – Starting the outage early showed us that advance planning and scheduling are critical for outage success. TVO's employees were able to flexibly react to the changed situation. This is clearly a strength that we can all be proud of.

Story by Eija Tommola

Good planning makes outages work better

– When taking into account that the outages started earlier than planned, and we even had to change their order, we can say that they proceeded well. Since work had been planned well in advance, the only major problem caused by the change in the schedule was the arrival of the necessary personnel at Olkiluoto, says Office Manager Tapio Kanerva from Maintenance, obviously happy with the end result.

– On the other hand, since we received workers little by little, issuing their access permits did not generate uncontrolled congestion, and we were able to take them to the worksite individually and provide good training for the work – even if this somewhat slowed down the starting of the work.

OL1's power upgraded by warranty

This year's outage was also full of work – a total of 5,700 work orders were prepared for completed work tasks.

On unit 1, the largest tasks were generator replacement and opening the low pressure turbines due to warranty work. – Since the low pressure turbine replacement, which was performed in 2010, did not generate the desired power increase, the turbines were opened during this year's outage, and the improvements that were discovered to work on OL2 were completed in the steam control of the low pressure turbines. These improvements gave us the missing eight megawatts, says Kanerva.

In addition to extensive maintenance work, all of the inner main steam valves were opened, and one auxiliary feedwater pump and three lower turbine bearing segments were replaced. It is also worth mentioning that, despite starting the outage ahead of schedule, nearly all of the work that was planned in advance could be completed.

Tapio Kanerva has experience from over 60 annual outages.

Unit 2 had a refuelling outage, with its normal repair, service, inspection, and testing work.

Experience brings effectiveness

Outage schedules have shortened over the years. – We have become more effective, as TVO has learnt from experience and has standardised the work tasks and functions that are part of the annual outage.

Investments have also been made to facilitate annual outages. – These investments have made the plant units much more annual outage friendly, Mr Kanerva explains. – TVO has acquired a large number of replacement components to allow them to be directly replaced with no delays. In the past, equipment was serviced during the outages, but nowadays most of the actual service can be performed while the plant units are in operation and less work is going on. This also reduces radiation doses and improves working conditions while maintaining the high quality of the work.

This was the 31st year of annual outages for Kanerva, bringing his outage total to over sixty. – Yes, I've seen a lot of them, but I think these were the last ones for me, Kanerva thinks. In the beginning of July, Mr Kanerva will hand over the position in the Maintenance office to Tomi Savolainen, while he will take over responsibility for the maintenance of TVO's new plant units.

Jukka Berg and Pekka Pösö from Ilmastointi Salminen Oy were cool-headed enough to take a personnel lift to a height of over 60 metres to inspect and install the corner and eave sheets of OL2's reactor building. Fortunately, the weather was kind on the workers.

Story by Petra O'Rourke

Hauling, painting, and high places

The outages for the Building Services unit proceeded according to plan, even if the start was slightly surprising. According to section head Kari Kuusisto, the repair of the turbine building rainwater pipelines at OL2 was one of the most significant work tasks for Building Services this year.

Like previous years, Building Services also managed the repair and preventive maintenance of the power plant buildings, as well as hauling, scaffolding work, and crane transport for other organisations.

Outage work of all kinds

– The single most significant building repair was completed on OL2, when the rainwater pipelines under the roof of the turbine building were repaired. This work will also be performed on OL1 next year, says Kuusisto. In addition to the scaffolding work for the above mentioned rainwater pipelines, a large amount of scaffolding was set up inside the condenser at OL1 for the inspection of the extraction pipes. Approximately 780 individual supports were constructed during the outages this year. In terms of hauling work, the largest tasks included the transport of radiation shield elements, generator cooling system pumps and pipelines, and turbine diffusers at OL1, for example.

– We also carried out a lot of painting, for example the blow-down tubes inside the "wetwell" or condensate pool; this was a demanding task in terms of both scaffolding and painting, Kari recalls.

Preventive maintenance work for the plant units involved inspections in the red and orange rooms of the plant units, outside flange service, roof inspections in the turbine building and, naturally, correcting any deficiencies found.

New players on the team

All 12 employees of Building Services, together with three summer employees, took part in the outage work. The amount of contractor personnel varied between 90 and 120. Seasoned veterans from TVO and the contractors were of course involved, but little by little, younger people are also joining in.

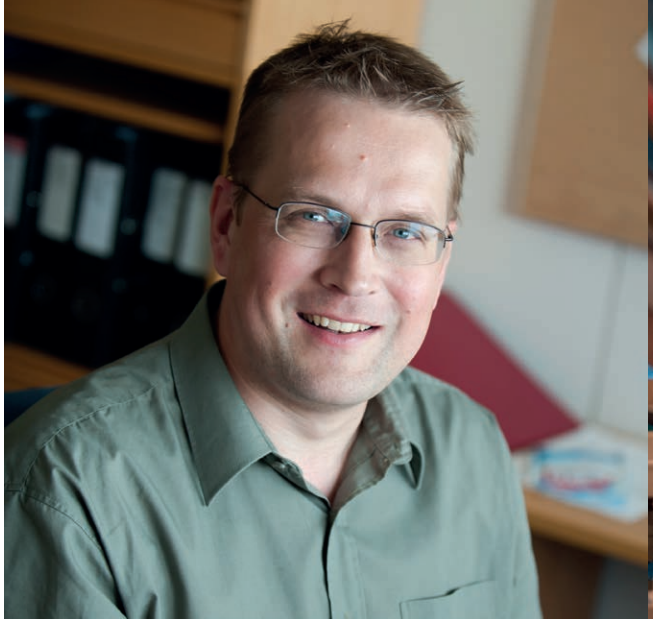
– Fortunately, we now have new and younger employees joining us to learn the work and that enables us to transfer valuable tacit knowledge to younger generations, Kuusisto reminds us.

Towards the next one

Preparation for the outages in 2013 starts immediately with a feedback event. – The event reviews any improvement proposals for the future. For building work, the actual planning for the next outage will start at the end of the year, Kari says.

Not everything goes according to plan, and there are always some surprises in store. Good planning helps in adapting to new situations.

– We might have been a bit lucky, but Building Services was able to respond reasonably well to the start of the outage being moved. We were a few workers short for the first few days, after which the situation was back to normal, Kuusisto summarises when asked about the unusual start to the outage.



During an outage, Kim Dahlbacka works to ensure that the fuel work is carried out according to TVO's instructions.

Story by Petra O'Rourke

Careful work creates reliable production, and the occasional record

Fuel work during annual outages is demanding and requires extreme precision. This year, everything went according to plan. The schedules were kept and the start-ups of the plant units set records for being the fastest in the operating history of the plants.

At OL1, the service outage included refuelling, control rod transfers, fuel and probe inspections, and inspections of the control rod blade tops. OL2's refuelling outage consisted of refuelling, control rod transfers, and fuel and probe inspections.

Important work inside the core

According to section head **Kim Dahlbacka** from Reactor Supervision, the refuelling of OL1 consisted of 700 steps, of which 668 were fuel transfers and 32 were test extractions for control rods. Visual inspections were performed on two GE14 and two ATRIUM 10XM fuel elements. - Control rod transfers for OL1 involved 14 control rod positions. During the disassembly of fuel, the tops of 17 control rod blades were inspected inside the core. The fuel inspections went well and no problems were found. Three control rods were found to have fractured, and they were replaced with three intact ones, says Dahlbacka.

The refuelling outage of OL2 involved handling fuel elements of the types SVEA-96 Optima, SVEA-96 Optima2, and GNF2. In total, there were 580 fuel transfers, and the 54 assemblies that remained in place were inspected for possible fuel failure. Two control rods were also replaced. For unit two, the inspections proceeded according to plan. – One failed fuel assembly was located and successfully removed, Dahlbacka summarises.

In addition to TVO's Reactor Supervision organisation, six refuelling machine operators and four trainees acting as fuel transfer supervisors took part in the fuel work.

All's well that ends well

The schedule for fuel transfers worked well: The service outage for OL1 took 88 hours in total, which was 3 hours less than planned. At OL2, fuel transfers took a total of 62.5 hours. The organisation was quick to react to the sudden start for the outages. – The start did not affect our work quality, but it did put extra hours in our working days, since we had to quickly create the transfer lists for the fuel and control rods, Dahlbacka explains. The training for the new refuelling supervisors was also compressed into a shorter timeframe.

The start-ups for both plant units were the fastest in their operating history. - One of the decisive factors was that we had a reactor engineer present to update the start-up plan in real time throughout the entire period. This removed any unnecessary wait. The new PCI rules also made start-up faster, Dahlbacka concludes.

Story by Eija Tommola and Lauri Inna

A maintenance unit goes anywhere

– The final tests during start-up were completed in record time, since no corrective actions were required. Despite the ever stricter guidelines and regulations, work was completed faster than ever before. This deserves praise, says Office Manager Matti Vaaheranta from Electrical and I&C Maintenance.

Maintenance is involved in most aspects of the outage, and this means that an all-day presence is necessary to ensure that work flows smoothly. When systems are tested and operated, Maintenance is there to ensure that everything works as it should.

A sudden start to the outage

The change in the outage period's starting time affected all of the units' work. The work related to the stator and rotor replacement had already been started on the main generator for unit 1, but the water leak discovered in the generator started the entire replacement early. During the first days, preparations for repairing the rotor were being made – until the order for the replacement of the entire generator came through. This also meant that the outage was started ahead of time.

The new generator scheduled for replacement was already at Olkiluoto. It was surprisingly easy to get the workers to the site. – Part of the reason was that preparations were already underway at Olkiluoto, and Alstom's personnel, for example, were at our storage, preparing the generator for the replacement, Vaaheranta says.

This year, only refuelling was planned for OL2, and no new installations were scheduled. – We only performed minor service – unlike at unit 1, where we carried out all the new installations and more demanding work, Vaaheranta summarises.

Spare parts storage saves time

During outages, Maintenance replaces several motor actuators. Over the following year, the serviced actuators are sent batch by batch to their manufacturers for service.

– And this means that we have serviced actuators available for the next outage. This has required significant capital investments in the equipment, but keeping the outages short saves money, Vaaheranta reasons.

The SIMO project required several temporary cables to ensure the electricity supply. – Securing the necessary amount of people for the cable installations was challenging indeed. We needed dozens of competent workers, and acquiring the access cards early required some special arrangements. But it all went well in the end, even if we did end up with fewer workers than in previous years.

The condensate cleaning automation for OL1 was also replaced during the outage. Above all, the modification made the process easier to control and maintain. Earlier, condensate cleaning was based on analogue technology; now, the system was updated to match modern requirements by connecting it to a data system that is similar to the turbine automation. – We took the entire control system a generation ahead, Vaaheranta states. The modification increases reliability and makes it easier to track the process.

One parallel line ran along the rest of the outage work: repair work on the emergency diesel generator was uninterrupted. The work has been going on for about a year, and the intention was to replace the equipment at the latest during the outage. As the outages were started early, work on the diesel generator was stepped up. During the outages, the generator was still in Helsinki for testing, and it was only replaced once the plant was online.

There is always room for improvement

Despite the success of the work, Vaaheranta still thinks that there are things to learn and improve. This time, the emphasis is to be placed on performing modifications and the subsequent inspections.

He commends the Authority's rapid actions and co-operation. – As soon as we could figure things out, the authority was on board and approved the clarifications once they were complete, be it in the evening or at the weekend, Vaaheranta states happily. – Everyone had a good attitude, even if many people missed the graduation parties. Our thanks go to all who participated in the planning and installations of maintenance work.

Helvi's partner for the courier service is a nippy Renault.

Story by Elina Mäkitalo

Ten years of express service

Helvi Salonen from RTK Palvelu Oy has been working as an express courier for Olkiluoto's outages for 10 years. Outage personnel have already provided her with a number of pet names.

– I enjoy working as an express courier. During the outages, I transport goods from one place to another on the island of Olkiluoto. At times, my car is packed full of items, and I unload them from door to door. I co-operate with a lot of different people, Helvi summarises.

The most important tools for Helvi are her phone and car. – When the phone rings – and this happens a lot – I need to get going. The days are busy. This year, I have not counted my kilometres but, on a busy day last year, I clocked in at 65, Helvi says.

Helvi has been working for RTK Palvelu for over 20 years already. During normal plant unit operation, Helvi works as a housekeeper in OL2's auxiliary building. – I like how working as an outage courier provides variation to my regular work.

Helvi cannot give any negative sides to being an express courier. – In addition to the nature of the work, I like working longer during the outage, and the fact that I'm also needed during the weekends. This means a bit more money in my pocket, Helvi says laughingly.

In her free time, Helvi is busy with her grandchildren. – All my children live in Rauma. Therefore, it is easy to maintain contact. I like having everyone I love near me, Helvi says with a smile.

Helvi wishes to thank everyone who participated in the outage, especially Office Manager **Harri Varjonen**, who was her supervisor for TVO during the outage.

Story by Johanna Aho and Lauri Inna

The black-bearded veteran of veterans

For 35 years, outage planner Jaakko Lehtinen has planned his calendar around the annual outages of the OL1 and OL2 plant units. Year after year, work has been scheduled precisely and to the last minute. The planning has been completed only to start again.

Now, the last outages are complete for "Jaska", as he is known amongst his peers. – Each year has given some sense of achievement, as the units have been restarted after service. this year there is a certain nostalgia to it all, Jaakko describes.

Based on present information, Jaakko will follow next year's outages from his "hybrid cabin" at the heart of Old Rauma. Jaakko will retire at the turn of the year, but before that he has his desks and shelves to clean up and new workers to train. – From now on, my years will start in January, not at midsummer. Next spring, I will go fishing at the nearby market and enjoy my life in a new way, Jaakko reveals.

The outage veteran with strong expertise came to Olkiluoto from IVO in 1977. Jaakko, who has enjoyed his career at Olkiluoto, started as a work planner, but in the mid-1990s, his title was updated to outage planner. In practical terms, his work has always consisted of outage planning, development, and evaluation, and his goal has been a successful outage.

Calm, bearded man

The scope of his career is put into perspective when you consider that, while Jaakko has been working in Maintenance, OL1 and OL2 have undergone several extensive modernisations, increasing the net outputs of the plant units alone by 220 megawatts. – You could say that through his work planning tasks, Jaakko has been involved in almost everything. Creating procedures for the Work Management

System and maintaining the fault data system are some of the central achievements of Jaakko's career, summarises Mauri Hakola, long-term colleague and supervisor to Jaakko. The co-worker's comment speaks volumes about the positive working atmosphere and mutual joking: – Jaakko is a calm, bearded man with a sense of humour, Mauri summarises.

The world is changing, and Olkiluoto is no exception

Over 30 years have brought with them many developments and changes. Jaakko, who sees himself as a supporter of change, has a positive opinion of this. – Information technology has proceeded in leaps and bounds, for example, but I like it. This is why I started as an IT support person in my time. It's good that our management continues to promote change even today, says Jaakko.

The outage pioneer has seen outages become much shorter during his career, but Jaakko refuses to take credit for it; he states that everyone working for the outages has been instrumental to the success.

The appearance of young people in the working environment has also been positive. – Maintenance has received some excellent people who are great to work with, Jaakko states. In addition to his colleagues, Jaakko praises the improvements in occupational safety that have taken place over the years. Jaakko's attitude towards work routine says a lot about the outage veteran's work ethic. – I have never turned down a job that was given to me, and have always done what was expected of me.

– Radiation protection needs more emphasis, and the personnel must pay more attention to the guidelines and regulations related to radiation protection. This is not only a task for Radiation Protection, it concerns us all, Henttinen emphasises.

Story by Johanna Aho

Successful radiation protection creates a radiant atmosphere

The goal of Radiation Protection is to keep occupational radiation doses as low as possible. The work that culminates with the outage creates a framework for safe working conditions in a nuclear power plant. Successful radiation protection brings with it a radiant atmosphere of safety and enjoyable work.

Annual outages are the busiest and most important time of the year for Radiation Protection. Approximately 80 to 90 per cent of the annual total dose is accumulated during the outages. Reducing doses during the outage immediately affects the entire year's results.

Schedule change was demanding

The fact that the outages were started early affected the work of many organisations, including Radiation Protection. The change in the order of the outages kept the Radiation Protection personnel busy from the outset. Work had to be scheduled again, and some of the advance preparations had to be done over.

– Personnel resources were especially demanding. Luckily, about 20 of our summer workers were here when the outages started, and their 3-week training was in the final stretch. Radiation protection personnel from AlaraTech Oy, however, were only prepared to join us later according to the original schedule. During the outages this year, we had nearly 30 people working in addition to our own resources. However, we were able to put the group together reasonably quickly, explains Radiation Protection unit manager **Jukka Henttinen**, who now had his sixth outages as the head of radiation protection.

Other areas were also challenging. Since outage preparations had been made well in advance, the entire arsenal of equipment, protective gear, and instruments had already been taken to OL2, from where they had to be moved to unit 1. The replacement and commissioning of TL dosimeters had to be scheduled again for the outages. There were more induction trainings than initially planned, which in turn kept RP technicians busy, as they had to provide the radiation protection training.

Successful end result

As in previous years, all of the annual work carried out in the reactor hall and containment were demanding in terms of radiation protection. – Radiation protection has been especially important for the service of the reactor building valves and the ASME inspections of the piping welds, Henttinen explains.

Comparing the radiation doses from this year's outages with other years is challenging, since the outages were very different from before due to the hurried start and the long duration. – Despite this, the doses remained rather low. Therefore, all in all, we can be satisfied with the results, Henttinen states.

In addition to TVO's own measurements, STUK's measurement vehicle took internal contamination measurements from people working in different rooms and as part of different professional groups. The total number of people measured was slightly above 70. No cases exceeding the registration limit of 0.1 mSv were registered. – In fact, there have been no cases for the last three years, despite the fact that the equipment is very sensitive and precise, Henttinen points out.

The Radiation and Nuclear Safety Authority extensively supervises the outage, and in addition to the measurement vehicle, the centre made several inspection visits to Radiation Protection. – In addition to the negative points, I have also asked them to comment on positive findings. On the other hand, we are required to inform them of any significant events and discovered deficiencies, Henttinen comments. – Naturally, there are things to improve in radiation protection, but we have made significant progress during the last 3 years, Henttinen explains.

Everyone's business

Once the outage building was completed in 2009, the entrance buildings of OL1 and OL2, the laboratory and the KPA storage were converted to double monitoring, clearly marked passageways for entry into the plant unit were taken into use, and new measurement instruments were introduced. The next large development project will be the replacement of the personnel pre-monitors. – The aim is to replace all of the outdated monitors in the first stage of the double monitoring during the next three years, says Henttinen.

The primary goal for radiation protection, however, is to prevent radiation doses. Therefore, the most important development target is to improve the actions and procedures of people working inside the controlled area; in addition to equipment purchases, this is a strong development area for Radiation Protection.

RADIATION DOSE

	OL1	OL2	OL1&OL2
Total dose for annual outage (manmSv)	428.46	139.43	567.89
Predicted total dose (manmSv)	502	130	632
Largest personal radiation dose (mSv)	6.31	3.92	7.91
Goal for personal doses (mSv)			<10 [1)]
Number of persons under radiation supervision	2287	1973	2346

[1)] Our own goal is that the personal dose for no worker must exceed 10 mSv during the outage or the entire year. The highest allowed personal dose for a radiation worker is 50 mSv per year and 100 mSv over five years. In other words, the dose caused by radiation work for a worker must not exceed an average of 20 mSv per year for five years, or a value of 50 mSv during any single year.

Story by Johanna Aho

Outage crunch completed successfully

We can already learn from the occupational safety observations. The best part is, however, that we no longer need to report everything; people know how to ask about issues, and that creates a favourable end result for everyone.

This year, the occupational safety organisation consisted of five people during the day and two in the evenings during the outages. The additional four employees were, therefore, welcomed with open arms. – The outages are always crunch time for us, but this year they were especially demanding because the outage schedule changed from the original plan. The change also brought with it additional occupational safety challenges, says **Sarianna Niemi**, now in her first outage as Occupational Safety Manager. Niemi took over the position in March from **Markku Passi**, who became a senior advisor and is retiring soon.

Visibility is important

According to Niemi, supervising, instructing, and co-operating with the different actors in the field is especially important during the outages, even though the attitudes towards occupational safety have significantly improved in recent years. The occupational safety people no longer

need to look for work; people know how to contact them. – I am very much a hands-on type of person. During these outages, I tried to ensure functional communication, interaction with the field, and immediate feedback when necessary. I believe this approach makes occupational safety visible in the field. I see us as an expert and helper organisation, Niemi explains. **Juha Hemmilä**, working as a summer employee for TVO's Occupational Safety organisation, shares the view. – Simply asking about things will go a long way. Remaining silent is not the right option, says Hemmilä, now out in the field for his second summer.

Observations from the rounds

During the outages, Occupational Safety makes three rounds on the plant units every day. In addition, they make individual visits to different locations each day based on the received requests. A total of 392 safety observations were registered during the outages. This was four per cent less than last year. Most observations were made from liftings, protection of openings, and the labelling of safety-classified materials.

During the outage of OL1, four accidents resulting in work absence was reported, along with five zero-level accidents that did not cause any work absence. Of the accidents leading to work absence, one occurred to a member of TVO's personnel, and three to contractor personnel. In one of the accidents, a person hurt their side after stepping into an unprotected, unmarked opening.

One accident leading to absence occurred in the outage canteen, where a person cut their hand. An event where a person bumped their head when reaching for tools on a control rod drive platform also caused work absence. The toolbox was located underneath a cable tray, and the tray cut the person's head as they tried to get up. Bump caps were immediately reserved for such locations where hard hats cannot be used. Another accident leading to work absence occurred at the end of the outage, when a person's leg was cut and bruised by a welding cart. No such accidents were reported for the outage of OL2.

Positive trends

– Occupational safety issues are moving ahead, year after year. Some things, on the other hand, are repeated concerns year after year. This sometimes has you thinking whether our learning organisation is in fact learning anything, Niemi explains. The safety observations are registered in KELPO, where they are processed for further treatment. After the outages, the Occupational Safety organisation analyses the safety observations and considers the corrective actions. Most of the actions can be taken quickly, but sometimes they take time to process, and you can only see the desired results during the next outages. – The best part of the job is receiving positive feedback from the field; it makes you feel like you're not working for nothing, says Niemi in closing.

Juha Hemmilä (left) and Sinikka Saarinen on a supervision round with Jan Fransson from Alstom and Sami Mäyrä from YIT.

Story by Johanna Aho

Routine expert work

In the Fuel and Waste Handling office, the outages proceeded according to plan this year; not even the initial schedule change generated any substantial extra work. Decontamination, however, had new introductions that challenged experts from different fields.

The Fuel and Waste Handling unit prepared for the outages in a routine manner. Waste management is responsible for the storage and further processing of service waste, waste oil, scrap metal, and other waste generated in the controlled area. It is important to ensure that the water treatment systems are working, all the equipment is operational, and that the water amounts are appropriate for keeping the tanks from filling up during the shutdown.
– For us, the shutdown and start-up of the plant units are the most important stages of the outages. At this stage, we are usually at work for the first three days nearly without interruption. For us, the start of the outage was relatively easy in terms of plant water processing, for example. Creating the shift lists for fuel handling is naturally a demanding work task, explains planning technician **Pekka Simula** from the Fuel and Waste Handling unit.

This year's annual outages generated a total of 16.5 tonnes of service waste and 5.5 tonnes of scrap metal from the controlled area. Approx. 3,500 cubic metres of purified water was pumped out from radioactive water processing. The figures are relatively low compared to last year.

"Decorobot" off to a challenging start

This year, the decontamination box, or container, received a programmable robot to handle the washing of the most radioactive components. The project was managed by **Pekka Nousiainen**. The device creates significant improvements for decontamination.

The installation of the robot was completed just before the outages, but the settings were not quite correct when the work started. Commissioning and adjusting the robot requires co-operation between the I&C, Electrical, and Maintenance departments, among others. – I am very proud of our team spirit and flexibility in demanding conditions. Negligence is a swearword to me. It is important for everyone to take care of their work, and to have a positive attitude towards it, says Simula who has worked in all of OL1's and OL2's outages.

– Outage work was completed during normal hours. However, my wife just sent me an SMS asking me what time I would be home if I left right now, says Pekka Simula while continuing his work with a twinkle in his eye and a phone in his hand.

The purpose of decontamination is to reduce radiation doses for equipment service and repair. Before the introduction of the "Decorobot," radioactive particles and other impurities from the surfaces of the components were cleaned using a manually operated device that provided poor results for corners and protrusions, for example. The new robot can be programmed to precisely clean components of different shapes. The device first operates a dry run, followed by a pressurised water and ceramic pellet wash. Chemicals are not used in large amounts.

Distance reduces radiation doses

The robot is used to clean heavily radioactive components, such as recirculation pump shafts and all blow-off valves.
– The device has given us very good cleaning results. Therefore, I am confident that it will enable us to reduce the employees' exposure to radiation in the future. The robot allows us to keep our distance from the cleaning, since it can be partially programmed from another room, Simula explains.

– Well, fire protection is not exactly rocket science. With a bit of common sense, every one of us can observe risks, says Vesa Katavisto and urges personnel to pay attention to fire safety issues.

Story by Johanna Aho

Down with the fire loads – up with the safety

For Fire Protection, the outages went according to plan: there were no alarms, and the work mostly consisted of supervision rounds in the plant area. The rounds paid special attention to the integrity of fire compartments, minimising fire loads, and hot work practices. The attitudes and practices of employees have room for improvement, but positive changes can also be seen.

In recent years, special attention has been paid to the fire loads at the plant units. To this end, dozens of fire sectioned storage facilities have been built at the units for storing loose items. Despite this, the fire loads still increase during outages, as items are brought in by the pallet load. Fire is the number one risk, and a large fire load creates a lot of smoke, causing a risk to the safety of both the plant unit and personnel. – On our inspection rounds during the outages, we observed that modification processes do not take into account the removal of fire loads; pallets and cable reels were not immediately removed from the premises, for example. We have written safety observation reports to remove this problem, says Fire Chief **Vesa Katavisto**.

Annually reoccurring challenges

Year after year, an important task for fire protection is to maintain the integrity of the fire compartments. They can prevent the spreading of fire and combustion gases. This year, 56 deviation reports were recorded for problems with fire compartments, such as doors being left open. The amount is down by nearly 50% from last year. – We are seeing clear improvement, but we still need to keep working on this issue. Attitudes towards fire safety are improving. This is also visible in the amount of good suggestions received from the field for closing temporary penetrations that we have received from the field, Katavisto explains. During the outages, Fire Protection increased the amount of public information related to fire compartments. A special "Close fire doors" theme day was also arranged, during which the closing of doors was under additional surveillance.

The largest deficiencies found during the outage were related to hot work practices. – The process has several areas for improvement. The entire process needs to be reviewed, from applying for the permit to ending the hot work. During these outages, we discovered issues that may affect the safety of hot work, Katavisto explains with a worried look on his face. During the outages, a total of 198 hot work permits were issued, of which 162 were at OL1 and 36 at OL2.

Additional resources are welcome

During outages, the amount of personnel in Fire Protection increases by about ten people. Each year, the fire patrol group from Eurajoen Palotiimi and the rescue authorities from Satakunta Rescue services take part in Fire Protection. In addition to securing more people resources, preparing for the outages meant providing extra training for the regular and additional personnel, and issuing bulletins for the contractors. – Apart from an increase in the number of supervision rounds, starting the outages early did not really affect us. However, schedule changes can easily affect work concentration, which in turn affects safety. Compared to last year, for example, we provided a lot more advice for contractors and workers, says Katavisto.

Chemist Jari Vaittinen studying the new remote controlled microscope that arrived in the active laboratory just in time for the outages. The microscope is used for studying radioactive deposits, for example.

Story by Johanna Aho

That special chemistry

For Chemistry, this year's outages proceeded as planned, after an unplanned early start. A failed fuel assembly was located in the OL2 unit's reactor and removed. In other respects, the target values for process water chemistry were met.

The start and end of an annual outage are the busiest times for the Chemistry unit. During shutdown, Radio Chemistry is responsible for example for monitoring the radioactivity levels of the reactor water and off-gas stack, and for analysing samples related to emissions and radiation protection. This year, the failed fuel on the OL2 unit generated a significant additional workload.

During start-up, the objects of study are the condensate cleaning system, feedwater, and reactor water ions. This year, the sulphate, chloride, nitrate, fluoride, and chromate concentrations during plant unit start-up were lower than last year. This is partially explained by the fact that the two previous outages contained a large amount of work tasks, even if the difference in duration is not extensive compared to this year.

The laboratory has a little less than 20 persons studying and analysing over 800 samples during the outages. There are also some queries concerning chemicals and safety classified materials. Some additional samples, such as metal deposits, are also brought to the laboratory for analysis during outages. At the same time, the laboratory personnel also perform inspection rounds at the plant unit.

The slow pace of this year's outage at OL1 somewhat reduced the stress, but overtime work was still required.
– The days were quite varied during the outages. We worked hard during shutdown and start-up, but at other times the research and analysis proceeded normally, says chemist **Jari Vaittinen**. Vaittinen is responsible for planning the sampling, approving the analysis results and compiling the monthly reports, annual reports and outage reports for water chemistry.

– This year, the outages were quite long and they started exceptionally but, in my opinion, we were able to perform our work fluently and with no special obstacles. A good, flexible team makes things work well, Vaittinen describes. Vaittinen, seemingly happy with his work, says the best parts of it all are the nice colleagues, good facilities and equipment of the laboratory, and the varied work tasks.
– There is always something going on, either at the operating plant units or at the KPA storage. You can never really tell what the day will bring, but that is a positive thing, Vaittinen states.

Story by Petra O'Rourke

An important man behind the scenes of outage work

A successful outage contains a lot of important background work that many of us may not even think about. During the outages, Jussi Leino from RTK-Palvelu Oy manages housekeeping, protection, and cleaning work. Carrying them out properly simplifies outage work and, for its part, makes low radiation doses possible.

Jussi, 33 years old and a native of Toijala, ended up at Olkiluoto quite by accident. His parents told him that there were open positions for the annual outages at Olkiluoto, and Leino put in an application to RTK-Palvelu Oy in 2000. The very same spring, he was already hard at work.

Nowadays, in addition to general housekeeping, such as vacuuming and washing the floors, Leino's tasks include process clean-ups, decontamination, and logistics arrangements during the outages. Presently, his work area covers the OL1 turbine building and the reactor buildings and reactor halls of both plant units.

Stop the contamination

During annual outages, Leino is continuously prioritising issues. – There are several groups working at the same time in the reactor hall, and my job is to take them all into account and to manage the situation in order to control surface contamination. This also makes my own work easier, he says. Leino's preventive work also includes the installation of protective plastic at different worksites.

During the annual outages, Leino's working environment contains radioactive dirt, but he has a very level-headed approach to radiation. – I am absolutely not afraid of contamination. In case of doubt, put on more protective equipment. Knowledge of the plant is also essential for Leino's work. – Plant knowledge is accumulated over time. First, I tried to learn the internal addresses and room numbers by heart, but it did not work out, he says. Now, after nearly 12 years of working, he feels right at home in the controlled area. If you were to take him, blindfolded, to any part of his working area, he's quite sure he would know his way out without issue.

During the outages, Jussi Leino from RTK-Palvelu Oy is also responsible for rinsing the grappling hook on the refuelling machine.

Washing the reactor pool is one of Jussi's most demanding tasks during the outages. – When you're fully equipped, dehydration is always a concern. The most important thing is to get out of the pool safely, and preferably on your own two feet, Leino reminds us.

A man of music and motorbikes

To balance out the work, Leino has several manly hobbies, such as heavy metal music, motorbikes, and Hi-Fi. He became a motorbike enthusiast in his teens and bought his first bike as soon as he received the A driver's licence at the age of 21. Now he's already riding his third bike, a Yamaha TDM 900. – This year, I started riding on the 12th of April. In the summer, I use the bike for all my daily needs, and I ride about 6,000 to 7,000 kilometres per year, Leino summarises.

The unusual start of the work this spring also affected Leino. – Starting the outages at OL1 by surprise created a logistics obstacle for us, since all the necessary items for starting the work were at the wrong plant unit. You could say the corridors were full, Leino remembers, already looking back with a positive attitude.

He already has his mind set on the summer holiday that starts before Midsummer. – I have no special plans for the summer. I just need to paint a couple of speaker boxes and a few bicycles, he summarises.

Story by Eija Tommola

Nearly 1,400 work permits for unit 1

– All work related to the process must have an appropriate work permit; without one, no actions may be taken, outage coordinator Pekka Vilo emphasises.

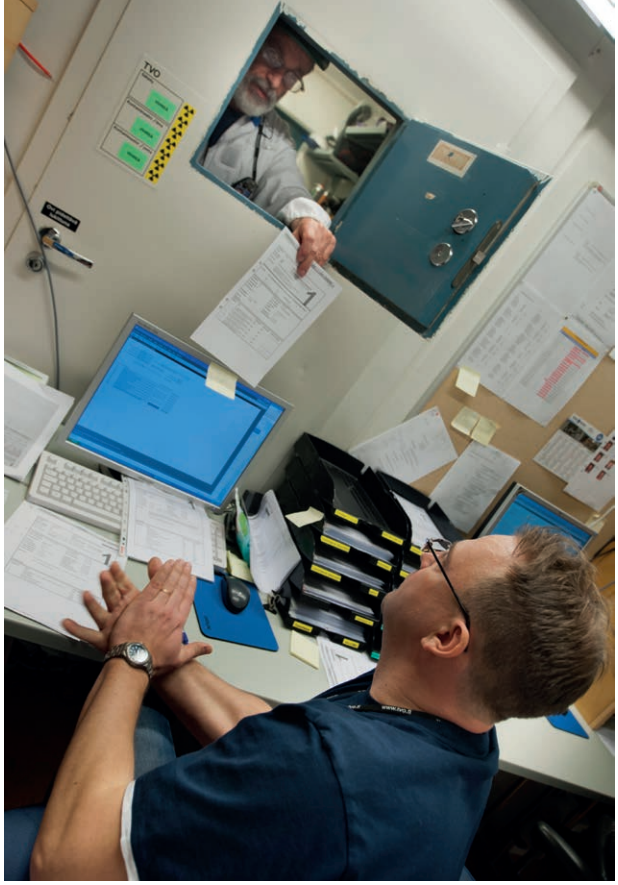
A separate work permit is established for each work task. – One permit may contain several work phases. During valve service, for example, you first set up the necessary scaffolding, and then you perform the mechanical, electrical and I&C work, and testing, clean up the location, and carry out any other necessary activities, Vilo explains.

Before the work permit is handed over to TVO's or the contractor's work supervisor, the outage coordinator checks that TVO's operating personnel have performed the necessary isolations for carrying out the work safely.

Once the work is complete, the work supervisor confirms the correct performance by signing the work permit. After receiving a notification that the work is complete, TVO's operating personnel restore the safety precautions and perform any required functional testing to ensure that the equipment is in appropriate working order. – We have been following this practice for several years. This eliminates the possibility of human error, Vilo emphasises. Completed work is recorded in the Work Management System nearly in real time.

Exact schedule planning is important

The work lists and schedules for outages are planned several years ahead. The finishing touches are applied during the year leading up to the outage, as the repair and service work being planned is confirmed. – We spent last winter planning the schedules and the safety precautions for the work permits, Vilo says. – Outage work must be scheduled precisely, since the overall schedule is tight. Some work may only be performed at a given time, whereas other work is not affected by schedule pressures.



– There are a total of four people working in the work permit office, from six in the morning to seven in the evening. After that, the work permits are handed over to the shift supervisor of the night shift. Our task in the work permit office is to remain in control, says outage coordinator Pekka Vilo.

For example, only a certain time has been reserved for the service and repair of the blow-off system 314; this is a time when the entire system is closed, allowing work to be performed safely, Vilo says. – The planning needs to ensure that a sufficient number of safety systems are operational even during the outage.

Unit 1 started the outages

The outage for Olkiluoto 1 was started early, and so the outage schedules had to be remade. – Fortunately, we had done our planning well in the winter. But it was not simply a matter of drawing new schedule lines. When the outage was started ahead of time, we did not have enough employees reserved. We had to adjust the schedules due to a shortage of workers even at the middle of the outage. Securing human resources was a challenge in itself, Vilo analyses.

The annual outage for unit 1 took 31 days, and unit 2 had a 9-day outage. – This year's outages went well, and why wouldn't they? We have over thirty years of experience, Pekka Vilo concludes.

Story by Tiina Kuusimäki

SIMO project proceeding one subsystem at a time

The renovation of the low voltage switchgear, known as the SIMO (Switchgear Modernisation) project, was completed for subsystem A at OL1 this year. The original plan was to also replace the switchgears of subsystem D, but the early start of the outage caused a change of plans. A total of 10 switchgears and three distribution transformers were replaced in the A subsystem. Eleven kilometres of cable was installed, and over 230 people took part in the switchgear installations at the plant unit.

SIMO is coordinated by TVO's project manager **Antero Hietikko** and his project group. Antero is a project engineer in TVO's Electrical Technology office, and he has been responsible for SIMO since 2011. – The SIMO project started in 2007 with the first preliminary analyses. In 2010, the pilot installations were made in OL2's EYT systems (no nuclear safety classification). Last year, the safety classified (SC2) switchgears of one subsystem were replaced at OL2, followed this year by one subsystem for OL1. Based on present information, the project will continue at least until 2016.

Low voltage switchgears in practical terms

The low voltage electricity distribution network of the plant units is divided into four parallel, identical subsystems that contain a total of 125 different switchgears, and 74 distribution transformers per plant unit. The networks of both plant units can supply electricity with no back-up, diesel-backed electricity, and battery-backed electricity (UPS).

The low voltage switchgears are the energy transfer systems for the safety systems within the subsystems. They supply power to pumps and motors, for example, thereby controlling their operation. If one subsystem fails, the plant unit's safety systems will continue to operate normally.

– Safety systems can also operate with two, or even one subsystem, allowing the plant to be shut down safely. Each subsystem is autonomous in order to prevent the failure of one subsystem from causing a malfunction in the other subsystems, Antero Hietikko states.

Antero Hietikko has been working at Olkiluoto for over 30 years. He transferred to TVO in 1985.

The main switchgear room of the diesel-backed system requires a space of about 150 square metres; this is a large system indeed.

Switchgears replaced in international co-operation

Replacing the switchgears became necessary when acquiring spare parts started to cause problems. – The switchgears are from the late 1970s. Since the original spare parts are no longer on the market, new parts must be purchased. Each new part must be separately qualified and approved by the Radiation and Nuclear Safety Authority, Hietikko summarises.

The main partner for the switchgear replacement has been ABB Oy, with equipment suppliers from France, Germany, Italy, and Sweden as subcontractors. Several Finnish installation companies have been involved in the installation. – SIMO is one of my longest projects. For the outage of 2012 alone, we have 68 folders full of design documentation. So far, over 84,000 working hours have been spent on SIMO.

Several earthquake tests, qualifications, audits, data security plans and risk analyses have been performed in relation to the implementation of the SIMO project. – We require a high level of safety culture from equipment suppliers, installers, and ourselves alike. These components are essential for the plant unit, and special attention must be paid to installing and commissioning them, project manager Hietikko concludes.

Story and images by Petra O´Rourke

Open-flame salmon to end the evening shift

The open-flame salmon dinner, a long-standing outage tradition, brought workers together to enjoy a fillet of fish. This year, the laid-back event came with plenty of sunshine and music from troubadour **Jarmo Nieminen**. The dinner was held in front of the central office canteen on 22 May, while the outage for OL1 was still under way. People found the fish enjoyable, and the tents were quickly full of happy chatter.

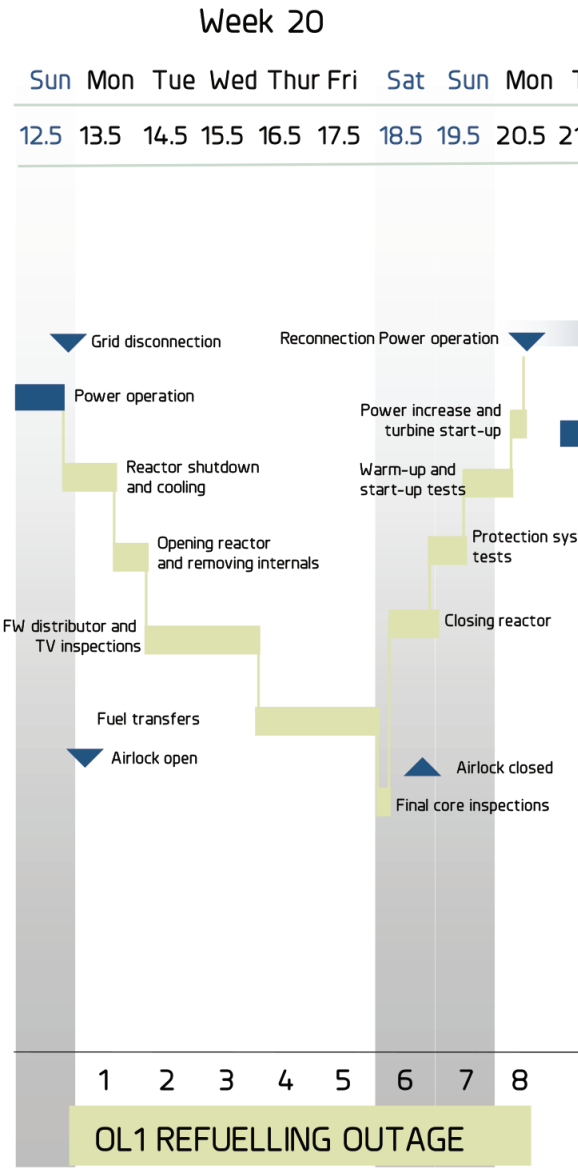
Jarmo Nieminen, working in I&C Design, took up the guitar after looking for a hobby to balance out his work.

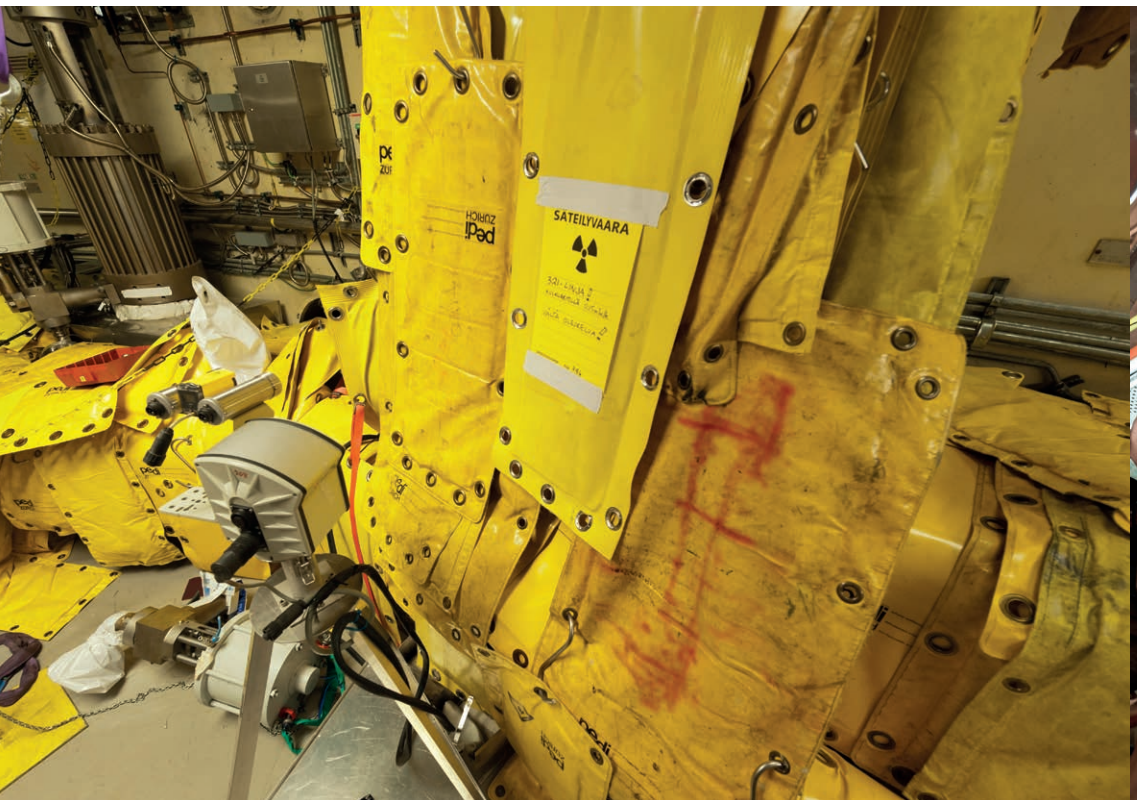
Outage workers formed queues to get to the open-flame salmon.

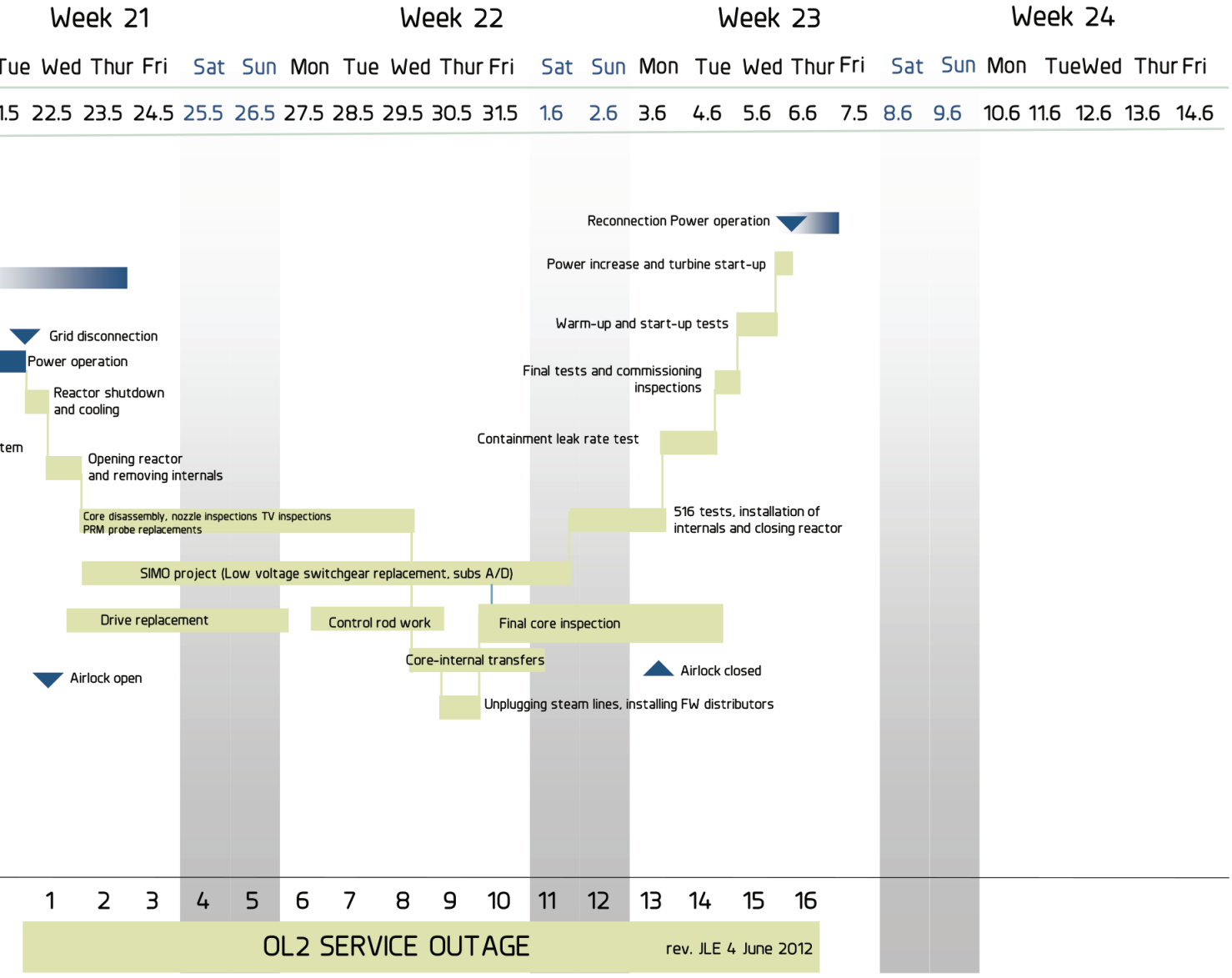
The open-flame salmon dinner had the feeling of an old-time garden party

Preliminary schedule – Olkiluoto 1 and 2, annual outages 2013

R113 12 May 2013 to 20 May 2013, 8 days
R213 21 May 2013 to 6 June 2013, 16 days






Week 21
Week 22
Week 23
Week 24
Tue Wed Thur Fri Sat Sun Mon Tue Wed Thur Fri Sat Sun Mon Tue Wed Thur Fri Sat Sun Mon Tue Wed Thur Fri
1.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 1.6 2.6 3.6 4.6 5.6 6.6 7.5 8.6 9.6 10.6 11.6 12.6 13.6 14.6
Reconnection Power operation
Power increase and turbine start-up
Warm-up and start-up tests
Final tests and commissioning inspections
Containment leak rate test
Grid disconnection
Power operation
Reactor shutdown and cooling
tem
Opening reactor and removing internals
Core disassembly, nozzle inspections TV inspections PRM probe replacements
516 tests, installation of internals and closing reactor
SIMO project (Low voltage switchgear replacement, subs A/D)
Drive replacement
Control rod work
Final core inspection
Core-internal transfers
Airlock closed
Airlock open
Unplugging steam lines, installing FW distributors
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
OL2 SERVICE OUTAGE
rev. JLE 4 June 2012

Outages R112 (OL1) and R212 (OL2) in a nutshell

	OL1	OL2
Planned duration	28 d 20 h 23 min	7 d 22 h
Actual duration	31 d 2 h 37 min	9 d 6 h 31 min
Difference	+ 2 d 6 h 14 min	+ 1 d 8 h 31 min
RX12 ACTUAL TOTAL DURATION 40 D 9 H 8 MIN		
Grid disconnection	24 April 2012 at 15:37	27 May 2012 at 18:21
Reconnection	25 May 2012 at 18:14	6 May 2012 at 00:52

At the end of the outage on Saturday, 26 May 2012, the OL1 plant unit was operated to a warm shutdown in order to repair a valve leak at 07:36. The length of the repair outage was 17 h 46 minutes.

Outage work from Olkiluoto 1

- Refuelling
- Completion of low pressure turbine renovation
- Generator replacement
- Modernisation of condensate cleaning I&C
- Low voltage switchgear replacement in one subsystem
- Replacement of one auxiliary transformer
- Containment leak rate test

Outage work from Olkiluoto 2

- Refuelling
- Normal service and repair
- Inspection of one internal steam line isolation valve

Outage contractors

ABB OY
ABB Service Oy
AIRIX Teollisuus Oy
Alaratech Oy
ALSTOM Finland Oy
ALSTOM Power Sweden AB
AMK-Engineering Oy
Arme Oy
Asennus N&H Service Oy
Assa Abloy Entrance Systems
BIS Production Partner Oy
CCI AG
CLS-Engineering Oy
DEKRA Industrial Oy
Doseco Oy
Empower Oy
Empower Suomi Oy
Eng'nD Oy
Eupart Oy
Eurajoen Paloteam Oy
Euran teollisuushuolto Oy
Finnish Sea Service Oy
Flowserve
Fortum Power and Heat Oy
HR-Kala
IKU-Tekniikka Oy
Ilmastointi Salminen Oy
Inspecta Oy
Inspecta Sertifiointi Oy
Inspecta Tarkastus Oy
Insta Automation Oy
Is-Technics Oy
Jamtec Oy
JR-Kiito Ky
Kil-Yhtiöt Oy
Konecranes Service Oy
Koneistus J. Lähteenmäki
Kraftdragarna AB
KSB Finland Oy
Lahden Lämpökäsittely Oy
Lapin Saumaus Veikko Peltomaa
Lassila & Tikanoja Oyj
Lemminkäinen Kiinteistötekniik
Lujitemuovi Matti Nordberg Ky
Lämpösulku Oy
Lääkärikeskus Minerva Oy
Maalausliike Heino Oy
Maintpartner Oy
Masino Oy
Noorfin Oy
Petteri Raak Oy
Power Instruments Oy
Proma-Palvelut Oy
Promeco Solutions Oy
Prosystem AB
Pöyry Finland Oy
Rakenne-Rinki Oy
Rakennushuolto Kallio & Forss
Rauman Metallipaja Oy
Rauman Sähköpalvelu Oy
Rauman Tekniikkakeskus Oy
Rauvola & Simula Oy
RTK-Palvelu Oy
Sammet Asennus Oy
Sata-Electro Oy
Satmatic Oy
Schäfer & Urbach
Securitas Oy
Sempell GmbH
Siemens Osakeyhtiö
Siemens Oy
Sodexo Oy
SP-Suunnittelu Oy
Suomen Teollisuus-Sukellus Oy
Sweco Industry Oy
SVS Supervise Service Oy
Sähkö-Rauma Oy
Säkylän Sähkö-Puisto Oy
Säteilyturvakeskus
Teknikum Oy
Telinekataja Oy
Teline-Rami Oy
Timanttityö Santala Oy
Toiminimi H. Vainio
Transbaltic Oy
TYL KPA
WesDyne TRC AB
Vesi-Vasa Oy
Westinghouse Electric SwedenAB
VTT
YIT Kiinteistötekniikka Oy
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