Unique induction into the nuclear industry
Focusing on operational safety
Boiling water reactor training at Olkiluoto
A physicist among engineers
Pioneer in nuclear expertise

TVO Nuclear Services Oy (TVONS) is a subsidiary of Teollisuuden Voima Oyj:n (TVO). It offers the TVO group’s high-quality nuclear power plant services, based on over 30 years of experience and nuclear expertise. Our services cover the entire lifecycle of a nuclear power plant.

With the help of our competent staff and continuous improvement, we have achieved top results; this is manifested by the load factors of the Olkiluoto nuclear power plant, which are among the best in the world. The reliability of the energy supply is strong proof of our expertise.

TVONS stands for

- Fluent cooperation with companies and other institutions, both domestically and internationally.
- Design expertise and robust practical skills.
- Honest professional pride and a willingness to share our expertise.
- A working culture where matters are handled responsibly, systematically, and with commitment.
- Setting goals high and working relentlessly to achieve them.
Posiva offers unique commercial expertise

Posiva Oy will be 20 years old this year, but the final disposal of spent nuclear fuel has been studied in Finland since the 1980s. At this time, Teollisuuden Voima (TVO) started the location studies related to final disposal in Finland. The new Nuclear Energy Act entered into force during the same decade, and one of its substantial changes involved preparation for the costs of nuclear waste management. Finland has been a pioneer in this respect, since the funds required for the final disposal of spent nuclear fuel have been collected by adding that cost to the price of nuclear electricity over the years and stored in a dedicated fund. A change in the legislation that entered into force in the subsequent decade imposed a ban on the import and export of spent nuclear fuel; therefore, it was natural for TVO and IVO (presently Fortum) to start cooperating in the field of spent fuel disposal, which resulted in the founding of Posiva Oy.

After several stages and years of research, Posiva received a decision-in-principle for the final disposal facility in 2001. The construction of the underground research facility, ONKALO, started in 2002. ONKALO has been used to collect information on the operation of the final disposal facility for the construction licence application that was submitted in 2012. The construction licence application is still under processing. This year, the Radiation and Nuclear Safety Authority issued a positive safety statement concerning the licence application, and the Government will now process the issue. If Posiva receives the construction licence, it will move to the implementation stage of the project: the construction of the actual final disposal facility.

Both domestic and international cooperation has been done with several different parties during the project. In Finland, several different parties have been involved in the site feasibility studies and the preparation for the implementation of the project. Furthermore, Posiva has been working in close cooperation with the Swedish Svensk Kärnbränslehantering Ab (SKB). The cooperation with SKB has spanned several years and it has focused on the development of final disposal technology. Finland and Sweden are the first countries that have taken the plans related to the final disposal of spent nuclear fuel this far.

The amount of spent nuclear fuel generated by the five nuclear power plant units of Posiva’s owners, Fortum and TVO, is only about one per cent of the total amount of spent fuel in the world. However, the total budget for the final disposal is several billion euros. The services related to the final disposal of spent nuclear fuel will become a substantial area of business in the future. Posiva is currently planning how it could be involved in the service business and utilise its expertise and pioneering position.

In addition to the business aspects, Posiva also considers it important to ensure the final disposal expertise once the company moves to the production stage after design and implementation. TVONS, as the expert in selling Olkiluoto’s services, is a part of this development work, as it can provide its experience in international nuclear power projects throughout the life cycle of the plants. Going forward, Posiva’s final disposal expertise can be proudly marketed both domestically and internationally.

JANNE MOKKA
PRESIDENT, POSIVA OY
Unique nuclear industry training at Olkiluoto

STORY BY KIRSTI KUUSISTO | PHOTOS BY KIRSTI KUUSISTO AND RAIMO KAIPIAINEN

The “Induction into the Nuclear Energy Industry” training arranged by TVONS was the first in Finland to be completely arranged by those who are already working in the industry.

The trainers were experts from TVO and Posiva who took time off from their daily work in order to share their information and expertise with the students.

– A total of 53 students participated in the training; all of them had a technical education or work experience in the field. The training consisted of a total of 19 days, during which they received basic information concerning nuclear power plant functions and nuclear waste facilities and the requirements and procedures related to them. The students also completed TVO’s induction training and its radiation protection part, which qualifies them for work at all Finnish and Swedish nuclear power plants, says Kirsti Kuusisto from TVONS.

– The participants were happy with the training. The contents were found to be versatile and extensive. The visits to different sites at Olkiluoto were also seen to provide both detailed and general information concerning the area and its functions. The trainers were also satisfied. According to them, the training provided good challenges, since the students came from different fields of technology and they had no previous experience with nuclear facilities.

A seminar day was arranged at the end of the training in order to allow the students to contact and network with the representatives of companies working in the Olkiluoto area and elsewhere in the Satakunta region.

The training was financed by the Satakunta Centre for Economic Development, Transport and the Environment, and the Rauma Chamber of Commerce, the Satakunta TE Office and companies working at Olkiluoto were also involved in the project.

Juho Kauppi from Logistikas Oy spoke about the operation of the company during the final seminar of the training.

The students involved in the training took part in a nuclear waste course at Vuojoki together with employees from TVO and Posiva.
TVONS and the Radiation and Nuclear Safety Authority (STUK) are resuming their long tradition of arranging regional cooperation seminars.

– The cooperation and information exchange between the Finnish nuclear power plants, Kola NPP and Leningrad NPP as well as the nuclear safety authorities of these countries is considered very important, says STUK's local inspector Jukka Kallionpää who works at Olkiluoto.

The goal of the cooperation is to compare the different practices and to focus on continuous improvement through learning.

In 2015, the regional cooperation programme includes six seminars related to the improvement of operational safety. Two seminars will be held at Olkiluoto, one in Loviisa and three at the Sosnovy Bor power plant. The seminars at Olkiluoto deal with the training of nuclear power plant personnel and the experience gathered during construction. Fire protection is the topic in Loviisa, while Sosnovy Bor's seminars discuss nuclear waste, maintenance programmes for equipment and systems, and plant events and modifications and their processing.

The first of this year's seminars was held at Olkiluoto in March. The seminar was titled “Training and licensing of operations personnel and reacting to emergencies” and it consisted of a week full of presentations from Finnish and Russian experts and plenty of active discussion. The week also included visits to OL1 and the simulator, the final disposal repository for low and medium level radioactive waste (VLJ), the ONKALO Research Gallery, and the Electricity from Uranium science exhibition at the visitor centre.

– Regional cooperation offers an excellent opportunity to study the working methods at other plants and to see how the theme of the seminar is being implemented in practice, Kirsti Kuusisto explains.
TVO’s and Fortum’s power plants have a long history of cooperation in terms of annual outages and radiation protection, for example. The boiling water reactor training marketed by TVONS is a new introduction.

– A few years ago, Fortum contacted us to request training concerning the operation of a boiling water reactor, since Loviisa Power Plant is a pressurised water reactor, says Visitors Manager Anne Niemi from TVO who arranged the event.

– Fortum paid for the boiling water reactor training for its power plant experts in order to be able to utilise the competent personnel at other plants going forward. The training for Fortum’s employees was arranged through TVONS, and it took place at Olkiluoto in February. The trainers were TVO’s own experts from different fields.

– The four-day training provided participants with basic information concerning the operating principle of the boiling water reactor, as well as a good starting point for any further training. The schedule was tight and there was a lot to learn. If further trainings are arranged, they will be divided over more days. The days can then be distributed over two weeks, for example, Niemi says.

The feedback from Fortum's employees indicated that they were very happy with the level of expertise of the trainers from TVO and the contents of the training itself.
A physicist among engineers

STORY BY JUKKA-PEKKA PAANANEN
PHOTO BY JOHANNA AHO

TVO employs seven physicists. Contrary to what you might think, however, they do not work in a laboratory. Matti Paajanen, the leader of the team, explains the work of a physicist in a nuclear power company.

TVO’s physicists are reactor physicists, and as the title suggests, the work focuses on the reactor, the heart of the plant. Instead of working in a laboratory, reactor physicists mostly work with computers. Their main task is to monitor the behaviour of the reactor and to plan its operation for years to come.

– We analyse the behaviour of the reactor from a physicist’s point of view. This way, we can prevent production disturbances well before they occur, says Paajanen, who works as the head of the Fuel unit’s calculation and supervision team.

– The shift supervisor works in the control room and makes the immediate decisions concerning the shutdown of the reactor in case of failure, for example. We work to control the reactor in the long term.

“Solving problems as a team is fascinating”

The nuclear power companies usually purchase the fuel design work from the fuel supplier. TVO has selected another route. The company uses its own physicists in the design of the fuel life cycle.

– We design the composition of the fuel and its placement inside the rods. After this, the fuel supplier manufactures the elements according to our wishes. This allows us to keep the expertise in-house and to make decisions independently of the suppliers.

The operation of the reactor involves a complex series of causes and effects. Paajanen finds that solving challenging technical problems as a team is the most fascinating part of his work.

– In a university, for example, the work of a physicist is very abstract, and the results may only materialise after a decade. Here, you can see the results of your work sooner. However, even here, it can take a year – so it’s all relative, Paajanen says, laughingly.

The reactor physicists plan the use of the nuclear fuel for up to ten years in advance. Sensible planning allows the fuel to be utilised in the most economical manner. However, the current safety of the reactor is the starting point for each working day.

– Even though we are regulated by the authorities, for me the most important thing is that the team has an unwavering work ethic. The fuel must not be damaged even under exceptional conditions. Advance planning is important. Any disturbances must be detected early, and we are creating functional models for all kinds of exceptional conditions.

The reactor is a pressure vessel inside the nuclear power plant that utilises the controlled chain reactions of the nuclei. The reactor consumes nuclear fuel in order to heat water. Depending on the power plant type, the reactor is approximately 5 metres in diameter and has a height of 12–20 metres. Photo by Hannu Huovila.
TVONS has launched training cooperation with the Emirates Nuclear Energy Company (ENEC). The company, operating in Abu Dhabi, is constructing the first nuclear power plant units in the United Arab Emirates. The cooperation allows ENEC to draw upon TVONS’s versatile nuclear power expertise.

TVONS’s nuclear power plant expertise and the different aspects of cooperation were included in the discussions when TVONS’s Managing Director Mikko Leppälä met ENEC’s representatives in the UAE in March. Since ENEC has no previous experience in nuclear power and the construction and operation of nuclear power plants, the company is very interested in all of the different stages of a nuclear power plant’s lifecycle. The Finnish nuclear power expertise and our high load factors are internationally valued. The first meetings with ENEC’s representatives were held in the autumn of 2014 in Finland. The training cooperation and its possible forms were discussed in detail during the meetings. The cooperation was launched by arranging a safeguards training seminar for ENEC’s representatives at Olkiluoto.

The first training, titled “Safeguards training for ENEC”, was held at Olkiluoto between 30 March and 2 April. The training topics included TVO’s operations in general, training matters, fuel handling and safeguards matters. Cooperation between authorities in Finland and nuclear material supervision and reporting were also discussed.

For a new operator, the operation of a nuclear facility and the special supervision requirements, such as safeguards and export controls, are new things. The concepts and supervision applied may differ even when experts from different countries are used. This is because international safeguards controls are always implemented on a country-specific basis in the manner agreed with IAEA in the safeguards agreement.

Studying other nuclear power plants is necessary in itself. Furthermore, the good practices in national and international nuclear material supervision are necessary information for the new countries. Central topics include a nuclear material accounting and supervision system, reporting, and the enabling and implementing of authority supervision and inspections.
TVONS’s Managing Director met ENEC’s representatives in Abu Dhabi in March.

– After completing an induction training such as this, the trainees are better qualified for creating supervision practices at their own plant and for justifying their creation and use to the management of the plant. An experienced operator with a good reputation, coming from a country that has no nuclear weapons, is a valuable training partner whose good practices can be adopted. As the challenges in preventing the proliferation of nuclear weapons are changing and the supervision is developing, longer-term cooperation would benefit safety and make nuclear safeguards more effective, says safeguards expert Matti Tarvainen from ENEC.

The leaders of the training seminar, who came from TVO, explained that the course participants were very motivated, interested and active throughout the training. During the training, they seemed to understand that knowledge of the legislation and basic issues related to their own tasks is not sufficient; they also need to have other knowledge, such as a basic understanding of the plant. For the participants, the visit to the Olkiluoto 1 plant unit was their first visit ever to an operating nuclear power plant, and it made many things more tangible for them.

TVONS received good feedback from the course participants, as they felt that the course tailored for ENEC met their expectations very well. The training held at Olkiluoto was a good opener to the cooperation, and the partnership with ENEC will continue into the future.

TVONS participated in the trade fair as part of FinNuclear’s stand.

Taking in the international atmosphere

STORY BY SUSAN PIETILÄ | PHOTO BY MIKKO LEPPÄLÄ

TVONS was one of the Finnish companies participating in the Middle East Electricity 2015 (MEE) trade exhibition in Dubai.

The MEE exhibition was held in Dubai, the United Arab Emirates, in March of this year. This international energy industry exhibition had over 1,250 exhibitors from 55 different countries. TVONS was a part of FinNuclear’s joint stand that included a total of six Finnish companies. The three-day exhibition was held in several halls of the World Trade Center, and the event had a large number of visitors.

The themes of the exhibition included power, lighting, solar power, renewable energy sources and nuclear power. The exhibition offered several seminars and the opportunity to participate in different meet-ups. TVONS was contacted by several local actors who were interested in nuclear power and especially in the final disposal of spent fuel.

So far, the United Arab Emirates has not been using nuclear power, but four APR-1400 pressurised water reactors are currently under construction. The construction is being handled by the South Korean energy company Kepco. The first three units are expected to be completed in 2018-2019, and the fourth will be completed in 2020.
TVONS has been cooperating with STUK for several years in order to train both countries with existing nuclear power capacity and new countries only planning to start using nuclear power.

In 2014, Saudi Arabia’s King Abdullah City for Atomic and Renewable Energy (K.A. CARE) and STUK agreed on a cooperation where STUK has a key role in the development of a national regulatory body in Saudi Arabia. K.A.CARE aims to create a peaceful and safe nuclear energy programme and to construct several nuclear reactors. The cooperation between these two authorities is expected to last for several years.

On 5–6 March 2015, TVONS arranged a training at Olkiluoto for eight well educated young men from Saudi Arabia. The topic was Safeguards, Safety and Security.

The lecturers and course representatives were fuel engineer Päivi Rintala and reactor engineer Tommi Lamminpää, who represented TVO’s best expertise in the area.

The first day started with a general presentation of the topic and discussions. In the afternoon, TVO’s operations and the Olkiluoto area were studied by means of a tour to the OL1 plant unit and the spent fuel interim storage. A bus tour of the OL3 construction site was also arranged. The day ended with discussions concerning expectations and the lessons learned during the day.

The second day of training included presentations of POSIVA’s activities and a visit to the final disposal site for low and medium level radioactive waste and the ONKALO Research Gallery. The afternoon was spent reviewing the exercises and group work assignments completed during the days and discussing issues that raised interest.

The K.A.CARE group found it very interesting and useful to work with the licensee and to see how the cooperation works between the regulatory body and the licensee. The discussions brought up how important it is for the authority and the licensee to be aware of their own responsibilities and act according to their roles.

The cooperation will continue, and a market for similar trainings will remain.
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