

## Challenges for a TSO supporting both the regulator and industry

E.K. Puska<sup>1</sup>

<sup>1</sup>VTT Technical Research Centre of Finland (VTT), Espoo, Finland

*E-mail contact of main author: eija-karita.puska@vtt.fi*

**Abstract.** A typical TSO supporting both the regulator and industry is a TSO in a relatively small country that has only a few nuclear power plants in operation or in construction. The paper reflects and discusses the challenges met by such a TSO mainly using the VTT Technical Research Centre of Finland (VTT) as the example case.

### 1. Background and Current Operational Environment

In Finland the TSO role of VTT was born along with the construction of the first four Nuclear Power Plant (NPP) units in the country during the late 1970' and early 1980's. In particular, for the two Loviisa VVER-440 type plant units there was a need of independent analysis tools and expertise both on the regulatory side and on the side of the plant owner. During the past four decades the challenges to VTT as a TSO have changed due to changes in the domestic and international operational environment, such as changes in VTT funding structure from a governmentally funded organisation to an organisation with only 25 percent or less in the near future from the governmental budget.

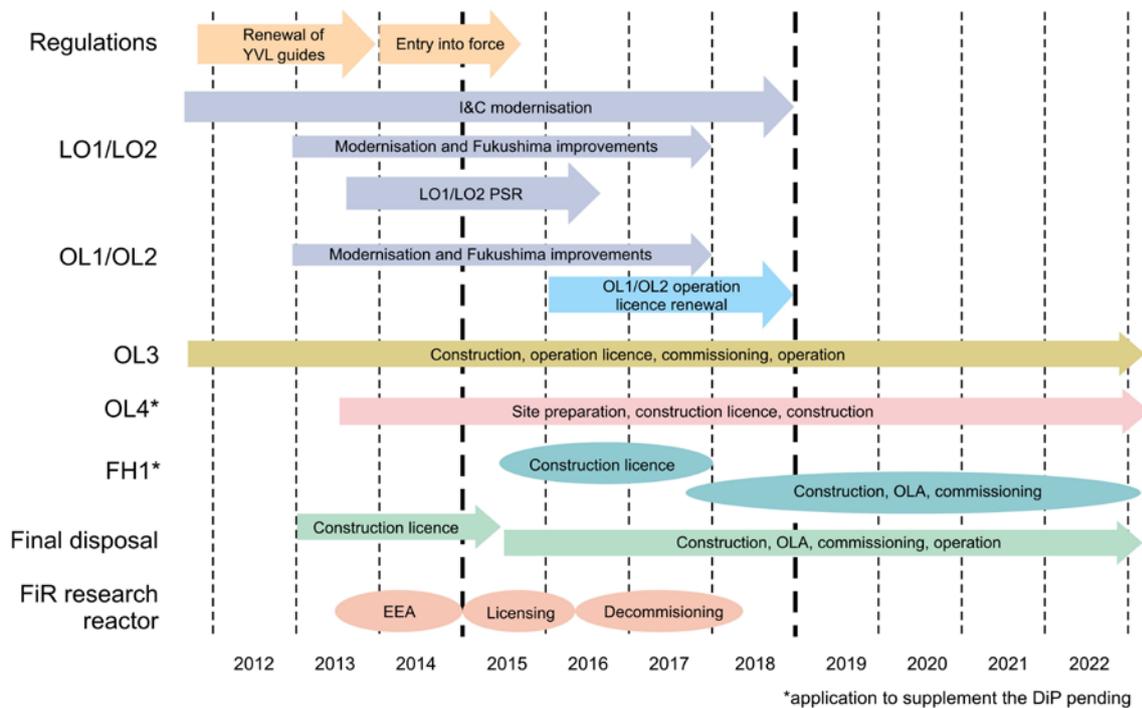


FIG. 1 Estimated timing of licensing processes of nuclear installations in Finland [1].

The TSO service needs of the domestic regulator are fairly predictable, as indicated in Figure 1 [1]. During the time of modernisation projects or periodic safety reviews of the operating plants the regulator needs TSO services. During the intervals between these activities the need of TSO services is quite low. During the construction and operation licence application periods the need of TSO services is high, but when the licences are granted the need decreases drastically.

VTT carries out the TSO activities for the regulator STUK, as well as for any other customer, as confidential assignments. Thus, VTT cannot provide information on these assignments. However, the information provided by the regulator on STUK's oversight of Finnish nuclear power plants shown in Figure 2[2] reflects well also the variations in the need of supporting TSO services for the operating plants and those in construction or planned.

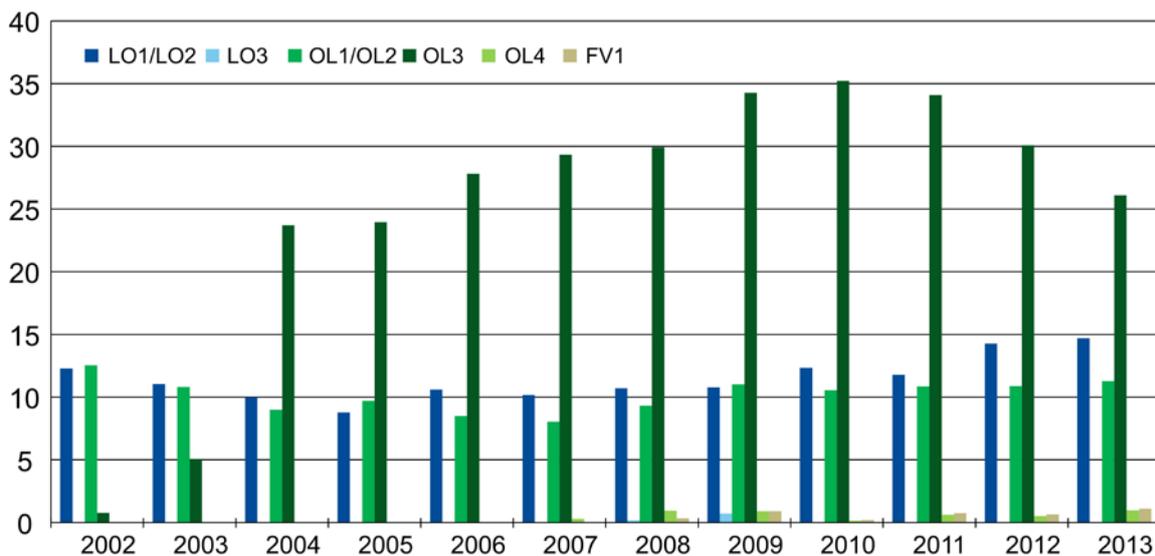


FIG. 2 STUK's oversight of Finnish NPPs in man-years/NPP. Reproduced from[2].

When the TSO expertise is needed, it is needed in a wide scale of technical expertise areas and using various experimental facilities, as described below in chapter 4. However, this demand by the regulator is not sufficient to ensure the existence of the expertise at VTT. Thus, VTT needs to support also the domestic nuclear operators as well as to continue to enhance operation with foreign regulators and industry.

## 2. Creating and Maintaining Technical Competence

One of the major challenges for a TSO is to create, maintain and enforce the required competences that consist of experts, tools and facilities. In Finland the national research programmes in reactor safety and waste management have a key role in ensuring that the country possesses the required competences. These programmes are based on the Nuclear Energy Act and their formal duty is to ensure that the regulator has access to the required competence and tools in Finland. In practice these programmes serve the entire nuclear community by fostering new experts, developing new methods and maintaining the key competencies. The particular feature is that all key players of the country including both the regulator and the industry are represented in the decision making bodies. The duration of the national programmes is four years and the general outline of the research is defined in the Framework Plans [3] that serve as the basis of the annual planning. The framework plans are

based on the national needs that are defined in the competence reviews [4] and long-term national research strategies [1].

Figure 3 illustrates the competence areas and their relative funding in SAFIR2014 programme in 2014 [5]. The SAFIR programme with annual volume of 10 million euros and 64 person years is approximately half of the entire research done in the area of reactor safety in Finland. The competence areas (with short name in brackets referring to Figure 3) are: Man, Organisation and Society (Human), Automation and Control Room (Automation), Fuel Research and Reactor Analysis (Core), Thermal Hydraulics (Thermal), Severe Accidents (Severe), Structural Safety of Reactor Circuits (Materials), Construction Safety (Construction), Probabilistic Risk Analysis (PRA), and Development of Research Infrastructure (Infra). The research projects are chosen on the basis of annual competitive call for proposals. The research programme covers the key expertise areas of a TSO working in the reactor safety field. Due to the limited resources the emphasis in SAFIR program is in fostering the new generation of experts in research projects where they gain expertise that is later on required when carrying out the assignments in the TSO role.

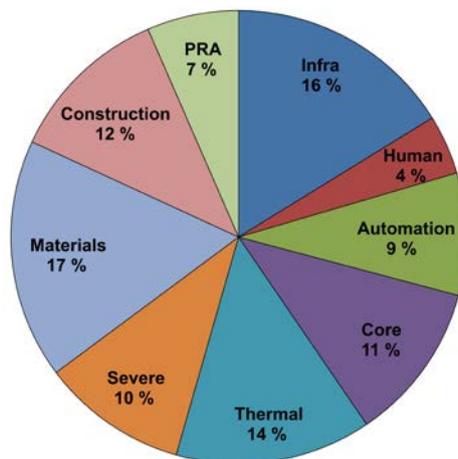


FIG. 3. The research areas of SAFIR2014 programme and their funding share in 2014[5].

VTT is the largest research partner with 86 % of the entire volume of the programme. The second largest research partner is Lappeenranta University of Technology (LUT) that has the large experimental thermal hydraulic research facilities in Finland. LUT acts as the TSO in thermal hydraulic area in Finland serving both the regulator and the industry. Thus, it faces similar challenges as VTT in the TSO role.

### 3. TSO independence to support both the regulator and industry

The major challenge for a TSO supporting both the regulator and industry is to avoid conflicts of interest and simultaneously maintain the impartiality and transparency. The four primary principles applied at VTT to maintain the independency and confidentiality as a TSO are condensed into four short slogans: 1) Not the same analyses, 2) Not the same people, 3) Not the same equipment and 4) Not the same software.

The first principle means that if VTT is supporting the regulator in the safety review of a new build VTT will not be the main or one of the primary TSOs for the plant owner were it even 100 % by different experts using different analysis tools or experimental methods. The acceptance of nuclear power is a sensitive matter in many countries and consequently such a 'VTT versus VTT' case would not be accepted by the general public.

The second principle reflects the general ethical rule that one is not allowed to review and accept one's own work. In the practical TSO activities it means that if an expert has carried out a certain analysis for the regulatory side, the same expert will not carry a confirmatory analysis in the next stage for the plant owner using the same or even different tools and methods.

The last two principles mean that if there is an equally reliable analysis tool or experimental method available the alternative tools or methods are used in the assignments for the regulator and the industry. This last principle should always be reflected against the fact whether the alternative tool or method really is equally reliable and whether the staff experience is sufficient to use it. The fact is that in many areas the same analytical tools and experimental methods are used both by the regulator and by the industry.

In addition to the above principles the TSO must have management and data systems and organisation structure and safety culture that enable it to maintain absolute confidentiality of the customer data and project results as well as required level of confidentiality in interactions with the customer.

#### **4. TSO functions in operating organisations**

##### **4.1 TSO Functions**

In new plants the regulatory body /safety authority may need TSO support in independent safety assessment and analyses during the plant licensing process. The plant owner may use a TSO to provide safety assessment and analyses that are independent from the analyses provided by the plant vendor in order to make sure that the plant will meet its design and/or performance criteria. The plant vendor may use local TSO expertise to ensure that the plant safety features and the safety analyses provided to the safety authority fulfil the requirements and acceptance criteria of the country where the plant is being built.

In operating plants the regulatory body /safety authority may need TSO support in independent safety assessment and analyses in license renewal, periodic safety review and/or in design changes and modernization projects. The plant owner may use a TSO to perform the required analysis for the license application or to verify that the plant changes / new components will meet their design/performance criteria.

Whether the safety authority needs external TSO depends on the resources and structure of the safety authority. If the TSO capabilities are embedded in the regulatory body/ safety authority or reside in a TSO that is closely connected and fully funded by the regulatory body or by the government, there is usually no need for an external TSO. In many countries this is not the case and external TSOs are needed.

The plant owners do not usually possess adequate personnel to dedicate their time for safety analyses besides their daily tasks in the plant operation and maintenance or experimental facilities to carry out the required tests. Thus, an external TSO is required for the assessments and analyses.

The plant vendors are expected to have the staff with sufficient technical capabilities. However, they may not have sufficient knowledge on local conditions and thus an external TSO is needed.

Figure 4 illustrates the functions of VTT as a TSO that is serving both the regulator and the industry on a case-by-case basis.

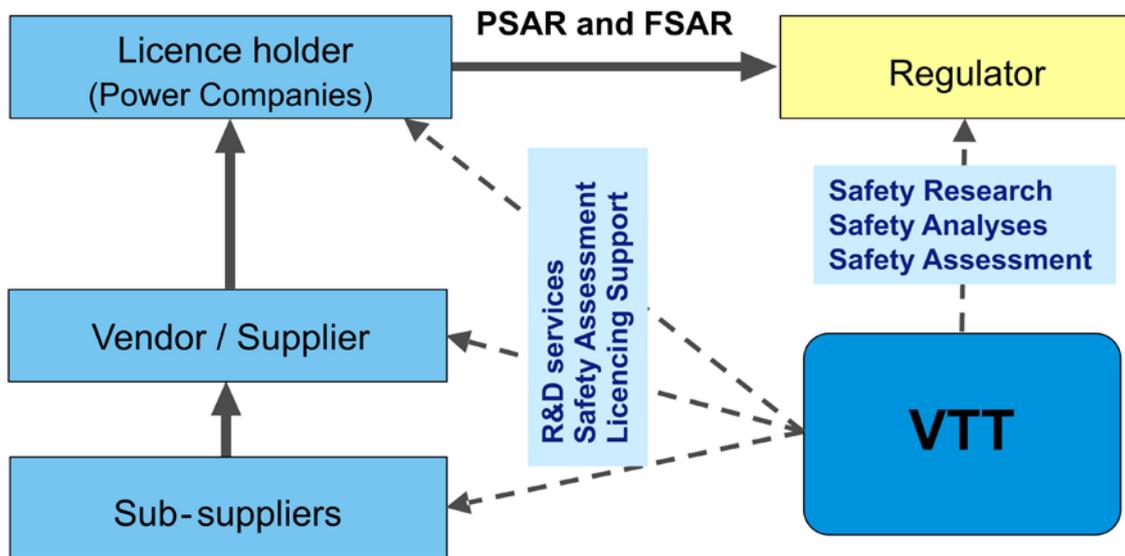


FIG. 4 VTT's roles as a TSO serving the regulator or the industry on a case-by-case basis.

#### 4.2 Independent Safety Assessment

Independent safety assessment methods include reviewing of existing documentation, performing independent safety analyses and carrying out independent experiments. The document review consists of the review of design documents and safety analysis results included in a Preliminary Safety Analysis Report (PSAR) or Final Safety Analysis Report (FSAR) and review of material supporting the PSAR/FSAR. In this review comparison with previous experienced is done. With experienced experts and proven concepts this concepts provides good results. With new concepts quite often some independent safety analyses or experiments are carried out in addition to the document review. The independent safety analyses can comprise of the full set of analyses or a selected set of cases as a confirmatory analysis. The independent safety analyses are carried out by independent experts preferably using different tools from those used by the vendor. The TSO may need to build an independent plant model for the safety analyses or build a new experimental device describing a particular system or component of the plant.

#### 4.3 Example of TSO activities in a new build

VTT has been one of the major TSO organisations of the Finnish regulatory body STUK during the Olkiluoto 3 (OL3) EPR construction licence application review and has continued to support STUK also during the post construction licence period. According to STUK [6] VTT supported STUK in the OL3 construction licence review in the following areas: independent comparative analysis of transients, DBAs, severe accidents, experimental and analytical studies on airplane crash, assessment of digital I&C systems, evaluation of primary system design: strength analyses, manufacturing technology, materials, primary coolant chemistry, experimental and analytical fire safety studies (cable fires) and review of specific parts of OL3 PRA.

## **5. Potential Conflicts of Interest**

### **5.1 Situations for Potential Conflict of Interest**

Due to the reasons explained in chapter 3 VTT has to 'select the side' in large projects quite clearly and early on in order to avoid any doubt of conflict of interest. In such cases there are two cases where one has to be cautious in order to avoid a conflict of interest. The first one is in the very early phases of the project before any formal decisions on 'selecting the side' are made inside VTT. In that phase VTT representatives may approach the different partners or the representatives of the regulator and plant owner and vendor may approach the individual VTT representatives independently and without knowledge of the other contacts. In order to avoid such cases to develop into conflict of interest situations, good and prompt but confidential exchange of information inside VTT is crucial. Another typical case with a potential for a conflict of interest could take place when VTT is acting as a TSO to the regulator in a PSAR/FSAR review that typically contains thousands of pages of material plus a large amount of supporting material. During the review VTT may detect that the vendor/plant owner uses as supporting evidence e.g. results of materials tests carried out previously by VTT in an independent assignment for the vendor. In that case VTT should promptly inform the regulator on the detected or potential conflict of interest and leave the decision to the regulator. Depending on the importance of the evidence the regulator may draw its own conclusion without TSO assistance or have the assessment of that supporting evidence carried out by another TSO.

Special emphasis is paid to the maintenance of independence (lack of bias) of VTT or an individual employee, when a statement is requested from VTT or an independent review study is ordered concerning a topic for which VTT has previously conducted studies to another customer.

When such a situation is recognised, the new customer is informed in advance on possible conflicts of interest. The alternative ways to ensure independence include that the study will be performed by person(s) that have not been involved in the studies carried out for another customer, and different research methods or a computer code is employed when reasonable. If the assignment involves any material or data besides common knowledge and publicly available documents, the customer has to provide the materials and data.

Usually a Non-Disclosure Agreement (NDA) between partners is signed already in the negotiation phase, since the conclusions may be that in order to avoid conflict of interest VTT has to abstain from carrying out the assignment to the new customer.

In its public calls for tenders the Finnish regulator STUK requires clarification of expertise, experience and independence of the experts carrying out a specific task. In this connection an explicit confirmation is provided by the TSO that the expert has not participated in projects carried out for the parties that are under the regulatory control of STUK concerning the specific plant or plant type.

## **6. Lessons Learned**

The role of national research programmes, in particular the role of the SAFIR programmes in reactor safety, has been crucial in fostering new experts for the Finnish TSOs and providing the future experts the possibility to learn the required skills in a forgiving environment. For a TSO to operate successfully the critical mass of expertise and the devotion of the key

experts is crucial. In a competitive environment where the expertise is scarce and material benefits offered by the industry or by the regulator are more lucrative than those by the TSO, this is challenging for the TSO.

According to the VTT experience using same TSO for a long time is an advantage both for the TSO and for the client, since the key experts become well aware of the issues and need less preparatory time for the next task.

The changes in the operating environment outside VTT and inside VTT created the need to formulate clear rules and practices for avoiding possible conflicts of interest. There is also a need to develop new capabilities and a need for readiness to act in new type of tasks and new environments, which have opened up new needs to consider and handle potential conflicts of interest.

Additional challenges for a TSO supporting both the regulator and industry include prioritising the needs of the various customers, making strategic decisions on participation in future tasks in Finland and abroad and making strategic decisions on acquiring new major research facilities, such as the VTT Centre for Nuclear Safety [1].

## 7. Conclusions

It is possible to for a TSO to support both the regulator and the industry. In a small country this is a necessity, since there are not enough resources to create or maintain separate TSOs for the regulator and the industry. This leads to a risk of conflict of interest. In order to avoid the conflicts of interest and to continue to support both sides the TSO has to have clear principles of operation. The TSO staff must also be aware of these principles and apply them in their daily work. Prompt action inside the TSO and informing the client are essential when a risk for a conflict of interest is detected.

## 8. References

- [1] Research strategy for the nuclear energy, Energy and Climate 16/2014. MEE Publications. Ministry of Employment and the Economy. September 2014. ISBN 978-952-227-848-7.
- [2] Alm-Lytz, K., STUK and YTO General Presentation, Radiation and Nuclear Safety Authority, Finland, 2014.
- [3] National Nuclear Power Plant Safety Research 2015-2018. SAFIR2018 Framework Plan. Energy and the Climate 34/2014. MEE Publications. Ministry of Employment and the Economy. September 2014. ISBN 978-952-227-877-7.
- [4] Report of the Committee for Nuclear Energy Competence in Finland, Energy and Climate 14/2012. Ministry of Employment and the Economy, 2012. ISBN 978-952-227-599-8 and ISBN 978-952-227-600-1.
- [5] Hämäläinen, J. and Suolanen, V., SAFIR2014 Annual Plan 2014, Report VTT-R-03911-14, VTT Technical Research Centre of Finland, 2014.
- [6] Valtonen, K., Support from expert organizations, Presentation at Safety and Regulation of Nuclear Power Plants -Regulatory Project Management And A New Set Of YVL Guides For Design And Construction Of A New Build In Finland –course, Radiation and Nuclear Safety Authority, Finland, October 28-31, 2013.