



## Points of Emphasis in the Supervision of Bavarian Nuclear Power Plants

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### ABSTRACT

In Bavaria, a state of the Federal Republic of Germany, nuclear power is one of the major sources of electricity generation. The Bavarian State Ministry for State Development and Environmental Affairs, as federal authority is responsible for the supervision of these Nuclear Power Plants. Over recent years, the points of emphasis of supervision by the authorities have shifted. New findings in safety technology, increased and enhanced evaluation of operational experience and the growing use of IT (information technology) have resulted in new points of emphasis within the field of supervision. These new developments call for new approaches and procedures both on behalf of authorities and expert organizations, nevertheless, they are indispensable for the continued existence of nuclear power not only in Germany and have already reaped first successes.

### 1 GENERAL

Today I have to start with some contraries between the declared aim of the new German Federal Government and the goals of the Bavarian Government.

I'm sure you heard about the Federal's aim, to shut down all Nuclear Power Plant as soon as possible. On the other hand the Bavarian Government is not only convinced in the economical necessity of using Nuclear Power, it also is convinced, that the operation of Nuclear Power Plants can be done in a safe way. But you need a powerful supervision and so my performance shall show the Points of Emphasis in the Supervision of Bavarian Nuclear Power Plants.

In 1995, the Bavarian Minister President coined the phrase of "Bavaria as a business and industrial location", and stressed the importance of a moderate but nevertheless effective and dependable administrative law as an instrument in environmental policy. For the Bavarian administrative authorities this means, law enforcement based on the actual facts, in accordance with the principle "as much self-responsibility as possible and as much control as necessary".

Nuclear technology plays a special role in this context:

Five power stations with a gross electrical power output totaling approximately 6.400 megawatts produce roughly 70% of the electrical energy required in Bavaria. The proportion of electricity generated in nuclear power stations is thus roughly twice as high as that in the rest of the Federal Republic of Germany's power stations.

The Bavarian State Government is convinced that we will not be able to do without nuclear power for quite a long time. The prerequisite for responsibly advocating this kind of technology, however, is that nuclear power stations are operated with a maximum of safety. Nevertheless, electricity generation must be cost-effective if the business location is not to be endangered. It is accordingly our aim, to optimize the enforcement of the Atomic Energy Law by using a more effective approach and by focusing on what is essential such that the alleged contradiction between the demand for unlimited safety on the one hand and cost-effectiveness on the other is solved.

## 2 LEGAL FRAMEWORK OF SUPERVISION

The Atomic Energy Law in general regulates the peaceful use of nuclear energy and protection from the danger it harbors. This law, in particular, also forms the legal framework for licensing and state supervision of nuclear power stations.

The fulfillment of the Atomic Energy Law is very specific in Germany and, as far as I know, not comparable to any other country:

The Atomic Law is a Federal Law, which has to be fulfilled by the governments of the states, the „Länder“. In the case of Bavaria the Bavarian State Ministry for State Development and Environmental Affairs is the executive power for licensing procedures and supervision.

The function of the Federal Government is confined to monitoring "lawful" and "appropriate" enforcement of Federal Law by the states.

In Bavaria, we strictly work in accordance with valid federal law and order. In areas with a certain leeway as far as organization is concerned, we are guided by the principle to operate as save as possible, in order to ensure effective and appropriate administrative enforcement with respect to the issue of licenses or approvals under the Atomic Energy Law.

## 3 SAFETY-ORIENTED APPROACH AS A NECESSARY MEASURE TO SATISFY LEGAL REQUIREMENTS

Operational experience, results gained from probabilistic safety analyses (PSA) and progress made in the state of the art pertaining to safety technology repeatedly indicate means of improving a plant over and above its originally licensed condition.

We therefore understand plant supervision primarily as design-oriented supervision, which is intended not only to maintain but to systematically increase the safety of our nuclear power plants.

The evaluation of plant safety during both licensing and supervisory procedures, focuses on the concept of safety objectives. Accordingly, the basic technical safety requirements which guarantee a sufficient level of safety in the operation of nuclear power stations are oriented according to the following safety objectives:

- control and limitation of reactivity
- cooling of fuel elements
- containment of radioactive substances
- limitation of radiation exposure

#### 4 INTEGRAL SUPERVISION AS A NECESSARY INSTRUMENT TO SATISFY LEGAL REQUIREMENTS

Plant safety should not be a reflection exclusively of design-oriented codes of practice, but must also be oriented to the state of the art in science and technology. It is the safety objectives underlying these codes of practice which are therefore essential. In this context, it becomes evident, that design-oriented codes of practice basically do not prescribe the manner in which the fundamental safety-oriented objectives are to be achieved.

In principle, plant safety is influenced by the human factor, technology and organization. These three factors, in turn, are interdependent. In the light of this, proof that safety objectives have been achieved must take into account all influencing factors. This can only be realized by an integral approach, which is the only way to ensure that interfaces have also been taken sufficiently into consideration.

#### 5 TOOLS FOR IMPLEMENTING INTEGRAL SURVEILLANCE IN THE BAVARIAN SUPERVISORY PROCEDURE

In the following, I will concentrate on the supervisory procedure in order to give you some concise examples in the time available to me.

The intention underlying integral surveillance is to take into account all factors which may influence a nuclear power station's safety. For this purpose priorities should be set, i.e. the areas which are critical to the safety of a nuclear power station must be monitored more intensively than less important influencing factors.

The most important elements of integral surveillance are:

- information systems
- site inspections
- periodic tests and inspections
- monitoring of emissions and of the surroundings
- checking the expertise of the personnel
- human factor (HF) system
- evaluation of modifications in plant technology and mode of operation
- periodical safety reviews.

These elements are characterized by the fact that they include basically all influences deriving from the three factors man, technology and organization. With this approach, one can be sure that implicit attention is paid to interface problems.

##### 5.1 Information Systems

A systematic approach to data recording and evaluation, which can be used in all plants has been realized in the form of the "Data Recording System for Plant Surveillance and Reliability Analysis" and the "Plant and Safety Monitoring System for Supervision in Line with the Atomic Energy Law". These two systems were set up jointly by Technical Inspection Service (TÜV) of southern Germany and the Bavarian State Ministry for Regional Development and Environmental Protection. All safety-relevant information pertaining to the actual state of a plant, important modifications, results of periodic tests and inspections and results of safety analyses are collected and processed for evaluation. Excluded are informations collected in the HF system, which is subjected to strict confidentiality.

Thus a system is available, which:

- provides access to safety-relevant information pertaining to the respective power station at all times and
- makes it possible to quickly assess the importance of events by linking-up safetyevaluated information.

## 5.2 Site Inspections

Annual site inspections are carried out by the supervisory authority and the expert organization as a general supervisory measure. On this occasion spot checks are performed to see whether the condition and functioning of plant components and systems and the plant's mode of operation comply with the prescribed provisions, and whether in the light of the accepted state of the art in science and technology, there are no objections against continued operation of the overall plant.

These site inspections are provided in the licensing provisions, which oblige the operator to have these inspections carried out.

The site inspections are carried out in the form of partial inspections performed over the year according to a time schedule agreed with the operator.

## 5.3 Periodic Testing And Inspection

The periodic testing and inspection of the overall plant, its systems and components is performed in accordance with a fixed testing and inspection schedule. Periodic testing and inspection is conducted either by the operator alone and/or by involving an independent expert organization. If the operator performs the testing and inspection alone the test records will be inspected on a random basis.

If the tests fail ore show malfunction, the operator has to fix up immediately. All failures are recorded and the supervision authority is informed about the results.

## 5.4 Supervision Of Radioactive Emission And Imission

In accordance to the Radio-Protection Decree the environment around the nuclear power plants is supervised by measurements of the radiation of air, water, soil and vegetation in a fixed plan.

A special Remote-Monitoring-System was installed, so that the supervision authority all over the time gets the most important measurements out of the power plants and form the Environment around the plants. Special point of supervision are the release of radioactive products by the exhaustingsystem, including all important meteriological data's.

This system is installed in the workrooms of the Bavarian State Office of Environmental Protection. This remote system gives automatically alarms, if one of the adjusted limits are reached.

## 5.5 Competence Of Personal

One of the most important tools for supervision are the checking the technical qualification of the staff. The formal licensing examinations for the controllroom staff are carried out in presence and by participating of the supervision authority. There is also a fixed plan for schooling all staff of the power plant. The lessons learned are usually checked by the operator.

These methods for improving and holding the knowledge of the personal is an important basic for the save handling inside the plant.

## 5.6 The Human Factor In Plant Supervision

Bavarian plant operators have introduced a human factor (HF) system in order to optimize the influences on human efficiency. Among other things, this system is used to collect reactor safety relay messages, events which are subject to notification as well as confidential information and to examine them for their optimization potential.

Special attention is paid to the man-technology interface. Over and above the measures implemented by the operator in respect of the man-machine interface any possible shortcomings pertaining to the man-organization interface are also included in the HF discussions at the end of the year (quality assurance in general, maintenance and servicing).

## 5.7 Evaluation Of Modifications

Major alterations to a nuclear power station or the operation thereof necessitate a license based on Sect. 7 of the Atomic Energy Law.

Allow me a remark on the side; in Bavaria, we do not actually differentiate between major modifications, i.e. modifications which are subject to licensing, and other, not legally regulated modifications. In both cases, the depth of testing and inspection is the same: it is only the formal provisions laid down in the Atomic Energy Law and the Procedural Ordinances pertaining to the Atomic Energy Law that are applied exclusively to major modifications. For minor modifications procedural directives formulated by us, which are also laid down in the obligations pertaining to operational licenses and/or in operational manuals, are applied.

In each individual case, any modification within a plant must be accompanied by proof of the proper safety-related technical functioning -- also in interaction with existing elements -- and of the required reliability of the components. The modification procedure thus allows constant adaptation of the technology used to further developments in the state of the art.

Over and above the individual modifications, the tests and inspections performed in this context provide a detailed picture of the technical state of the overall plant.

## 5.8 Periodical Safety Tests And Inspections

The periodical safety inspections (PSI) which are designed to be carried out with a view to safety objectives, represent an important instrument for the integral evaluation of plant safety. The PSI focuses on demonstration in how far a plant corresponds to the state of the art in safety technology.

This approach, being oriented to safety objectives, on the one hand allows deviations from the rigid provisions of the code of practice. On the other hand, however, it also makes high demands on the qualification of the persons involved in the procedure. Competence and decision-making power are in demand since -- as has been shown by experience -- all tolerated deviations from the code of practice must always be justified in detail and answered for in controversial discussions. The balanced inclusion of deterministic (test-) results and probabilistic safety analyses is of special importance in this context.

In Bavaria a PSI has either been completed or is underway in all nuclear power station blocks.

## 5.9 Results Of Integral Surveillance

With the integral approach, all knowledge, plant data and operational experience available in a plant is interlinked and made accessible to all employees via the information system. Efficient evaluation procedures provide valuable decision-making aids as far as operational

management and plant and process optimization are concerned. In this way, the loss of knowledge which may occur due to fluctuations in the operating staff is reduced to a minimum as also is the cost of training measures to bring staff up to date with technological modifications and of initial training for new employees.

As far as periodic tests and inspections are concerned, an approach which makes it possible to shift tests and inspections into the phase of power operation and/or to prolong the intervals between testing and inspection without reducing the power plant's safety has been developed in cooperation with plant operators. For this purpose, suitable measures such as consistent evaluation of operational information and application of progressive testing technology are being developed.

In order to distribute individual measures over the course of time, we support endeavors by operators to perform preventive maintenance during power operation.

#### 5.10 Safety Status Of Bavarian Nuclear Power Stations

PSI's have proved that the safety of Bavarian plants corresponds to the state of the art in safety technology in respect of their sound design, the modifications performed during the period of operation and the plant management. The integral approach taken in PSI, also revealed, however that certain plant optimization measures can still be taken with respect to safety technology. On the one hand, this means additional costs e.g. for retrofitting measures. On the other hand, however, the scope of certain elements of the surveillance scheme can also be reduced without impairing plant safety.

All in all the status and results of the PSI performed in Bavaria show that the operators of nuclear power stations are willing not only to maintain but even to increase their plants' safety far beyond legal requirements. This is due, last but not least to the general conditions laid down by the Bavarian authorities, which focus on the satisfaction of safety objectives and on further increasing safety, and do not insist on point-by-point fulfillment of design-oriented codes of practice.

## 6 SUMMARY

Economic demands made on operators of nuclear power stations have become more and more pressing. Although the safety of their plants is doubtless most important to the operators of nuclear power stations, they are nevertheless forced to further optimize their plant's operation.

In practice, the operation of Bavarian power stations has shown that the surveillance scheme implemented by us ensures the nuclear power stations' safety while opening up optimization possibilities. We are convinced that the adopted course must be adhered to. In the end it will lead to a further increase in the safety of nuclear power stations without jeopardizing their profitability.

So, focusing back to my beginning, I accent again, the Bavarian Authority is convinced, that Nuclear Power Plants can be operated under optimized safety. So we can't see any safety-reasons for the shutdown of the Bavarian Power Plants, especially as these plants consists a quite new construction and are held at the top of the technique.