

Translation

In the case of any differences in interpretation of this guide the Finnish version shall take precedence over this translation.

SURVEILLANCE OF NUCLEAR FUEL PERFORMANCE

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1

GENERAL

To become sufficiently assured of the safety of the nuclear fuel performance, it is necessary that

- for the evaluation of the fuel design, specifications, manufacture, quality control and safety as well as for the evaluation of safe fuel operation and safety margins a sufficient knowledge based on own observation and observations attainable from elsewhere is available,
- safety related phenomena of fuel behaviour are observed,
- a sufficient knowledge based on own observations and experiences is acquired for evaluating how fuel behaviour phenomena observed elsewhere may be exploited.

In the guide YVL 6.1 "Licensing of nuclear fuel and other nuclear materials" (1978-04-23) it is supposed that the power company will compile a programme for the surveillance of the fuel operation conditions and for the spent fuel examinations. The requirements concerning the programme are presented in this guide. The objective is to attain and maintain the knowledge presented above.

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FUEL PERFORMANCE SURVEILLANCE PROGRAMME

In the fuel performance surveillance programme the activities of the power company for

- the surveillance of the fuel operating conditions,
- the spent fuel examinations and
- the procuring of reference information

are presented.

The programme is to be delivered to the Institute of Radiation Protection (IRP) for approval at least one year prior to the start of commissioning of each nuclear power plant unit. Changes and supplements of the programme shall also be approved by the IRP. The programme may also be divided into separate parts. In the following, requirements, which shall be taken into account, are presented.

2.1

Fuel operating conditions

The operating conditions of the fuel, reactor core and the coolant shall be known. The reactor and fuel power, power changes, power distribution, safety margins (e.g. heat flux, margin to heat transfer crisis), and burn-up as well as the activity of the coolant and the chemical condition of the water shall be observed. The requirements imposed on the specified variables as well as power changes and the methods to be used are presented in the programme.

Activities in case of fuel failures shall be planned in advance. Plans and methods to be used for the evaluation of the number and magnitude of the fuel failures are presented.

The reporting and inspecting activities of the power company concerning the operating conditions are to be given. The power company shall especially compile a monthly summary report concerning the fuel performance and the operating conditions.

2.2

Post irradiation examination of spent fuel

Systematic visual inspections of the fuel channels, bundles and rods shall be carried out at each unit during fuel reloadings and, if needed, also during other shutdowns. The requirements (criteria, scope, methods, instructions etc.) concerning the visual inspections are presented in the programme. On the basis of the observations more exact examinations at the plant site or in a hot cell shall be undertaken, when needed (e.g. an unexpected change in the structure of a fuel bundle). The causes of fuel damages (leaks, mechanical faults etc.) shall be attempted to solve.

A possibility to carry out leak-tests of fuel bundles shall be available at each plant unit. The leak-tests shall be carried out during fuel reloadings and when needed also during other shutdowns, if observations during the operation indicate leaking fuel bundles to be in the reactor. Leaking fuel bundles shall be prepared or removed from the reactor. The requirements concerning the leak-tests are presented in the programme.

The requirements concerning dimensional control of the fuel channels, bundles and rods as well as other nondestructive or destructive fuel examinations are presented in the programme. To the extent the power company intends to use information to be obtained from the fuel manufacturer the fuel surveillance programme of the manufacturer is included in the power company programme. However, dimensional control, other nondestructive and, if needed, destructive examinations shall be carried out

also for fuel used in the Finnish power station. Likewise, well characterized fuel rods shall be irradiated and post irradiation examinations shall be carried out on these fuel rods in order to investigate separate fuel behaviour phenomena (e.g. fission gas release, swelling, densification, dimensional changes, interactions and temperature distributions).

In defining the scope of the fuel examinations to be carried out, information obtained from the same type of fuel used in similar conditions, changes made in the fuel design parameters and manufacture, and observations in other examinations are taken into account.

2.3

Reference information

This part of the programme contains the activities of the power company to obtain information on the fuel from organizations using the same design during comparable conditions.

3

REPORTING TO THE INSTITUTE OF RADIATION PROTECTION

A summary report on the fuel performance and operating conditions, fuel examinations carried out and unexpected phenomena observed is included in the annual report to be delivered to the IRP. The report includes especially a survey of fuel damages and failures.

A special report in accordance with guide YVL 1.5 on unexpected phenomena observed in the fuel behaviour and on deviations from the requirements imposed on the operating conditions is to be delivered to the IRP.

The IRP is to be notified in advance about fuel examinations to be carried out. Examination reports with results and evaluations are to be delivered to the IRP for approval within two months from each completed examination.

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LITERATURE

1. STL - B; 24
Surveillance of fuel operation conditions and examinations of spent nuclear fuel, Helsinki, the Institute of Radiation Protection, 1979
2. U.S. Nuclear Regulatory Commission, Standards Review Plan, Section 4.2, Nureg -75/097.
3. Onsite Nondestructive Techniques for Irradiated Water Reactor Fuel, Draft 1, March 1978, IAEA.