

Expert approaches for evaluation of accident consequences, their classification and categorization. (Abstract).

V Vasekin (ENTEK, Russia), N Istomina (SEC NRS of Gosatomnadzor of Russia)

1. Expert approaches for evaluation of accident consequences are based on comparison between values of safety operation limits, project limits and calculation values of these parameters for each accident /1/.
2. There is uncertainty of determination and proof of operation limits, safety operation limits and design limits as well as uncertainty of calculation values.

Uncertainties of calculations arise from:

- approximate nature of conservation equations;
- numerical solution scheme;
- code model deficiencies or inadequacies;
- imperfect knowledge of boundary or initial conditions;
- uncertainties of input data;
- nodalization effects;
- code user effect.

3. It is necessary to take into account these uncertainties during evaluation of results of deterministic accident analysis. And it is necessary to use methods of evaluation of sensitivity of calculation results to uncertainties of input data and nodalization.

4. Outline of uncertainty methods developed in Europe /2, 3/:

- The AEAT Method |
- The UMAE Method
- The ENUSA Method
- GRS and IPSN Methods

5. Levels of deterministic safety analysis:

- Violation of the safety operation limits. This is determined under results of DSA by comparison between these results with the limits. If there are evaluations of uncertainties then we can do conclusions about conservatism of analysis, its quality and an error interval of calculating values.
- The measure of violation of integrity and working-capacity of safety barriers is determined by the value of exceeding of the determined limits and the term during which the violation takes place.
- Value of outlet of radioactive fission product in environment over admissible values is determined by the measure of violation of integrity and working-capacity of safety barriers. There are Russian computer codes for calculations of

fission product transport and confinement:

6. Russian Regulations determine following limits /1, 4/:

7. Conservatism result investigations of deterministic analysis are carried out on the base of evaluation of:

- uncertainty of calculations and substantiation of operation limits, safety operation limits and design limits;
- uncertainty of calculation values of current parameters for which there are these limits;
- sensitivity of calculation values to uncertainty of the input data, the nodalization, the choice of code options.

8. Existing approaches for classification of accident consequences.

- Types of radiation accidents
- Consequences classification of radiation accidents.

8.1 The Lines of Defence approach /5/.

8.2 Probabilistic Safety Analysis approach /6/.

8.3 There is an approach, which is based on evaluation of degree of safety barriers (fuel element (FE), fuel channel (FC), coolant circuit (CC), and localization systems (LS) including the reactor area (RA)) damage. This approach was stated on paper in a SEC NRS' report "Determination of accident gravity levels and safety critical functions. Development of guidance for control of beyond design accidents for Leningrad NPP units 1 and 2."/7/

9. The approach, which is offered in this report /8/, had to take into account:

- degree of violation of the safety operation limits;
- degree of violation of capacity for work and integrity of safety barriers;
- potential-possible outlet of radioactive fission products under violation of capacity for work or/and integrity of safety barriers.

Each of these classification intervals can be worked out in detail. The approach to the detailed elaboration of the accident consequences can be based on an evaluation of the value of potential-possible radioactive emission for every initial events, which concern to the above mentioned categories subject to the degree of violation of safety barriers integrity and the value of radioactive emission.

Literature

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