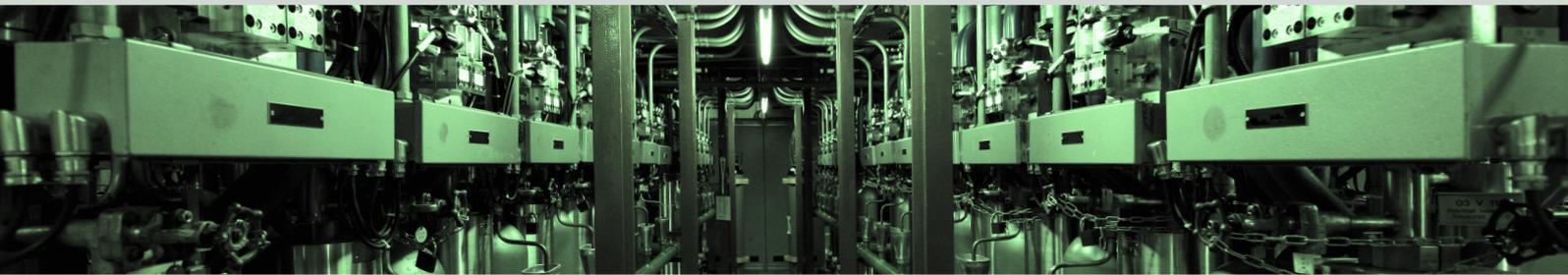




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Eidgenössisches Nuklearsicherheitsinspektorat ENSI
Inspection fédérale de la sécurité nucléaire IFSN
Ispettorato federale della sicurezza nucleare IFSN
Swiss Federal Nuclear Safety Inspectorate ENSI



ENSI's Research Strategy



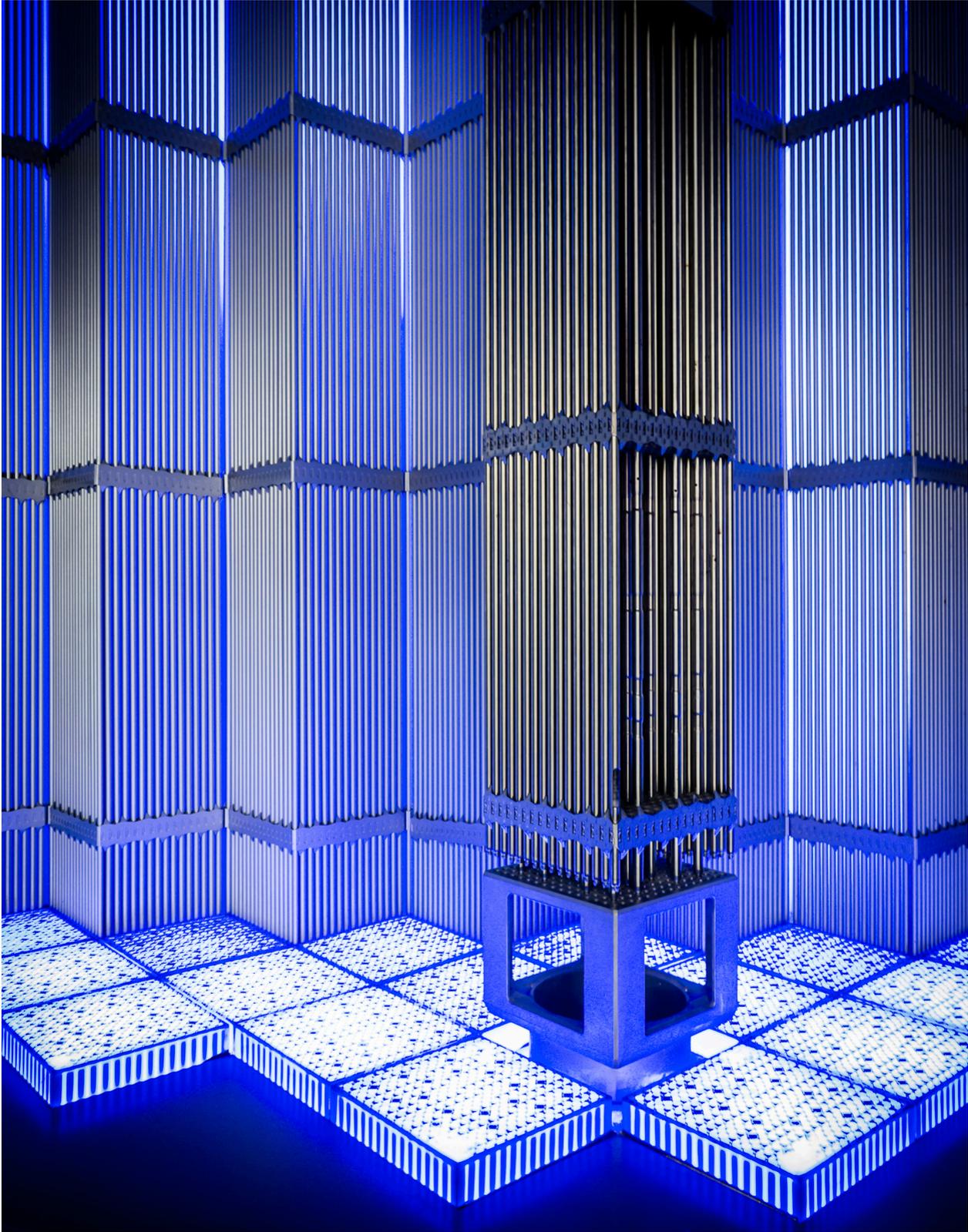
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June 2013

ENSI's Research Strategy



1 Basics of research and how it is financed

When nuclear energy is utilised, people and the environment must be protected against hazards due to ionising radiation¹. For preventive purposes, it is necessary to implement all the precautions that are required on the basis of experience and in keeping with the latest scientific and technological developments². According to international guidelines, the respective national authorities should implement measures to build up and maintain the expertise of all involved parties who are responsible for the safety of nuclear plants. Research and development are among the most important means of achieving these objectives³.

In Switzerland, the Federal government can promote applied research into the peaceful use of nuclear energy, especially as regards the safety of nuclear plants and nuclear waste management. In this field, it may support the training of specialists or may carry out such training itself⁴, and it can also participate in international projects on the peaceful use of nuclear energy⁵. In addition, the Federal government promotes scientific research into the effects of radiation and radiation protection, together with training in the field of radiation protection⁶. As far as civil protection is concerned, the government also cooperates with the Cantons on research and development, and it supports collaboration at national and international levels⁷.

Under the terms of the credits that are granted, the supervisory authorities are obliged to promote research, teaching and training related to the safety and security of nuclear plants, and in respect of nuclear waste management⁸. These activities should involve applied – rather than basic – research⁹. The supervisory authorities may also commission or take part in research projects focusing on the effects of radiation and radiation protection¹⁰.

The Swiss Federal Nuclear Safety Inspectorate (ENSI) is the Federal government's supervisory authority for nuclear plants. It performs the tasks assigned to it in accordance with the legislation on nuclear energy, radiation protection, civil protection / protection and support, and the regulations on the transportation of dangerous goods¹¹. In order to carry out its supervisory activities in a professional manner, ENSI must keep abreast of the latest developments in science and technology. For this purpose, ENSI

¹ as per Art. 4, paragraph 1 of the Federal Nuclear Energy Act (NEA/KEG).

² as per Art. 4, paragraph 3, letter a, NEA.

³ as per the IAEA General Safety Requirements, Part 1: Governmental, Legal and Regulatory Framework for Safety; cf. in particular Requirements 1, 10 and 11.

⁴ as per Art. 86, NEA.

⁵ as per Art. 87, NEA.

⁶ as per Art. 5, paragraph 1 of the Federal Law on Radiological Protection (LRaP/StSG).

⁷ as per Art. 8 of the Federal Law on Civil Protection and Protection and Support (BZG).

⁸ as per Art. 77 of the Nuclear Energy Ordinance (NEO/KEV) and the Explanatory Report on the NEO (Art. 76).

⁹ as per Art. 86, paragraph 1, NEA and Section 8.8.4 of the Dispatch regarding the NEA.

¹⁰ as per Art. 8 of the Radiological Protection Ordinance (RPO/StSV).

¹¹ as per Art. 2, paragraph 1 of the Swiss Federal Nuclear Safety Inspectorate Act (ENSI Act, ENSIG).

may undertake research itself, and it may also support nuclear safety research projects¹². In addition, the results of research provide the basis for its decisions¹³.

The research projects undertaken or supported by ENSI fall primarily within the category of applied research. These projects may also include development work which draws on available knowledge (such as experimental results) but which delivers essentially new findings, as opposed to the mere routine application of knowledge already acquired for the purpose of services (consultations, expert reports, routine measurements, training, etc.)¹⁴. Basic research devoid of aspects that can be utilised for supervisory activities does not fall within the category of regulatory safety research.

Research and development work can be billed only if it falls within the scope of ENSI's remit, i.e. it must relate to safety and security issues¹⁵. ENSI collects fees from the owners of nuclear plants, nuclear goods and radioactive waste for research and development work undertaken or arranged for individual nuclear plants in the course of its supervisory activities¹⁶. The Federal government also pays a contribution which is used to finance additional applied safety research¹⁷. Moreover, in order to cover the costs of supervisory activities that cannot be allocated to specific nuclear plants, ENSI collects an annual supervisory levy from the proprietors of nuclear plants¹⁸; this can also be used to pay the costs of research and development work undertaken at ENSI's behest.

ENSI endeavours to ensure that the Federal government finances an appropriate proportion of regulatory safety research.

2 Objectives

ENSI undertakes and supports projects under the auspices of its "Regulatory Safety Research" programme. In so doing, ENSI pursues the following objectives in particular:

1. **Investigation of open issues:** Questions regarding the safety of nuclear plants that are as yet unresolved arise not only from ongoing supervisory activities, but also in the course of the general development of science and technology. Research projects should make it possible to identify potential problem areas, to develop potential improvements, to reduce uncertainties and to improve processes. In these ways, such projects should play their part in maintaining and enhancing the safety of Switzerland's nuclear plants. In order to identify these issues, ENSI takes account – first and foremost – of

¹² as per Art. 2, paragraph 3 of the ENSI Act (ENSIG) and the Dispatch regarding the ENSIG.

¹³ as per the ENSI Management Manual, "Basics of Supervision" process (HPB0140).

¹⁴ on the basis of the Policy Paper on Research and Development at Universities of Applied Sciences, Rectors' Conference of the Swiss Universities of Applied Sciences (KFH) (2008).

¹⁵ as per Section 8.8.1 of the Dispatch regarding the NEA.

¹⁶ as per Art. 83, paragraph 1, NEA.

¹⁷ on the basis of Art. 86, paragraph 1, NEA; the funds are transferred to ENSI by the Swiss Federal Office of Energy (SFOE).

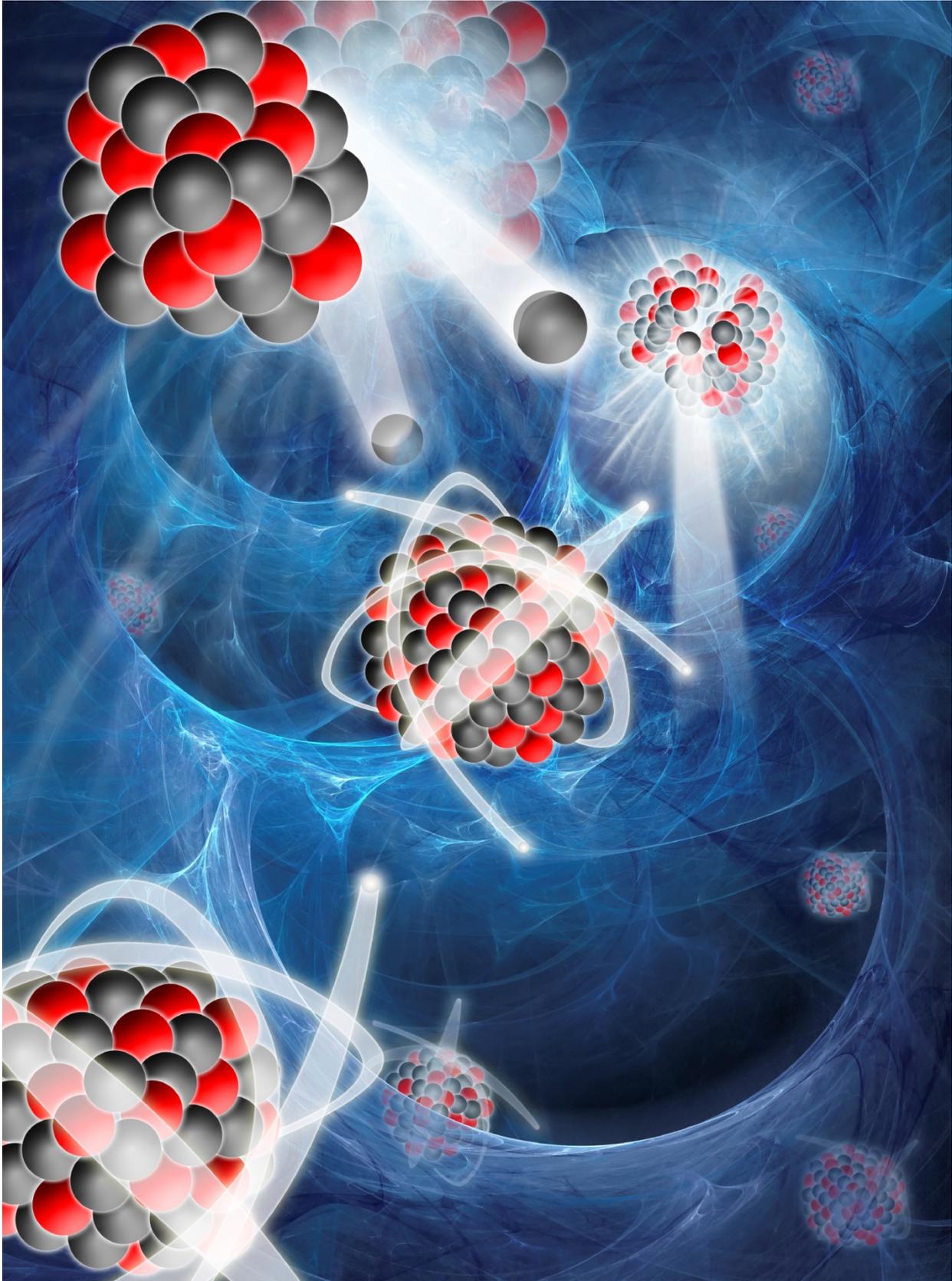
¹⁸ as per Art. 83, paragraph 2, NEA.

developments in international bodies, the results of ongoing research projects and specialists' conferences; it also considers recommendations from other Federal institutions, especially those from the Federal Nuclear Safety Commission (NSC/KNS)¹⁹. In addition, ENSI takes part in research projects of the Federal Working Group on Nuclear Waste Disposal (AGNEB). Specifically, moreover, it aims to close gaps in knowledge which are not covered by the research programmes of the supervised entities.

2. **Practical support for supervisory activities:** Research projects should deliver or continue to develop basic principles and aids which ENSI requires in order to carry out its tasks, e.g. for the purpose of drawing up ENSI guidelines and arriving at specific decisions. Examples of such aids include simulation programmes for safety analyses and investigative methods for inspections.
3. **Maintaining and expanding expertise:** Research projects should help to maintain and expand ENSI's expertise and (as a secondary aim) that of ENSI's own specialists. Research projects carried out in Switzerland are advantageous for this purpose, especially if they include training.
4. **Promotion of independent expertise:** Research projects, especially those which entail practical support for supervisory activities, can (to some extent) create the basis for expert reporting and for the operational monitoring of nuclear plants. In specialised areas where ENSI calls on external experts, research projects should help to develop independent expertise that will prevent potential conflicts of interest²⁰. For this purpose, and in order to encourage diversity, ENSI aims to base its research on different institutions.
5. **Promotion of international interchange:** A substantial proportion of international interchange at specialist level takes place in committees and similar bodies which control research and assess its results. This applies in particular to the bodies of the Nuclear Energy Agency (NEA) within the Organisation for Economic Co-operation and Development (OECD). Moreover, many research projects can only achieve helpful results with the help of contributions from multiple countries. Regulatory safety research should foster the international integration of ENSI into specialist networks.
6. **Enhancing ENSI's attractiveness:** Providing follow-through for research projects involves varied activities aimed at acquiring new knowledge; this work should make ENSI more attractive to new employees, especially younger and highly qualified individuals.

¹⁹ as per Art. 2 of the Ordinance regarding the Federal Nuclear Safety Commission (NSCO/VKNS).

²⁰ cf. also the IAEA General Safety Guide GSG-4 (2013): Use of External Experts by the Regulatory Body.



3 Criteria

In accordance with its legal basis and overall objectives, ENSI assesses support for proposed research projects according to the following specific criteria:

1. **Technical and qualitative aspects**, in particular:
 - a. Specialist / scientific requirement for the project in order to improve the safety of Swiss nuclear plants on the basis of the existing level of knowledge; also, avoidance of undesirable overlaps with ongoing or completed projects.
 - b. Expected quality of the work on the basis of the application, publications and other proven achievements, also (where appropriate) on the basis of ENSI's past experience with the applicants. This includes technical aspects as well as formal criteria such as compliance with deadlines and reporting.

2. **Relevance to supervisory activities**: Utilisation of the project results for specific supervisory work by ENSI which is scheduled in the foreseeable future or is already in progress. Examples include contributions towards drawing up guidelines and specific decisions by ENSI, as well as the development or improvement of aids (such as simulation programmes or investigative methods) that are used by ENSI. This point is especially important for assigning priorities to projects.

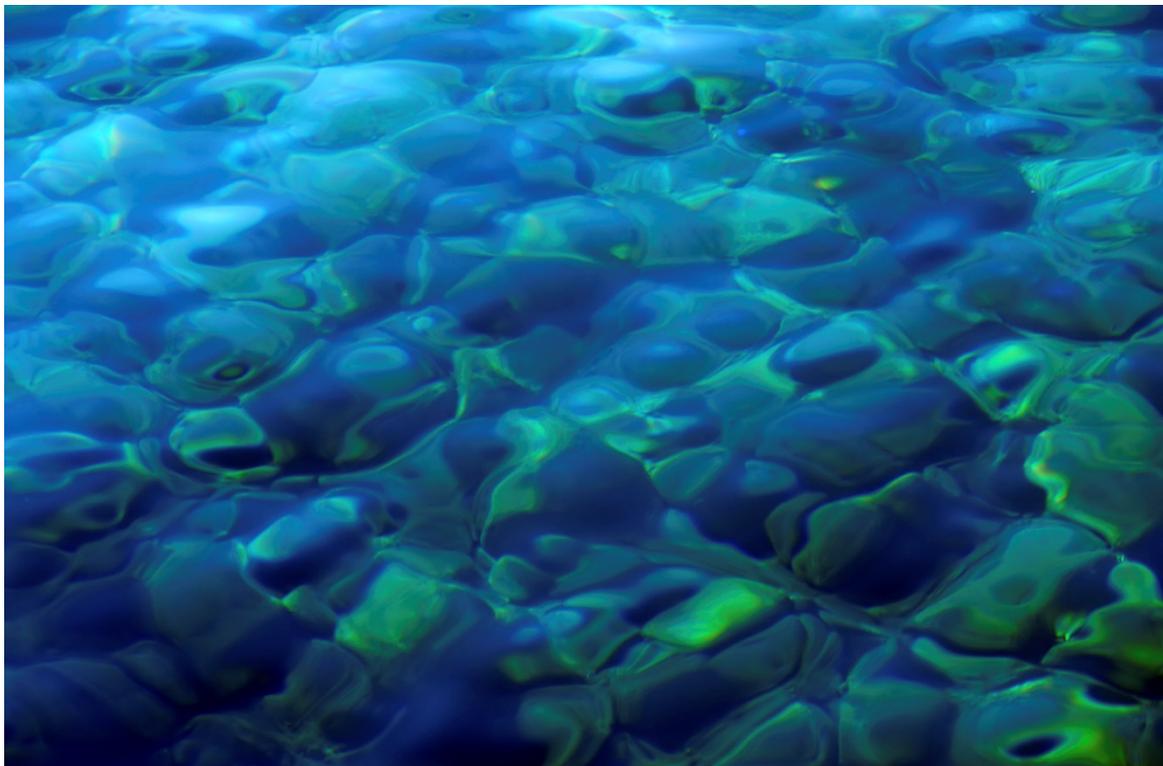
3. **Maintaining and expanding expertise**: Specific training/educational measures (especially the completion of degree or masters' dissertations and doctoral theses) constitute a key criterion for prioritising research projects. If projects are equivalent in other respects, ENSI gives preference to those which entail training or education in Switzerland.

4. **Impact on future recruitment of experts**: Project applications are reviewed to determine whether ENSI could commission the applicants to draw up expert reports on nuclear plants in the future. Experts must meet the following specific criteria²¹:
 - a. They must not work in an area of an organisation which is subject to supervision by ENSI.
 - b. The assignment must not relate to any parts or systems of a nuclear plant, or to related evidence of safety (in whole or in part) which the expert planned or constructed, or on which he/she reported, on behalf of the supervised party.

For these reasons, ENSI gives preference to research projects by institutions whose employees are unlikely to be involved in conflicts of interest in the relevant specialist area if they undertake potential expert work for ENSI at a later stage.

²¹ as per the ENSI Management Manual, "Procurement" process (HPB0460).

5. **Promotion of ENSI's integration into international networks:** This aspect relates in particular to projects with participation by organisations from various countries, which can therefore deliver results that could not be obtained in Switzerland alone. Examples include comparative calculations by various groups of research institutions or supervisory authorities (known as benchmarks) and the systematic identification and analysis of infrequent types of damage and events in nuclear plants.
6. **Demarcation from remit of supervised parties:** Research supported by ENSI must not comprise substantial parts of the supervised parties' own duties. Within international projects which also involve representatives of operators or manufacturers of nuclear plants, ENSI advocates the priority of safety aspects and/or support for supervisory activities.
7. **Risk analysis:** In case of foreseeable problems, especially if difficulties have already arisen in connection with comparable projects in the past, the applicants must carry out a risk analysis. Examples include difficulties with the international transport of radioactive samples, or problems with staff recruitment. Applicants must clearly show how they will avoid (or, if necessary, resolve) problems of this sort.



4 Control of research

Control of the "Regulatory safety research" programme is based on the ENSI Management Manual (MHB). According to the strategy followed by ENSI, every research project which is not managed by ENSI itself is followed through by (at least) one individual from the relevant specialist area at ENSI. The project supporter monitors the project and ensures that the knowledge gained from it is incorporated into ENSI's ongoing supervisory activities. Follow-through for research projects, as a measure to maintain and expand expertise, is a key function for specialists.

A central unit (Research Coordination) takes charge of tasks at the overall level and handles the external representation of regulatory safety research. More specifically, this unit is the first internal and external point of contact for project applications, and it manages research results centrally as part of ENSI's knowledge management system. Management decides on project applications when requested to do so by Research Coordination. In particular, management is responsible for prioritising the applications.

ENSI assesses Nagra's research programme when it comments on the waste management programme that is drawn up at regular intervals. ENSI monitors the content of research programmes undertaken by all supervised parties.

ENSI briefs the public on regulatory safety research at regular intervals. The main element of this information is the Research and Experience Report, published each year; Research Coordination is responsible for compiling this document, which has proven its merits and has also gained international recognition. This is attested by the "Good Practice" rating given to the Report in the course of the Review Mission by the IAEA Integrated Regulatory Review Service (IRRS) in 2011²².

²² Good Practice GP4 in: Integrated Regulatory Review Service (IRRS) Report to Switzerland. Brugg, 20 November to 2 December 2011.



5 Thematic orientation

ENSI's Research Coordination department continuously reviews potential subjects for research in liaison with the specialist departments. On the basis of the research strategy, management adopts a research plan which describes the key research projects for the next four years, with the aim of ensuring that planning is reliable.

In the coming years, ENSI's (new) research activities are likely to focus on the following subject areas:

1. Long-term operation of nuclear power plants, especially material ageing issues.
2. Extreme natural events, including earthquakes and floods in particular.
3. Decommissioning of reactors, including waste treatment (technical and organisational aspects).
4. Waste management issues related to the construction of deep geological repositories.

In addition, regulatory safety research is likely to focus on the following aspects:

- Integrity of fuel cladding tubes
- Injection of precious metals into the cooling circuit
- Internal damage and events
- Aircraft crashes impacting nuclear power plants
- Human reliability and the design of man-machine interfaces
- System behaviour, incidents and severe accidents
- Applied radiation protection topics

ENSI does not support any research on the new generation III reactors or on the potential generation IV reactors of the future, because these subjects are not relevant to ENSI's specific supervisory activities.

Brugg, 28th of June 2013

SWISS FEDERAL NUCLEAR SAFETY INSPECTORATE

sig.

Dr. A. Eckhardt
Chair of the ENSI Board

sig.

Dr. Hans Wanner
Director General ENSI

ENSI-AN-8398

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