

IAEA/NSNI/IRRT/99/01

January 1999

ORIGINAL: English



INTERNATIONAL ATOMIC ENERGY AGENCY

REPORT OF THE

**INTERNATIONAL
REGULATORY
REVIEW TEAM (IRRT)**

TO

Switzerland

30 November - 11 December 1998

DIVISION OF NUCLEAR INSTALLATION SAFETY

FOREWORD

by the
Director General

The IAEA International Regulatory Review Team (IRRT) programme assists Member States to enhance the organization and performance of their nuclear safety regulatory body. Such a regulatory body must work within the framework of its national legal system which in turn should ensure both the independence and the legal powers available to the regulatory body. Additionally the national administrative and legislative system should ensure that the regulatory body has sufficient funding and resources to carry out its functions of reviewing and assessing safety submissions; licensing or authorizing nuclear safety activities, establishing regulations and criteria; inspecting nuclear facilities and enforcing national legislation. The regulatory body should be resourced and staffed by capable and experienced staff to a level commensurate with the national nuclear programme. IRRT missions focus on all these aspects in assessing the regulatory body's safety effectiveness. Comparisons with successful practices in other countries are made and ideas for improving safety are exchanged at the working level.

An IRRT mission is made only at the request of a Member State. It is not an inspection to determine compliance with national legislation, rather an objective review of nuclear regulatory practices with respect to international guidelines. The evaluation can complement national efforts by providing an independent, international assessment of work processes that may identify areas for improvement. Through the IRRT programme, the IAEA facilitates the exchange of knowledge and experience between international experts and regulatory body personnel. Such advice and assistance will enhance nuclear safety in all nuclear countries. An IRRT mission is also a good training ground for observers from newly formed regulatory bodies in developing countries who follow the evaluation process. This approach, based on voluntary co-operation, contributes to the attainment of international standards of excellence in nuclear safety at the regulatory body level.

Essential features of the work of the IRRT experts and their regulatory body counterparts are the comparisons of regulatory practices with international guidelines and best practices, and a joint search for areas where practices can be enhanced. The implementation of any recommendations or suggestions, after consideration by the regulatory body, is entirely voluntary.

The number of recommendations, suggestions and good practices is in no way a measure of the status of the regulatory body. Comparisons of such numbers between IRRT reports from different countries should not be attempted.

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SUMMARY

At the request of the Swiss Government authorities, an IAEA team of eleven experts visited the Swiss Federal Nuclear Safety Inspectorate (HSK) to conduct an International Regulatory Review Team (IRRT) mission. The purpose of the mission was to review the effectiveness of the regulatory body of Switzerland and to exchange information and experience in the regulation of nuclear, radiation, radioactive waste and transport safety.

HSK has been allocated all the responsibilities normally associated with a regulatory body except the final part of the licensing process. In the opinion of the team, HSK has the technical capability to deal with the regulatory and technical areas for which it is responsible. It is an established organization whose staff are highly motivated and competent in their specialist fields. HSK has already started projects aimed at improving its effectiveness through adoption of more formal approaches to their own work and for interactions with the licensees. The team agrees that this is an important development and the preliminary indications are that it will lead to an improvement in the effectiveness and efficiency of the regulatory system.

The reviewers identified a number of good practices which have been recorded for the benefit of other nuclear regulatory bodies. They also made recommendations and suggestions which indicate where improvements are necessary or desirable to further strengthen the regulatory body in Switzerland.

The team believes that the following items should be priorities because they were identified in several of the review areas or because the reviewers consider that they will have the most significant impact on nuclear, radiation, radioactive waste and transport safety:

- the strengthening of the licensing power of the regulatory body and the planned improvements to the legal basis for clarification of the independence of the regulatory body;
- the introduction of a systematic and comprehensive approach to inspection of operational safety aimed at developing inspection competences and identifying and resolving operational safety issues;
- the development of an enforcement policy;
- the development of a waste classification system; and
- the fulfillment of all responsibilities concerning transportation of radioactive material including those not associated with nuclear power plants.

In addressing these and other detailed recommendations and suggestions in this report HSK should continue to develop more formal ways of working. During the coming years HSK will need to pay particular attention to human resource planning.

HSK staff put a considerable effort into the preparation of the mission. During the review the team was extended full cooperation during technical discussions with HSK personnel and the organization and administrative support was excellent. HSK counterparts were enthusiastic and interested in obtaining international advice on the way they conduct their work and on their plans for further development. In addition, team members appreciated the opportunity to identify lessons for their own organizations from HSK practices.

INTRODUCTION

At the request of the Swiss Government authorities, an IAEA team of eleven experts visited the Swiss Federal Nuclear Safety Inspectorate (HSK) to conduct an International Regulatory Review Team (IRRT) mission. The purpose of the mission was to review the effectiveness of the regulatory body of Switzerland and to exchange information and experience in the regulation of nuclear, radiation, radioactive waste and transport safety in the following specific predetermined areas: legislative and governmental responsibilities; authority, responsibilities and functions of the regulatory body; organization of the regulatory body; authorization process; review and assessment; inspection and enforcement; development of regulations and guides; emergency preparedness; radioactive waste management and decommissioning; radiation protection; and transport safety.

The review was conducted from 30 November to 11 December 1998 by an IAEA team of eleven experts. Before taking part in the mission the experts reviewed the Advanced Reference Material provided by HSK. During the mission, a systematic review of the predetermined areas was completed using interviews with staff and direct observation of working practices. HSK made available to the team a large number of legal, regulatory and internal documents in English and these are listed in Annex I.

Most of the IRRT activities took place at the HSK offices in Würenlingen. During the mission six members of the team visited the nuclear power plants at Beznau, Gösgen, Leibstadt, and Mühleberg to observe inspection practices or to interview utility management. There were also visits to the Federal Office of Energy in Bern; the interim radioactive waste storage facility "ZWILAG"; the DIORIT and SAPHIR facilities which are undergoing decommissioning at the Paul Scherrer Institute; the national emergency centre "AZ" in Zurich; the HSK emergency centre "Genora"; and the emergency operation centre at the nuclear power plant at Beznau. Two members of the team observed a meeting of sub-committee 6 of the Nuclear Safety Commission (KSA).

In carrying out the review the team recognized that there are a number of initiatives being taken by HSK which are aimed at improving regulatory effectiveness. The team was also aware that there are two particular developments which will have an impact on the regulation of nuclear, radiation, radioactive waste and transport safety in the future: the implementation of new legislation and the intention to incorporate HSK into a new agency (NASA).

1. LEGISLATIVE AND GOVERNMENTAL RESPONSIBILITIES

Experts: J. Scherrer and L. Reiman

1.1. PRINCIPAL LAWS OR OTHER LEGAL PROVISIONS

1.1.1. Federal Law on the peaceful use of Nuclear Energy (Atomic Energy Act) of 23 December 1959

This Law establishes the legal regime for „installations for the generation of nuclear energy or for the manufacturing, processing, storage or safe disposal of radioactive nuclear fuels and residues“.

„Nuclear energy shall be understood as all forms of energy that is set free during nuclear transformation processes“. So, all types of research reactors, even with very low power are concerned.

Installations, like accelerators, hot laboratories, sources or other facilities or activities are not regulated by this Law but by the Federal Law on Radioprotection (see 1.1.8.).

Article 4 of the Law stipulates:

„IA licence from the Federal Government is required for the following:

„a. the construction and operation as well as each modification of the purpose, kind and scope of a nuclear installation;

„b. transport, submission and purchase and every other form of possession of nuclear fuels and radioactive residues;“

Article 6 stipulates:

„Applications for licences shall be decided upon by the Federal Council or by the authority designated by it“.

Article 8 stipulates:

„¹The nuclear installations and every form of ownership of radioactive nuclear fuels and residues shall be placed under federal supervision.

„²The Federal Council and the authorities designated by it shall have the right in executing their supervisory function to order instructions at any time that become necessary for the protection of man, third-party properties and of important rights, for the preservation of the external security of Switzerland and the compliance with the obligations she has entered into under international commitments; they are also entitled to supervise the compliance with these instructions.

Article 37 (Para. 1) stipulates:

„The Federal Council shall decree the requisite execution provisions and shall set up the administrative bodies necessary for the execution“ and

Article 38:

„The Federal Council shall appoint commissions to study issues of nuclear energy“.

1.1.2. Ordinance concerning the definitions and authorizations in the atomic field (Atomic Ordinance) of 18 January 1984

This ordinance designates the authority in charge of the authorization process in its Article 6:

„Construction, operation and modification of atomic installations

„The Federal Council grants the construction authorization and the operation authorization of atomic installations as well as the authorization of modifying the purpose, kind and scope of them.

„The application for authorization shall be presented to the Federal Office of Energy.“

Article 9 designates the Federal Office of Energy as the body granting authorizations for the transport, delivery and reception of nuclear fuels and residues.

Article 10 stipulates:

„Supervision

„The Supervisory authorities can order instructions pursuant to article 8, Para. 2, of the Law, under the condition they do not induce modifications to the licences granted pursuant to article 4, Para. 1, letter a, of the Law“

Article 15 designates the Federal Office of Energy as the body granting authorizations for import, export, transit and the activity of third-party in the field of nuclear fuels and residues.

1.1.3. Federal Decree with respect to the Atomic Energy Law of 6 October 1978

In addition to the previously required authorizations, this decree (article 1) requires a general licence of the Federal Council for all nuclear installations (as defined in the Law - see 1.1.1.) which is a prerequisite for the granting of the construction and the operating authorizations.

The application for such a general licence shall be sent to the Federal Chancellery (Article 4). The general licence shall be limited in time (article 2).

The licensing procedure of the general licence requires publication of the application (article 5) and publication of the comments and expert opinions on the application (article 7). Everyone may raise objections on both publications. The decision by the Federal Council on the

granting of the general licence shall be submitted to the Federal Assembly for approval (article 8).

In a second section, this decree defines responsibilities in matter of wastes (article 10) and creates a fund to which proprietors of plants shall pay contributions to cover decommissioning (article 11).

1.1.4. Ordinance concerning the Supervision of Nuclear Installations of 14 March 1983

This text defines (article 1) the role of HSK „on the basis of Article 37, Para. 1 and 2, of the Federal Law of 23 December 1959 (see 1.1.1.)“:

„*Supervisory authority*

„*Supervisory authority with regard to nuclear safety and to radiation protection is the Swiss Federal Nuclear Safety Inspectorate (HSK). It makes decisions on behalf of the Federal Office of Energy*“.

In the German and French official versions HSK is designated as:

„*Hauptabteilung für die Sicherheit der Kernanlagen*“ and

„*Division Principale de la Sécurité des Installations Nucléaires*“,

which means literally „Main Division for the Safety of Nuclear Installations“, „main division“ referring to the fact that HSK is a main division of the Federal Office of Energy with a staff representing about the half of that Office.

1.1.5. Ordinance on the Swiss Federal Nuclear Safety Commission of 14 March 1983

Article 1 of this ordinance stipulates:

„¹ *The Swiss Federal Nuclear Safety Commission is an advisory body of the Federal Council and the Federal Department of Environment, Transport, Energy and Communication.*

„² *The Commission is administratively affiliated with the Federal Office of Energy*“.

The Commission has a secretariat at its disposal which is administratively assigned to the HSK (article 11).

1.1.6. Ordinance concerning the Protection of the Vicinity of Nuclear Installations of 28 November 1983

This ordinance regulates emergency preparedness, including warning the authorities and alerting the population, and describes the tasks of the operators of nuclear installations and of the competent authorities of the Federal Government, the cantons and the communities.

1.1.7. Ordinance on the Fees in the Field of nuclear Energy of 30 September 1985

This ordinance establish a system of fees on „anyone causing an activity“ of central services of the Federal Office of Energy, of the Swiss Federal Nuclear Safety Inspectorate (HSK), the Nuclear Technology and Security section (NS - in charge of physical protection controls) and the Swiss Federal Nuclear Safety Commission (KSA).

Such fees are not imposed „*to the Federal Government and, as a rule, its public institutions and corporations*“ nor „*to the cantons nor to cantonal and international public institutions, corporations and organizations for projects in the field of science and research*“ (article 3).

1.1.8. Federal Law on Radioprotection of 22 March 1991

The Law applies to „*all activities, all installations, all events and all situations which may present a danger connected with ionizing radiations*“. The authorization and supervision regimes of this Law do not apply to activities which require an authorization in application of the Atomic Energy Law (see 1.1.1.).

Article 30 stipulates:

„*Authorities which deliver authorizations.*

„*Authorities which deliver authorizations are the Federal Office of Public Health, and for activities exercised inside nuclear installations and tests with radioactive substances in the frame of preparatory actions [for the erection of a waste storage facility] in the meaning of article 10, Para. 2, of the Federal Decree to the Atomic Energy Law of 6 October 1978, the Federal Office of Energy.*“

1.1.9. Ordinance on Radioprotection of 22 June 1994

This ordinance establishes the Swiss requirements and principles to be observed in the field of radioprotection.

The new articles 87 and 87a (1st of August 1996) stipulate that wastes that are not coming from the use of nuclear energy shall be delivered to PSI [*Paul Scherrer Institute*] and define

duties of PSI. Article 87b creates a coordination commission as an advisory committee for the correspondent activities.

1.2. LEGAL DEFINITION AND POSITION OF THE SWISS REGULATORY BODY

HSK is the main division of the Federal Office of Energy (FOE) and is only designated in the Ordinance concerning the Supervision of Nuclear Installations (see 1.1.4.) as the supervisory authority making decisions on behalf of FOE. HSK performs mainly the tasks of review and assessments, and inspection and enforcement. According to article 37 of the Atomic Energy Law, HSK is considered as an „*administrative body necessary for the execution [of the Law]*“.

All other texts designate the Federal Council or FOE.

Licences according to the Atomic Energy Law (1.1.1.) and Federal Decree with respect to this Law (1.1.3.) are granted by the Federal Council. These decisions are drafted by the Legal Section of the Division for Energy Economy of FOE on the base of the HSK expert opinion and the KSA statement. Other decisions are made by HSK under the denomination of permits in order to authorize actions of the operators within the limits of the licences.

There are two different ways to define the safety regulatory body of Switzerland:

- (1) According to the position of HSK (main division of FOE) and the tasks of the Legal section of the Division for Energy Economy of FOE (drafting of licences) FOE could be considered as the Swiss regulatory body;
- (2) According to the particular position of HSK (main division situated in Würenlingen versus other divisions and sections situated in Bern), the Swiss regulatory body could be considered as the body composed of HSK and the Legal Section of the Division for Energy Economy.

In case (1) there would be no separation between the regulatory body and the Federal body charged with the promotion or utilization of nuclear energy and it would be a major non-conformance with principle (3) of the IAEA Safety Fundamentals “The Safety of Nuclear Installations”, Safety Series No. 110.

The IRRT experts considered that definition (2) is more representative of the observed practices and is more able to lead to future evolutions in accordance with internationally approved principles.

The definition and position of the Swiss regulatory body will be discussed according to the IAEA Safety Fundamentals “The Safety of Nuclear Installations” Safety Series No. 110 (designated in the following text as SF-110), the IAEA Safety Standard - Code on the Safety of Nuclear Installations: Governmental Organization (designated in the following text as 50-C-G) and the draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” (designated in the following text as “*LGI-Requirements*”).

1.2.1. Independence of the regulatory body

When a licensing decision includes also other objectives than nuclear safety, it is not abnormal that the regulatory body does not grant the licence itself. So, the Swiss situation, where the Federal Council grants the general licence and also some others main licences (construction, operation and modification authorizations) does not contradict internationally approved principles.

More generally, when principles of SF-110 or requirements of 50-C-G or LGI-Requirements require a fully responsible, independent safety regulatory body, this means that the government must provide for such a body and make sure that all activities in the field of civil nuclear energy or ionizing radiation, including its own activities, are controlled by a body that makes judgements and takes enforcement actions „without undue pressure from interests that may compete with safety“ (SF-110, Para. 304).

According to the discussion that the IRRT experts had with HSK staff, HSK seems to possess the characteristics for acting in a competent and independent way. However, the position of HSK as a division of the Federal Office of Energy gives an image to the public that does not attest that capability for independence.

More important is the fact that nuclear safety licences are drafted by the Legal Section of the Division for Energy Economy of the Federal Office of Energy (FOE) on the base of the expert opinion of HSK on one side and on the base of the statement of KSA (the advisory committee) on the other side.

According to the Attribution of tasks of the FOE, the Legal Section has tasks 1 to 4 dedicated to various energy policies, including the legal aspect of Programme Energy 2000 which, inter alia, contents the objective of increasing by 10% the power of existing nuclear power plant; task 5 is then „*apply nuclear energy legislation, and in particular lead the licensing procedures for nuclear installations and preparatory measures; draft licences and propositions that are addressed to the Federal Council and the Parliament*“. Even if the Legal Section consults HSK and KSA when their opinion and statement are not completely consistent, there are possible conflicts of interest between task 5 and the other tasks of the Legal Section which concern promotional activities.

1.2.1.1. Recommendations and suggestions

- (1) **BASIS** - The draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety”, Para. 205 stipulates:

“If other authorities, which may not meet the requirements of independence ..., are involved in the granting of authorizations, it shall be ensured that the safety requirements of the regulatory body are not ignored or modified in the regulatory process”.

- a) Recommendation: HSK should have the responsibility of drafting the final nuclear safety licence of any decision concerning nuclear installations.**

b) Suggestion: The Statement of the advisory Commission KSA should be sent by the Federal Department of Environment, Transport, Energy and Communication to HSK for consideration in the drafting of the licences.

- (2) **BASIS** - According to principle (3) of the IAEA Safety Fundamentals “The Safety of Nuclear Installations”, Safety Series No. 110:

“The regulatory body shall be effectively independent of the organization or body charged with the promotion or utilization of nuclear energy. ... No other responsibility shall jeopardize or conflict with its responsibility for safety.”

- a) Recommendation: The independence of the Regulatory Body should be ensured in a reorganization of governmental supervisory bodies. The Atomic Energy legislation should be revised accordingly.**
- b) Recommendation: A more independent position should be given to HSK with added legal staff.**

1.3. BUDGET AND FINANCIAL RESSOURCES OF THE REGULATORY BODY

The ordinance on the Fees in the Field of Nuclear Energy (30 September 1997) establishes fees for anyone „causing an activity“ of the Federal Office of Energy (Executive Board, Energy Policy service, Legal section), of HSK and of the Swiss Federal Nuclear Safety Commission KSA.

“Fees shall not be imposed to the Federal Government and, as a rule, its public institutions and corporations“ nor „to the cantons nor to cantonal and international public institutions, corporations and organizations for projects in the field of science and research”.

Fees for the activities of HSK and KSA are assessed according to expenditure of resources of these two bodies. The revenue from these fees goes to the general budget of the Government. Then HSK has to discuss its budget as a constituent part of the budget of the Federal Office of Energy.

Even if the actual budget of HSK is consistent with the fees recovered from operating organizations plus the fees that would have been paid by public installations if they were imposed on them, there is no clear link between fees and the budget of HSK. In addition, the budget of HSK has been affected by public policies like reducing the burden of taxes on the economy of Switzerland, policies which may conflict with the responsibility for safety of the regulatory body.

1.3.1. Recommendations and suggestions

- (1) **BASIS** - According to principle (3) of the IAEA Safety Fundamentals “The Safety of Nuclear Installations”, Safety Series No. 110: the regulatory body *“shall have adequate ... resources to fulfil its assigned responsibilities. No other responsibility shall jeopardize or conflict with its responsibility for safety”*.

- a) **Recommendation:** HSK should be enabled to discuss directly its budget with the department in charge of finance. Then, according to this accepted budget, the level of fees should be established.
 - b) **Suggestion:** Policies of the Government that could conflict with the assigned responsibilities of the regulatory body should not be applied to the regulatory body; thus general decisions of reducing staff of public offices or level of taxes recovered by State Departments should only be applied to the nuclear safety regulatory body if they do not jeopardize its efficiency and capability.
- (2) **BASIS** - As far as public or international or scientific activities are concerned, any difference in procedure related to fees for the regulatory body raises a question about the adequate control of these activities and facilities.
- a) **Suggestion:** Fees should be imposed to all operating organization, private, public, international or scientific. In case of difficulties some special budget could be provided to organizations that have difficulties for paying their fees.

2. AUTHORITY, RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY

Experts: J. Scherrer and L. Reiman

2.1. REGULATORY AUTHORITY

HSK is designated as the supervisory authority by an ordinance of 14 March 1983 (see 1.1.4.). Article 10 of the ordinance of 18 January 1984 (see 1.1.2.) gives the supervisory authority the power to order instructions in the meaning of article 8 Para. 2 of the Atomic Energy Law (see 1.1.1.).

So, HSK has clearly the authority to order measures related to safety which includes the authority:

- to develop safety principles;
- to establish regulations and issue guidance;
- to enforce regulatory requirements.

Chiefs of division of HSK had a clear knowledge of the enforcement powers of HSK. Personnel performing the inspections were less certain of their legal enforcement powers.

Article 39 of the Atomic Energy Law gives authorities to “the persons in charge of control functions”.

Assuming that HSK, supervisory authority, is composed of persons in charge of control functions, HSK has the authority:

- to require that operators provide any necessary information, including information from their suppliers, even if proprietary;
- to suspend authorizations and to set necessary conditions;
- to enter at any time sites and facilities to carry out inspections.

According to article 95 of the Radiation Protection Ordinance (see 1.1.9.), HSK has the authority to require operators to conduct safety assessments.

The regulation between UVEK/DETEC (Federal Department), Federal Office of Energy and HSK of 11 August 1997 gives HSK the authority to communicate directly information to the press and the public on incidents, restart of installations, delivery of permits by HSK, monitoring of the environment, research activities of HSK and meetings hosted by HSK.

So, HSK possesses almost all the responsibilities addressed in Para. 206 of LGI-Requirements. It was however noticed that the Division for International Affairs and Nuclear Questions of the Federal Office of Energy has in charge all multilateral and bilateral relationships which means HSK has no formal direct contacts in the field of nuclear safety with the IAEA, NEA or other countries.

2.1.1. Recommendations and suggestions

- (1) **BASIS** - HSK has legally the power to perform enforcement actions, including the power to curtail activities in the situation of Para. 521 of the draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety”, but not all staff of HSK are certain of that power.
- a) **Recommendation:** All staff of HSK should be well aware of the legal enforcement powers of HSK. HSK should establish additional procedures for enforcement and designate the level at which enforcement decisions can be made.
- b) **Suggestion:** HSK should consider having some legal staff or allocate a staff member the responsibility for enforcement matters in order to be able to deal with enforcement matters and train HSK personnel in them.
- (2) **BASIS** - According to Para. 206 of the draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” (which will supersede Para. 305 of the IAEA Safety Standard - Code on the Safety of Nuclear Installations: Governmental Organization) *“The regulatory body shall have the authority: ... (13) To liaise with regulatory bodies in other countries and international organizations to promote co-operation and exchange of regulatory information.”*
- a) **Recommendation:** HSK shall have the formal authority to represent Switzerland in foreign organizations (like the Department of Nuclear Safety -NS- of the IAEA) or in exchanges with other foreign regulatory bodies in matter concerning safety.

2.1.2. Good Practice

- (1) **BASIS** - According to Para. 206 of the draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety”:
- “The regulatory body shall have the authority: ... (10) To communicate independently its regulatory requirements, decisions and opinions and their basis to the public;”* - More generally this capability for information of the public is the warrant and the demonstration of the independence of the regulatory body.
- a) **Good Practice:** The agreement between the Federal Department UVEK/DETEC, the Federal Office of Energy, and HSK which allows HSK the competency to deliver, according to the situation or level of urgency, on its own behalf, press releases for affairs or events concerning safety in Switzerland.
- b) **Good Practice:** The publication of the expert opinion of HSK and of the statement of the advisory commission KSA in the licensing processes.

2.2. RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY

Through the discussions the IRRT team experts had with the staff of HSK, it appeared that HSK is acting, generally speaking, in accordance with the requirements of chapter 3 of LGI-Requirements.

In part 1.2. of this report it has already been described that HSK does not sign the licences and it has been recommended that HSK should draft the final nuclear safety requirements of any decision concerning nuclear installations.

HSK is participating with other relevant authorities mainly in the following areas:

- environmental protection in the frame of the Federal Law on Radioprotection, mainly through measurement in the environment;
- emergency planning and preparedness (see part 8);
- physical protection and safeguards mainly through relationship with the Section for Nuclear Technology and Security (SN) of the Federal Office of Energy.

Other fields of cooperation addressed in Para. 304 of LGI-Requirements are dealt with mainly through consultations during the licensing process.

3. ORGANIZATION OF THE REGULATORY BODY

Experts: L. Reiman and J. Scherrer

The Swiss Federal Nuclear Safety Inspectorate, HSK, designated by the Government to be the supervisory authority, is the main part of the Swiss Regulatory Body for safety in the field of nuclear energy. The primary task of the HSK is to oversee and assess the nuclear safety and radiation protection of nuclear installations in Switzerland.

The HSK is part of the Federal Department for Environment, Transport, Energy and Communication and is attached to the Federal Office of Energy.

3.1. ORGANIZATIONAL STRUCTURE

The Regulatory Body, as defined in the IAEA NUSS Documents, comprises not only the Swiss Federal Nuclear Safety Inspectorate, HSK, which is the main part in charge of nuclear safety and radiological protection under the relevant federal legislation, but also other parts of the governmental organization, in particular the Section Legal Service of the Federal Office of Energy, which is in charge of the formal aspects of the licensing process, and the Section Nuclear Technology and Security of the Federal Office of Energy (NS). That section supervises all measures aiming at physical protection of nuclear installations and safeguarding of nuclear materials.

The Federal Council has the exclusive competence to grant licences. The HSK is established by the Federal Ordinance concerning the supervision of nuclear installations, as the competent authority for supervising nuclear installations, at all stages of their life. The HSK is responsible for ensuring that all applicants/licensees fulfill their prime responsibility for nuclear safety and radiation protection.

The Swiss Federal Nuclear Safety Committee, KSA, is an advisory body to the Federal Council and to the Federal Department of Environment, Transport, Energy and Communication.

The HSK is divided into three divisions, three technical sections and a supporting staff, all reporting directly to the Director. The main functions of these units are indicated below:

- (a) Division for Mechanical and Electrical Equipment (MELA) deals with the structures relevant to safety, machines and electrical components, fire fighting systems and control rooms of nuclear installations.
- (b) Division for Reactor Design and Safety Analysis (RASA) investigates in detail the safety of nuclear power plants, using deterministic and probabilistic methods of safety analysis, under normal operating conditions, in disturbances and in the event of serious accidents.
- (c) Division for Radiation Protection and Emergency Preparedness (SANO) assesses radiation protection of the workers of a nuclear installation, protection of the environment and emergency planning activities.

- (d) Section for Personnel, Organization and Safety Culture (MOS) considers questions of human reliability and safety culture of nuclear installations operators, assesses their quality management and licences those power plant personnel who need licensing.
- (e) Section for Radioactive Waste Management (ERA) deals with matters concerning generation, handling, storage and disposal of radioactive waste, the transport of radioactive materials and the decommissioning of nuclear installations.
- (f) Section for Coordination of NPP Supervision (KOA) maintains an overall control on current safety-related issues of each plant and how they are run, coordinates inspections of specialist sections and maintains contacts to operators.

In addition there is a unit for safety research and international programs and a section for performing administrative duties and for providing computing services.

The organizational structure of the HSK is presented in Appendix 1.

There are no resident site inspectors and no regional offices. Each staff member, who is a specialist in a particular field, fulfills duties relevant to his/her field in three areas:

- review and assessment
- inspection and enforcement
- preparation of regulations and guidelines.

The HSK, as supervisory authority, is subordinated to the Federal Office of Energy (BFE/OFEN). The budget of the HSK is prepared by the BFE/OFEN and HSK has minor impact on that. The official nominations of HSK staff are made by the Director of BFE/OFEN. The Legal Section of BFE/OFEN prepares licences based on statements from HSK, KSA and NS and on the base of public and administrative consultations.

The BFE/OFEN is in charge of the energy legislation. The BFE/OFEN concerns itself with questions of energy economics and energy politics and considers aspects of supply security. Within the frame of the Federal Programme, Energy 2000, 10 % upgrades of the existing NPPs were foreseen.

The legally required review and assessment of applications by the HSK is conducted solely on the basis of nuclear safety criteria and is exclusive of any other considerations. However, in principle, there exists a conflict of interest between the duties of the HSK and the other duties of the BFE/OFEN and therefore the independence of the HSK is not guaranteed legally.

The independence of the HSK has been questioned in several parliamentary inquiries. As a consequence, a governmental project is considering possible subordination of the HSK within the frame of the formation of a National Safety Agency, NASA, covering all aspects of a conventional and nuclear safety.

3.1.1. Recommendations and Suggestions

In part 1.2.1.1. of this report it is recommended that “*The independence of the Regulatory Body should be ensured in a reorganization of governmental supervision bodies. The Atomic Energy legislative should be revised accordingly*”.

- (1) **BASIS** - According to paragraph 408 of the draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” of the IAEA Safety Standards Series states that arrangements shall provide for the establishment of advisory bodies, when necessary. Any advice offered shall not relieve the regulatory body of its responsibilities for making decisions and recommendations.
- a) Recommendation: In any reorganization of the regulatory body KSA should be retained as the advisory committee to the Federal Council and in addition in the future be also the advisory committee to the regulatory body.**

3.2. STAFFING AND TRAINING

The HSK employs at the moment eighty-five people. According to their basic education they can be divided in the following groups:

| | |
|-----------------------------|----|
| - engineers | 40 |
| - physicist | 21 |
| - other scientists | 9 |
| - technical, administrative | 15 |

The number of the personnel of the HSK has been successively increasing due to increased responsibilities and tasks.

The staff is recruited mainly from universities and industry.

The nuclear expertise in Switzerland is decreasing which may cause difficulties in further recruitments. Another threat is that reduction in technical expertise within the utilities could result in a greater burden on the Regulatory Body to make sure that all safety aspects are taken properly into account by the operators. The responsibility for safety may shift towards the Regulatory Body, which is not in accordance with the principles of safety culture and the principles of Safety Series Document No. 110 - Safety Fundamentals.

In the OECD/NEA report „Nuclear Safety Research in the OECD Countries“ it has been stated that “*Governments and Government Agencies need to undertake, fund or sponsor research to enable them to meet their safety responsibilities.*” The KSA has assessed the safety research programme of the HSK for the years 1996-1999 and in its report (KSA-AN-1899) come to the conclusion that an essential limitation of the proposed programmes could have negative influence on nuclear safety.

There is a continuous training programme in the fields of professional specific knowledge, personnel management, conduct of inspections and project management. In the area of Inspection and Enforcement, further training in conduct of inspections was recommended by the IRRT (part 6.2.).

There are staff exchange programmes with other regulatory bodies.

3.2.1. Recommendations and Suggestions

- (1) **BASIS** - Principle (3) of the IAEA Safety Fundamentals, “The Safety of Nuclear Installations” Safety Series No. 110 states that the regulatory body shall have adequate authority, competence and resources to fulfill its assigned responsibilities. During the review some areas were identified where there seemed to be a lack of resources (Reactor Design and Safety Analysis Division, part 5 of the report, Section for Radioactive Waste Management, part 9 of the report).
 - a) **Recommendation:** A review of the resources of the HSK Sections should be performed taking into account the duties and responsibilities of those sections.
 - b) **Recommendation:** Full-time Section Heads should be nominated to all HSK Sections to strengthen the line management of the Divisions in question.
- (2) **BASIS** - Paragraph 205 of the IAEA Safety Standard - Code on the Safety of Nuclear Installations: Governmental Organization states that:
“The Government shall arrange for adequate funding of the Regulatory Body to function effectively”.
 - a) **Recommendation:** The research funding available to the HSK has been decreasing in recent years. To maintain the nuclear expertise, which is important also from HSK’s point of view, adequate research funding should be provided by the Government for nuclear and radiation safety research.

3.3. QUALITY ASSURANCE

At the moment, no formal Quality Assurance (QA) system is in place in the HSK. However, some basic requirements pertaining to quality systems are covered by internal administrative guidelines.

The HSK has started a project the purpose of which is to introduce a quality management system within the HSK. Within this project the main processes of the HSK have been defined. The document management system is in the test phase. The resource planning system is in trial use by two units. Project management courses have been provided for about 40 people. The aims of the project are to increase the efficiency of supervision, quality of results and to make the work of the HSK more transparent.

The HSK is also improving their work processes. They are trying to couple the supervision with the PSAs and to couple the inspection methods with the evaluation of the safety

culture. They are also trying to do more in-depth and wider analyses of NPP events. These examples demonstrate the attitude of continuous development.

3.3.1. Recommendations and Suggestions

- (1) **BASIS** - Paragraph 404 of the draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” of the IAEA Safety Standards Series states that “The regulatory body shall establish and implement appropriate arrangements for a systematic approach to quality management which extend throughout the range of responsibilities and functions undertaken”.
- a) **Suggestion:** The first steps to introduce formal QA within the activities of the HSK, in addition to the on-going project, should be to start preparing a QA Manual and internal audits to establish whether existing internal guidelines are followed.
- b) **Suggestion:** HSK should consider self-assessment seminars for the whole staff. The purpose of these seminars would be to assess and develop activities based on, e.g. some international or national Quality Award Criteria and/or organizational assessment methods.

3.4. ADVISORY COMMITTEE

The Swiss Federal Nuclear Safety Commission (KSA) is an advisory committee to the Federal Council and to the Federal Department of Environment, Transport, Energy and Communication. It deals with fundamental aspects of nuclear safety and radiation protection and gives its opinion on licence applications.

The role of the KSA is to bring in additional professional expertise and experience from outside the administration and to provide a second opinion to the Federal Government.

The Committee is composed of thirteen members. At the moment four of them are from nuclear power utility organizations. The Committee meets about once a month.

The Committee has three subcommittees for the following areas:

- Engineering and reactor safety
- Radiation protection and waste management
- Plant personnel and organization

Each subcommittee meets about once a month.

The KSA shall include also members who are fundamentally opposed to the use of nuclear energy.

The members of the KSA are competent senior professional and they are not representatives of their employers or any other organization.

The Committee is supported by three scientific secretaries. Experts from the HSK take part in most sessions.

The KSA has a rather strong role in the licensing procedure in Switzerland. This may be explained by the fact that originally the KSA was the regulatory body which also made inspections of the nuclear installations. The HSK grew of the Secretariat of the KSA and took over the responsibility of inspections in 1972 and of the safety reviews in 1982.

3.4.1. Recommendations and Suggestions

No need for recommendations or suggestions was identified in this area.

3.5. LIAISON WITH OTHER NATIONAL ORGANIZATIONS

Other federal authorities, besides the HSK, have specific responsibilities relating to nuclear safety and radiation protection in and around the nuclear installations. These authorities are not involved in the licensing process.

The National Emergency Operations Center (NAZ/CENAL), as part of General Secretariat of the Federal Department of Defense, Civil Protection and Sports (VBS/DPS) is in charge of all emergency situations, including those due to events at NPPs as far as the protection of the public and the environment is concerned.

The Division of Radiological Protection at the Federal Office of Public Health (BAG/OFSP) is in charge of radiation monitoring of the environment outside facilities.

In addition to that there are several advisory committees to governments or governmental departments covering aspects of radiation protection, emergency planning and waste disposal.

In special fields of the supervision consultants are used to aid the HSK. The following institutions regularly do work for the HSK:

- SATI (Swiss Association for Technical Inspection) for the safety of mechanical components, especially in the area of in-service inspections
- IRA (Institute of Applied Radiation Physics) for dosimetry and emergency response
- PSI (Paul Scherrer Institute) for regulatory safety research
- ETH (Swiss Federal Institute of Technology) for regulatory safety research.

3.5.1. Recommendations and Suggestions

No need for recommendations or suggestions was identified in this area.

3.6. INTERNATIONAL COOPERATION AND LIAISON

The HSK has established bilateral cooperation arrangements with the regulatory bodies of France, Germany, Italy, Austria, USA, Canada, Argentina and Finland. Staff exchange programmes are active with USA and Finland at the moment. The HSK participates in the CSARP and COOPRA programmes of the USNRC.

The HSK has been active in establishing the network for regulatory authorities of countries with small nuclear programmes (NERS).

The HSK takes actively part in the activities of several international organizations such as IAEA, OECD/NEA, EU, ICRP and IRPA.

Switzerland supports countries of Eastern Europe and the CIS “in their efforts to develop and strengthen democracy”. The HSK co-ordinates bilateral projects with Russia (SWISRUS) and Slovakia (SWISSLOVAK) to improve the safety of their nuclear power plants. A new project with Ukraine (SWISSUP) is going to be started in the first quarter of next year. Common to most of these projects is that the HSK has only a coordinating role, a consultant is used in technical tasks.

Switzerland is also supporting and advising the activities of the Nuclear Safety Account.

3.6.1. Recommendations and Suggestions

- (1) **BASIS** - According to Paragraph 410 of the draft IAEA Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” of the IAEA Safety Standards Series national authorities, with the assistance of the regulatory body, shall establish arrangements for the exchange of safety related information to promote cooperation.
 - a) **Suggestion:** The HSK should consider ways to increase the participation of staff and corresponding resources in the nuclear safety assistance programmes, because they provide possibilities for learning.

4. AUTHORIZATION PROCESS

Experts: P. Govaerts and G. Caruso

GENERAL OVERVIEW

The legislative framework provides for two types of licences:

- General Licence:

It is applicable to any new nuclear installation since 1978 and includes the site licence. It determines the site and the main features of the project. A valid general licence is a prerequisite to the subsequent granting of the construction and the operating licences.

The four nuclear power plants (five units) currently in operation have no general licence since they were granted site and construction licences prior to that date.

The central interim storage facility for nuclear waste in Würenlingen, presently under construction by the “ZWILAG” company, has received a general licence and a construction licence.

- Licences for construction, commissioning, operation, modification or decommissioning:

These licences are by nature primarily technical since the main requirements relate to nuclear safety. Under the Atomic Energy Act, the conditions to be met and the procedures are identical in all cases.

The licences are granted by the Federal Council, on the basis of a draft written by the Legal Section of the Federal Office of Energy.

The decision is made on the basis of:

- the application for a project, supported by a safety analysis report, both to be submitted by the applicant;
- a procedure of review and assessment verifying that the project satisfies the safety objectives and takes account of experience and of the state of science and technology. This procedure leads to a Safety Evaluation Report (SER) established by HSK, which gives the results from the point of view of nuclear safety and radiation protection, including conclusions and, if necessary, proposals for licence conditions to be formulated in the licence;
- a statement of the Federal Nuclear Safety Commission (KSA) on the basic aspects of the project and on the SER of HSK;
- a comprehensive public consultation.

Licence conditions are legally binding as soon as they are included in a granted licence. In the frame of a valid licence, HSK has introduced the permit procedure which is used to authorize specific sets of the licensee's activities (e.g. selected parts of construction work, manufacture of important components, commissioning tests, start up after refueling or after modifications or

repairs,...). This permit procedure is directly between HSK and the licensee and is based on Article 8 of the Atomic Energy Act which states: “*The Federal Council and the authorities designated by it shall have the right in executing their supervisory function to order instructions...*”

4.1. LICENCE TIME LIMITATION

For historical reasons, the licences of the NPP are unlimited in time or have been issued for a limited period. This discrepancy exists in particular for the Beznau units. This might lead to difficulties at the time of expiration of the licence and decommissioning, like sharing personnel or waste facilities between a plant in operation and one under decommissioning.

4.2. LICENSING PROCESS

After HSK has completed its review and assessment of a project submitted by the applicant, it writes down its Safety Evaluation Report (SER) which includes conclusions (main requirements) as well as numerous findings and recommendations in the main text.

The licence and the SER of HSK are public documents.

4.2.1. Recommendations and Suggestions

- (1) **BASIS** - For a new authorization (like Beznau II in 1994) the Legal Section of the Federal Office of Energy writes down the terms of the Licence, based on the Safety Evaluation Report (SER) of HSK and on the recommendations of KSA for the technical part. The authorization mentions only the conclusions of HSK and KSA reports, while the other topics are only communicated to the applicant by HSK in written form.
- a) **Recommendation:** While the present situation for licensing continues, the licence should, in one of its paragraphs, make explicit reference to the Safety Evaluation Report (SER) of HSK and to the KSA statements, so that all recommendations or requirements can be pursued through the permit process.

4.3. GUIDANCE TO THE LICENCEES ON THE DOCUMENTS TO BE SUBMITTED

Although the applicants/licensees have the obligation to propose acceptable technical solutions, experience has shown that it is useful to make known to them how HSK will review and assess the application of a licence. This is done by means of guidelines prepared and established by HSK, which indicate ways of implementing some of the safety requirements. Up to now, HSK has established more than 30 valid guidelines covering a number of different topics.

4.3.1. Recommendations and Suggestions

- (1) **BASIS** - According to the draft IAEA Safety Requirements Document „Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” paragraph 504: “*The Regulatory Body shall issue guidance on the format and content of documents to be submitted by the operator in support of applications for authorization*”. Additionally, according to paragraph 508: “*In the review and assessment activities the Regulatory Body shall define and make available to the operator details of the principles and associated criteria on which its judgment and decisions are based*”.
- a) **Recommendation:** HSK should establish formal general safety requirements for all topics related to licensing stages. HSK should therefore issue additional guidelines on a priority basis on topics, such as: Quality Assurance, Fire Safety, Seismic Design, Decommissioning and Periodic Safety Reviews.

4.4. SWISS FEDERAL NUCLEAR SAFETY COMMISSION (KSA)

KSA is an advisory body of the Federal Council and the Federal Department of Environment, Transport, Energy and Communication; it is administratively affiliated with the Federal Office of Energy.

This Commission gives statements on applications for licences (all types). It may confine itself to fundamental issues related to nuclear safety and to items of the project which deviate from already proven concept. It makes statements on the corresponding expert opinions of HSK and other federal agencies. It can also make statements related to the issuance of regulations and to legislative amendments in the field of nuclear safety, and can examine research issues.

4.4.1. Recommendations and Suggestions

- (1) **BASIS** - During the review and assessment process of a project submitted by an applicant, KSA and HSK do their work in parallel and send their conclusions separately to the Federal Office of Energy. As KSA is not part of the Regulatory Body, there is no framework of consultation between both organizations to avoid contradictory view points.
- a) **Suggestion:** HSK and KSA should establish a formal procedure to resolve discrepancies between their technical recommendations prior to the drafting of the final licence.

4.4.2. Good Practice

- (1) **BASIS** - The Swiss Federal Nuclear Safety Commission (KSA) is involved in the licensing process, reviewing the corresponding evaluation report prepared by HSK and their conclusions and recommendations (Statements) are sent to the Federal Council.

- a) **Good Practice:** The establishment of an advisory body staffed by senior and experienced people to provide an independent input to the assessment process.

4.5. PERIODIC SAFETY REVIEWS

In accordance with the international practices, HSK has asked at the beginning of the nineties that the licensees perform a Periodic Safety Review (PSR). The subjects to be covered are those for new installations completed by a review of operational experience, backfitting, modifications and aging.

For all Swiss plants except Gösgen, PSR have been combined with major backfitting programmes or power upgrades. The PSR underway for Gösgen is comprehensive and the topics covered can serve as an example for further PSRs, which should take place on a regular basis.

4.5.1. Recommendations and Suggestions

- (1) **BASIS** - PSR shall be carried out as indicated in principle 25 of the IAEA Safety Fundamentals “The Safety of the Nuclear Installations” Safety Series No. 110: *“Systematic safety reassessments of the installation in accordance with the regulatory requirements shall be performed throughout its operational lifetime, with account taken of operating experience and significant new safety information from all relevant sources.”*; and additionally, according to the draft IAEA Safety Requirements, „Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” paragraph 303 part (3) *„Provide guidance to the operator in order that it can develop and present safety assessments or any other required safety related information”*.
 - a) **Recommendation:** HSK should send the guideline defining PSR requirements to all licencees and should indicate the exact dates at which the next PSRs are to take place.
 - b) **Suggestion:** For future PSRs effective arrangements should be made in order to ensure consistency. HSK should write the guideline defining PSR requirements for the next PSRs based on the experience gained in Gösgen NPP.

5. REVIEW AND ASSESSMENT

Experts: G. Caruso, P. Govaerts

Deterministic and Probabilistic methods are tools used by the supervisory authority. The safety of the NPPs are proven using both deterministic and probabilistic ways. The basis for, and objective of the review and assessment is to verify compliance with the safety objectives, principles and criteria. The establishment of the safety criteria is in the competence of the regulatory authority.

The Advisory Committee (KSA) is involved in the licensing process as it can review and comment on the licence applications and the corresponding safety evaluation reports prepared by HSK.

The review and assessment process is applied to the following activities:

- Licensing basis and process
- Periodic safety reviews
- Modifications to NPPs
- Event analysis

Design basis accidents (DBA) are reviewed by HSK in a deterministic approach considering:

- the plant behavior and the effectiveness of safety systems during occurrence of DBA accidents;
- the completeness of the analysis in view of Swiss and foreign regulatory requirements;
- operational experience world-wide;
- radiological consequences within the plant and the environment.

Beyond design basis accidents are assessed considering:

- the occurrence probability and their expected impacts on relevant structures, systems and components of the plant;
- the magnitude and time-dependent activity that would be released;
- the assessment of the PSA results from the point of view of the emergency planning and mitigation measures.

Operation of a NPP has to be in accordance with an appropriate set of limiting conditions of operation approved by HSK. These conditions are derived from safety analysis and test results and are included in the plant technical specifications.

HSK gives special attention on event reporting and investigation. Lessons learned and feedback from events are an essential contribution to safety of the NPPs. The main input for

HSK analysts to assess the events are the licensee information according to R-15 Guideline, attachment 3. Depending on the events, some events require a detailed root cause analysis that includes a human factor root cause analysis in the plant.

Technical sections are responsible for adequate event assessments:

- RST regarding safety significance;
- MOS regarding human factor and organizational aspects;
- Sections of SANO regarding radiological consequences;
- Related sections, if necessary ELT, MBT and PSA.

5.1. SAFETY ASSESSMENT RESOURCES

HSK from the regulatory point of view is responsible for the evaluation of the reactor design and safety analysis of the Swiss NPPs.

All evaluations activities related to the following areas:

- overall reactor design;
- design and performance of safety systems;
- fuel & core design;
- deterministic analysis of transients and accident responses;
- plant systems modifications;
- review of calculation methods and safety margins;
- operational procedures evaluations; and
- technical specifications analysis.

are mostly covered by the Section “Reactor Design and Safety Technology” (RST) that consists in a Section Head and four people. Moreover the same people devote time to inspection activities.

5.1.1. Recommendations and Suggestions

- (1) **BASIS** - According to the draft IAEA Safety Requirement Document, “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” paragraph 405: *“The regulatory body shall employ a sufficient number of*

personnel with the requisite qualifications, experience and expertise to undertake its functions and responsibilities..... The regulatory body shall acquire and maintain the competence to judge, on an overall basis, the safety of facilities and activities to make the necessary regulatory decisions”.

- a) **Recommendation:** Taking into account the number and type of Swiss NPPs, HSK should increase the human resources available to the Reactor Design and Safety Analysis Division, RST Section in particular, considering the extent, diversity and highly specialized activities.

5.2. PSA ACTIVITIES AND SEVERE ACCIDENT MANAGEMENT

HSK´s regulatory reviews and assessments and decisions are partly based on PSA results. A two steps evaluation process has been developed for the PSA studies taking into account first a preliminary review and second a detailed quantitative review. The major activities using PSA results are related to the overall safety of the NPP up to severe accidents and containment failure modes (Level-2 PSA), evaluation of plant modifications, backfitting, safety significance of operational events and severe accident management.

5.2.1. Good Practice

- (1) **BASIS** - In agreement with international practices, HSK has requested that each NPP submit a level-1 and a level-2 PSA covering the power operation and a level-1 PSA for shutdown states. HSK has developed guidelines to review these studies and to make independent calculations and it has asked to the licensee to develop severe accident management guidance. HSK also calculates the safety impact of plant modifications and events that occur at NPP´s using PSA level-1. Additionally, it has developed calculation methods based on the results of PSA level-2 and on-line measurements from the plant to help diagnosis and prognosis in case of severe accidents (ADAM system, see section 10.6).

- a) **Good Practice:** The thorough investigations of PSA results and the development of independent calculations capabilities, including severe accident management are achievements that go beyond normal international practices.

5.3. OPERATIONAL EXPERIENCE PROGRAMME

The operating experience analysis is carried out by a multidisciplinary group (BVA) that provide a systematic and comprehensive analysis of both the Swiss operating experience and the international operating experience. This group is composed by 6 experts and a project manager is in charge of the work coordination and organization. The group cover the main technical aspects:

- I&C and Electrical systems;
- Mechanical systems;
- Reactor physics;
- Radiation protection; and
- Human factors

Another technical expert may be included according to the needs of the project manager.

5.3.1. Recommendations and Suggestions

- (1) **BASIS** - According to IAEA Safety Fundamentals, “The Safety of the Nuclear Installations” Safety Series 110, paragraph 513: “*The operating organization must establish a programme for collection and analysis of operating experience*”. Additionally, according to IAEA Safety Series No 50-C-O establish on section 16, “Review of Operation and Feedback of Experience “*The evaluation of operating experience at the plant concerned as well as from the other plants shall be done in a systematic way by designated, competent persons*”.
- a) **Recommendation:** HSK should ensure that the licensee should provide them with reports of the national and international operating experience analysis. Actions applicable to Swiss plants should be assessed and agreed by HSK.
b) **Suggestion:** The minimum achievable scope and objectives of the operating experience programme should be specified by HSK.

5.3.2. Good Practice

- a) **Good Practice:** Carrying out independent operating experience analyses regarding to Swiss NPPs and international experience in a systematic way at HSK by means of an ad-hoc group with different specialities in the nuclear field.

5.4. PRIORITISATION OF SAFETY ISSUES

The findings of the safety evaluations and the resultant backfitting and safety improvements are stated as safety issues of NPPs. The control and maintenance of a survey of the safety aspects of the NPPs and their management is a significant task carried out by HSK, in particular, the control of the execution of requirements and all the requested and pending issues by means of a corresponding control list.

5.4.1. Recommendations and Suggestions

- (1) **BASIS** - All pending safety issues are detailed in a list independently of their safety significance and their priorities. Such issues are discussed and analyzed periodically between NPPs and HSK.
- a) **Suggestion:** To provide a clear understanding to the licensees, HSK should prioritize the pending safety issues in accordance with their safety significance.

5.5. PLANT MODIFICATIONS

HSK requires a comprehensive safety analysis for each plant modification or backfitting (guideline R-35) which defines what has to be met by the licensees. The guideline establishes how to evaluate the safety impact of a proposed modification. The Section for Co-ordination of NPP Supervision (KOA) prepares and coordinates the safety evaluation reports and the execution permits of backfitting projects and plant modifications for all Swiss NPPs.

5.5.1. Good Practice

- (1) **BASIS** - According to the draft IAEA Requirements document, “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transportation Safety”, paragraph 511 “*Any modifications to safety related aspects of a facility or activity (or having an indirect but significant influence on safety related aspects) shall be subject to review and assessment, taking into account the potential magnitude and nature of the associated hazard*”.
- a) **Good Practice:** In parallel to the co-ordination made by the KOA engineer, copies of the letter from the licensee proposing the modifications are sent to the division heads of HSK, allowing an independent check of the safety significance of the proposed modifications.

5.6. TESTING SURVEILLANCE PROGRAMME

Before commissioning of the NPP a testing programme of safety systems is established to check the status and ensure the reliability of safety systems during operation. After some years of operation of the NPPs many modifications to safety systems, test procedures and acceptance criteria have been carried out.

5.6.1. Recommendations and Suggestions

- (1) **BASIS** - According to principle (17) of the IAEA Safety Fundamentals “The Safety of Nuclear Installations” Safety Series No. 110: A set of operational limits and conditions derived from the safety analysis, test and subsequent operational experience shall be

defined to identify safe boundaries for operation. The safety analysis, operating limits and procedures shall be revised as necessary if the installation is modified. Additionally, according to IAEA Safety Guide 50-SG-08 “Surveillance of items important to safety in nuclear power plants”: the test frequency and the contents of the testing programme should be periodically reviewed in order to establish that they contribute in an effective manner to ensure the functional capacity of the system or component. The procedure should be established to ensure that this evolution takes place and that all necessary modifications approved by the competent authorities.

a) Suggestion: HSK should establish a programme to review the surveillance programme of the safety systems of NPPs. In particular, it should review the acceptance criteria and verify the exhaustiveness of the testing programme and the consistency between the testing procedures and the technical specifications.

5.7. SAFETY CRITERIA

Safety criteria are part of the regulatory process and the results of the PSA can be evaluated against a safety goal that express the desired level of safety. Safety criteria can be expressed in terms of the probability of occurrence of a health effect to members of the public or operators or accident releases.

Two safety criteria have been developed by HSK. One criterion is based on the individual dose limitation system versus probabilities, according to Swiss Legislation on Radiological Protection, chapter 7 -Incidents, article 94 and R-11 Guideline. Another criterion is related to beyond design basis accidents, based on the probability of release a certain amount of Cesium equivalent to the environment independently of the individual dose to the public or operators.

5.7.1. Recommendations and Suggestions

- (1) **BASIS** - Using different criteria to evaluate the plant safety, plant modifications or major plant-specific backfittings could lead to contradictory conclusions on the acceptability of the plant design.
- a) Suggestion: HSK should develop a formal and unique criterion that considers both design-basis accidents and beyond-design basis accidents or demonstrate that the current practice of using separate criteria achieves consistency.**

5.7.2. Good Practice

a) Good Practice: The efforts of HSK to assess the safety of the NPPs using the combination of probabilistic and deterministic tools.

6. INSPECTION AND ENFORCEMENT

Experts: H. Eichenholz and J. Wilson

6.1. ORGANIZATION OF THE HSK INSPECTORATE

HSK personnel are well qualified in the engineering and scientific disciplines that are needed to provide an effective review and assessment function to support the construction, licensing, and resolution of generic safety issues involving NPPs and other nuclear and radioactive waste facilities. These individuals are well motivated, and were observed to carry out their responsibilities with tenacity and professionalism.

The principle focus of HSK has been to assess the safety during the development and initial operations of the NPPs, including backfit considerations. In this regard, the supervisory inspection activities have had a very limited focus on operations.

The HSK programme or plan for supervision of NPPs is made up from the following elements:

- mandatory reporting by the licensee, starting at a low level (in terms of safety significance);
- a reporting system based on monthly and yearly reports prepared by the licensees;
- a well established system of discussion meetings for information exchange and supervision at different levels;
- vertical inspections (for specific subjects) which also cover general aspects such as seismic housekeeping or fire protection (e.g. the : “walkdowns” relating to the PSA) as well as organisational aspects (work preparation, work planning, protective locking of equipment);
- following of the work procedure for plant modifications having a bearing on safety (i.e. more than verification of submitted documentation), including all QA arrangement established by the licensee (with participation of experts, SATI = SVTI, etc.).

HSK has indicated their awareness of the need to re-focus their attention in developing an inspection program that can effectively perform operationally related verifications as an important element of their inspection programme. Clear evidence was presented by HSK of this recognition and remedies are being identified.

The overriding inspection philosophy of HSK is that every member of the inspectorate is an inspector. Practices observed by the IRRT reviewers are generally non-prescriptive. However, there are clear initiatives by HSK to develop inspection programme elements and guidance, but these efforts are neither systematic nor comprehensive. For example, while direction has been given to plan the inspection activities for the next year on a departmental level, there was no integrated management of resources to account for program reviews, reactive activities, and personnel development.

HSK has no resident inspectors and the KOA Section's site co-ordinator is more a project manager than a principal inspector with broad inspection responsibilities to provide operational safety oversight.

Team reviews in areas, such as Quality Assurance, In-service Inspection and Testing, Emergency Preparedness and Surveillance, have demonstrated a lack of sufficiently planned, systematic, and integrated approach in the conduct of HSK inspections. Additionally, there are a number of inspection areas that do not appear to be included in systematic fashion in their inspection program, such as, Operational Experience Programs (both internal and external), Training Programs for personnel not covered by licensed duties, engineering support to plant operations, fitness for duty of personnel involved in conducting safety-related activities, and Operational Safety Verification.

6.1.1. Recommendations and Suggestions

- (1) **BASIS** - HSK has not established a planned and systematic inspection program as recommended in Section 515 of IAEA draft Requirements - "Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety".
 - a) **Recommendation:** HSK should develop and implement an Inspection Program that is both systematic and comprehensive in nature.
 - b) **Suggestion:** HSK should consider the use of Section 335 of IAEA Safety Guide 50-SG-G4 in the development of a systematic and comprehensive inspection programme.
- (2) **BASIS** - Team reviews of inspection activities by HSK personnel at the NPP sites indicates insufficient programme focus on operational safety issues. Programme elements that focus on operational safety issues are described in Section 336 of IAEA Safety Guide 50-SG-G4, "Inspection and Enforcement by the Regulatory Body".
 - a) **Recommendation:** HSK should ensure that their inspection program has an appropriate focus on operational safety issues so that its implementation will provide an effective verification of the level of operational safety performance established at an NPP.
 - b) **Suggestion:** The focus on operational safety issues could be accomplished by specifying that this element of the inspection program is the responsibility of all HSK individuals that conduct inspections at NPPs and ensuring that specific guidance (including management expectations) is included within inspection program documents.
- (3) **BASIS** - Since HSK does not have a systematic inspection programme they are at present unable to fully assess the adequacy of resource allocations for inspections.
 - a) **Recommendation:** HSK should assess inspection resource in a manner that takes into the account the integrated nature of their supervisory responsibilities. Specific attention to resource needs should address the elements of program development, monitoring the effectiveness of inspection oversight, the

development of personnel competencies, and reactive inspections for event follow-up at the sites.

- (4) **BASIS** - Section 303 of IAEA Safety Guide 50-SG-G4 “Inspection and Enforcement by the Regulatory Body for NPPs” specifies “*that the verification of overall licensee performance requires inspections that focus on a relatively broad range of subject areas and do so with adequate depth and frequency*”.
- a) **Suggestion:** HSK should consider the allocation of responsibility for the management and performance of the inspection program’s operational safety verification activities to the KOA Site Coordinator.
 - b) **Suggestion:** HSK should confer with Member States that share similarities in their nuclear power programs (philosophy, resource allocations) to identify effective policies and objectives that can be emulated at HSK for the development of a comprehensive inspection program.

6.2. TRAINING AND QUALIFICATION OF INSPECTION STAFF

The training and qualification for inspection competencies is principally through the learning by doing approach. HSK relies to a high degree on the engineering skills and related technical competence of its professional personnel and has a program to provide and maintain technical competence to support inspection needs. Personnel involved in the conduct of inspections are by virtue of their professional experience more likely to perform activities as reviewers and technical assessors. Additionally, it is apparent that a number of experienced HSK personnel have reached an age where retirement may cause the loss of professional experience. Operational experience is generally lacking in HSK.

The MOS Section in conjunction with other departments and sections responsible for conducting inspection is focusing efforts to improve inspection competencies by the use of formal training courses in inspection practices. Efforts have also occurred recently to share information with neighbouring Member States (inspection croisées) on inspection practices. Other training initiatives are occurring at HSK to enhance the training of inspectors and there is the use of a permanent working group since 1997 to identify training needs. The success of HSK’s mission in the inspection area will be directly affected by the inspection competencies of its’ personnel and their ability to mobilize the professional talents in a shared or teamwork environment.

6.2.1. Recommendations and Suggestions

- (1) **BASIS** - During observation of inspection activities IRRT reviewers noted a high level of technical competence but in general, insufficient knowledge of inspection techniques to facilitate the broad review of an area being assessed. These observations indicate a lack of a systematic training program, as described in Section 212 of IAEA Safety Guide No. 50-SG-G4 (Rev. 1), “Inspection and Enforcement by the Regulatory Body for NPPs”, which provides guidance on technical competence and personnel qualifications.

- a) Recommendation:** During the development of the comprehensive and systematic inspection program (as recommended elsewhere), HSK should determine the training and development program necessary to meet program goals and objectives; ensure that the personnel who perform inspections are appropriately trained and qualified in effective methods of inspection, and maintain technical competence.
- b) Suggestion:** HSK should develop training profiles for each individual performing inspections, which records training experience and prescribes refresher and further training needs; conduct team-building training for HSK personnel to enhance inspection performance; and consider broadening the practice of temporary assignment of its inspection personnel to foreign NPPs to gain relevant operational experience and insights into the various phases of plant operations (refueling, start-up and shut-downs, etc.)

(2) **BASIS** - At the present time, HSK has a number of personnel who perform inspections that have considerable length of service. HSK expects that turnover of its staff will increase due to planned retirements. Section 405 of IAEA Safety Guide No. 50-SG-G4 (Rev. 1), „Inspection and Enforcement by the Regulatory Body for NPPs”, discusses the importance of the regulatory body having staff capable of performing activities required by the inspection programme.

- a) Recommendation:** HSK should develop a plan to address the loss of personnel due to retirements. This plan should also take into account the issue of loss of nuclear competence within the country given the current stagnation in the NPP industry.

6.3. METHODS OF INSPECTION

Inspections are conducted by HSK personnel whose traditional function has been to conduct reviews and assessments associated with licensing/technical review actions. This practice, when combined with HSK's current limited operational inspection perspective and fundamental inspection competencies, results in narrow technically oriented inspections (However, evidence of wider perspective were observed in the areas of radiation protection and PSA verification). HSK has recently developed additional guidance in the form of Directive W-17, „Inspection by the HSK“. This document, in part, was recently developed to provide a framework for preparation and implementation of inspections. While this effort is laudable, the document needs further development as a guide for the conduct of inspections.

HSK indicates that as a rule, their inspections are spot checks and the extent and intensity of the inspection is dependent on safety significance. This focus on safety over compliance verification as an overriding principle is to be commended. A review of inspection reports indicates that, in general, the HSK inspections reflect a narrow perspective in reviewing the interested area.

6.3.1. Recommendations and Suggestions

- (1) **BASIS** - Observations by the Team indicated that the guidance provided to HSK inspection personnel is insufficiently detailed to ensure that the inspection program will operate with consistency and equity. Expectations for the methods of conducting inspections are described in chapter 5 of IAEA Safety Guide No. 50-SG-G4 (Rev. 1), “Inspection and Enforcement by the Regulatory Body for NPPs”.
- a) **Recommendation:** HSK should provide specific and detailed guidance for the approach, conduct, methods, and expectations necessary to be carried out for inspections. Additionally, this guidance should ensure that a proper level of supervisory attention is focused on the selection of HSK personnel that employ the proper inspection and technical competencies.

6.3.2. Good Practice

- (1) **BASIS** - A recent initiative in the area of human factors is resulting in the development of inspection guidance that can capture Human Factor considerations in a systematic and integrated way. This initiative will aide in assessing the safety culture performance of NPPs.
- a) **Good Practice:** HSK has recognised that organisational factors encompass all levels and areas of nuclear power plant operation. As such, HSK has identified that they need to be observed and recorded by safety oriented inspections that are part of the inspection programme. These include radiation protection, engineering and operational safety verifications. The HSK initiative, MOSAIC (Organisational Factor Inspection Checklist) provides a means for the individual inspectors to focus on organisational deficiencies as part of their regular inspections. MOSAIC is a systematic approach for the planning, conducting and reporting on inspections and focuses on organisational factors and has the potential to optimise inspection resources.

It is noted that because this approach improves communication and organisational focus across HSK it will address performance concerns that have been identified in the difficulties for HSK to act in an effective integrated manner in implementing an inspection programme.

6.4. INSPECTION REPORTS

Inspection reports currently contain, in many cases, a mixture of observations and assessments associated with review and assessment activity for licensing related issues as well as those involving more traditional inspection activity. Up until recently HSK had not provided necessary guidance on the contents of the inspection reports. The HSK recent initiative to revise Directive W-17, “Inspection by the HSK”, now provides somewhat more explicit guidance. The review of recently released inspection reports has demonstrated an improvement in the quality and consistency of reporting inspection activities.

Notwithstanding this observation, many inspection reports remain narrowly focused on the subject matter and lack appropriate corroborating details to support the inspection findings. As such, it is difficult to assess the operational safety performance of a utility from the inspection activity described in the report in this manner. Additionally, the IRRT reviewers noted that inspection personnel are directed to transmit drafts of their inspection reports to the installation examined for any comments ‘in order to make sure that the professional facts in the reports are correct.’

6.4.1. Recommendations and Suggestions

- (1) **BASIS** - The use and contents of inspection reports is described in chapter 7 of IAEA Safety Guide No. 50-SG-G4 (Rev. 1), “Inspection and Enforcement by the Regulatory Body for NPPs”. HSK developed inspection reports did not conform to this guidance in areas such as future regulatory action considerations and periodic review of inspection findings including trends and root causes.
 - a) **Recommendation:** HSK should review its current guidance on the production of inspection reports.
- (2) **BASIS** - The factual and technical accuracy of HSK inspection reports was often challenged by the NPPs. International good practice requires that inspection reports are consistently of high quality and accurate in documenting operational safety at NPPs.
 - a) **Recommendation:** HSK should improve the technical accuracy of inspection reports and stress the necessity for improved performance by inspection personnel in this area.
 - b) **Suggestion:** HSK should consider discontinuing the practice of submitting draft inspection reports to the utility for comment.

6.5. REGULATORY ACTION AND ENFORCEMENT

The HSK has no defined Enforcement Policy. However, the IRRT reviewers noted that, consistent with international practices, the regulatory body has a number of graduated executive measures available to ensure that licensees take corrective action in a timely fashion.

It is clear that the Regulatory Body has on the basis of atomic law the ability to suspend or withdraw licences that are in force. It appears that orders to curtail activities given by the HSK would require confirmation by the Federal Council/Government. HSK relies upon management meetings and warning letters as the principle vehicles for articulating safety concerns and issues to NPP licensees.

It was unclear to the IRRT reviewers if HSK personnel can put into practice the stated HSK policy that it is the licence holder who is fully responsible for his installation and operation. While HSK has stated that inspections do not mean that responsibility of the licensee can be transferred to HSK, some of the Team’s observations during site inspection accompaniment suggest that this philosophy is not always practiced.

6.5.1. Recommendations and Suggestions

- (1) **BASIS** - As stated in para. 513 of the draft IAEA Requirements: Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety, “*Enforcement actions shall be applied by the regulatory body in the event of deviations or non compliance with conditions and requirements*”. In addition Section 816 of IAEA Safety Guide No. 50-SG-G4 (Rev 1) Inspection and Enforcement by the Regulatory Body for Nuclear Power Plant recommends “*The Regulatory Body should adopt clear administrative procedures and guidelines governing the use and implementation of enforcement actions*”.
- a) **Recommendation:** HSK should generate an Enforcement Policy that clearly lays out the practices and procedures to be followed by HSK personnel for the implementation of enforcement actions that are used to ensure compliance by licensees with regulatory requirements.
- (2) **BASIS** - Principle (2) of IAEA Safety Fundamentals “The Safety of Nuclear Installations” Safety Series No. 110 states “*the prime responsibility for safety shall be assigned to the operating organization*”. Additionally, Section 813 of IAEA Safety Guide No. 50-SG-G4 (Rev 1) “Inspection and Enforcement by the Regulatory Body for Nuclear Power Plant” states that “*The degree of authority delegated to the regulatory inspectors to ‘take on the spot’ enforcement actions shall be determined by the regulatory body*”. During Team review of HSK inspection activity observations were made where the utility placed the responsibility for the safety issues being identified onto HSK inspectors in that the resolution of the matters were left to HSK to pursue. No guidance for inspection personnel in these matters currently exists.
- a) **Recommendation:** HSK should develop adequate guidelines for inspection personnel performance when potential safety issues or potential non-compliance with licenced conditions are identified during the conduct of inspections. These guidelines should reinforce the principle that the licensee is responsible for safety.

7. DEVELOPMENT OF REGULATIONS AND GUIDES

Experts : L. Reiman, G. Caruso

7.1. REGULATORY APPROACH

The legislative and regulatory framework for governing the peaceful use of nuclear energy, the safety of nuclear installations and radiation protection in Switzerland is established on a four-level system:

- Federal Constitution
- Federal Laws
- Federal Ordinances
- Guidelines

The Federal Constitution stipulates that the legislation on the use of nuclear energy and on radiation protection is enacted exclusively at the Federal level.

The main legal provisions for authorizations and regulation , supervision and inspection are established by the Atomic Energy Act, the Federal Decree to the Atomic Energy Act and the Radiological Protection Act. These are the basis for further legislation and for guidelines issued by the HSK and the KSA.

The civil liability for nuclear damage caused by nuclear installations or by the carriage of nuclear materials are regulated in the Nuclear Liability Act.

The Swiss policy for regulation and supervision of nuclear installations, as expressed in the legislation, is essentially to indicate that nuclear safety and radiological protection have to be ensured, without entering into technical details. The legislation is thus limited to prescription of safety objectives. The applicant of a licence has to seek and present technical solutions reflecting the internationally recognized state of science and technology.

According to legislation two main licence types have to be distinguished:

- General Licence
- Construction, operating and decommissioning licences

The general licence is applicable to any new nuclear installation. It is granted by the government and has to be approved by the Parliament. The construction , operating and decommissioning licences are granted by the government.

The Atomic Energy Act has been under revision for some time. Some of the objectives of a new Nuclear Energy Act are to maintain the competence to grant nuclear licences exclusively at the federal level, to contribute to the further safe operation of the existing nuclear power plants and to prescribe about decommissioning and radioactive waste management. The aim is to place the granting of a general licence under an optional referendum.

The legislation related to radiation and nuclear safety of nuclear installations is prepared by the legal section of the Federal Office of Energy (BFE / OFEN) with the assistance of the technical expertise of HSK staff.

HSK publishes guidelines, which present the criteria it uses in evaluating an application or in assessing activities and projects of the nuclear power plant operators. These guidelines are not binding, the applicant is entitled to propose other solutions. However, compliance with the guidelines makes it easier to verify that safety is adequately ensured. Any departures from the guidelines have to be evaluated and justified. The use of guidelines which are not mandatory gives more flexibility to take into account the state of the art of the nuclear technology.

Some procedural guidelines are an exception to the above, they are mandatory. More than thirty guidelines are presently in force.

In the guidelines the HSK has introduced the permit procedure which can be used within the frame of a valid licence.

There is no goal to cover all safety related areas or functions with these guidelines, the decision to prepare a new guide is made on a case-by-case basis. HSK Guidelines are used to complement the regulations of the country of origin of the Swiss nuclear power plants.

Some guidelines of special importance are published by HSK and KSA together. KSA and all utilities are asked to comment on every guideline in the preparation phase. KSA may choose whether to give a statement or not.

In preparing the guidelines the IAEA NUSS Codes and other international standards are used as reference material.

There seems to be a need for some new guidelines of fundamental nature concerning for example QA, operational experience feedback, deterministic and probabilistic analyses, periodic safety reviews and decommissioning.

For structures and equipment it is the responsibility of the utility to select appropriate standards and to present them to the HSK for approval in the application of a request.

HSK issues a permit for the next cycle after each refueling/maintenance outage and this process is certainly very good for maintaining the design safety case.

7.1.1. Recommendations and Suggestions

(1) **BASIS** – According to paragraph 206 of the draft Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” of the IAEA Safety Standards states that “*The regulatory body shall have the authority: (1) to develop safety principles and criteria; (2) to establish regulations and issue guidance*”.

a) Recommendation: In the future Nuclear Energy Act under preparation, or in some other relevant law or ordinance, a clear authorization to HSK to issue

guidelines should be presented to clarify and strengthen the role and status of the HSK Guidelines.

- (2) **BASIS** – Paragraph 404 of the draft Requirements document “Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety” of the IAEA Safety Standards Series states that “*The regulatory body shall establish and implement appropriate arrangements for a systematic approach to quality management which extend throughout the range of responsibilities and functions undertaken*”.
- a) **Recommendation** – The process for preparation of the HSK Guidelines should be documented in the internal guides of HSK. HSK should review existing guidelines and should make plans to update them, if necessary, and to assess the need to expand the scope of guidelines. Greater management attention should be paid to the issue.

7.1.2. Good Practice

- (1) **BASIS** - Before issuing a permit for restart after an outage HSK performs a comprehensive safety assessment.
- a) **Good practice:** When reviewing the NPP application for start-up, the HSK makes an extensive assessment of the core design, periodic testing and maintenance, modifications performed and of the radiation protection aspects.

8. EMERGENCY PREPAREDNESS

Experts: J. Wilson and H. Eichenholz

Emergency Preparedness in Switzerland is well established and has a firm basis in law. HSK has a small, dedicated professional team who are committed to maintaining good emergency preparedness within HSK. They assure adequate emergency preparedness at the Nuclear Power Plants (NPPs) within current HSK Inspection and Enforcement policies. They also provide training to both HSK and other external emergency response organizations.

The coordination of radiation monitoring data at the federal level within Switzerland is exemplary and exercises demonstrate that the collaboration of technical expertise between HSK and the National Emergency Operations Center (NAZ) in emergency conditions is excellent.

8.1. LEGAL BASIS

In addition to the Federal Act and Federal Ordinance on Radiological Protection there is specific legislation to cover radiation emergencies. Ordinances cover Emergency Protection (Notfallschutzverordnung), the National Emergency Operations Center (VONAZ), Iodine Tablets and Emergency Organization in Case of Increased Radioactivity (VEOR).

There is a Federal Ordinance on the Protection of the Population in the Vicinity of Nuclear Installations in Case of an Emergency and on Coordinated Radiological and Chemical Protection. A strength of the Swiss system is the ability at the federal level to combine the resources of civil authorities, civil defense and the army for any type of national emergency.

A recently revised (March 1998) document entitled „Emergency Planning and Preparedness for the Vicinity of Nuclear Power Plants in Switzerland“ outlines the federal concept for action during a nuclear power plant accident. This document was written by HSK in conjunction with the Swiss Federal Commission for AC Protection (KOMAC), the Swiss Federal Commission for the Safety of Nuclear Installations (KSA) and the NAZ.

8.1.1. Good Practice

a) Good Practice: The ability at the federal level to combine the resources of civil authorities, civil defense and the army for any type of national emergency.

8.2. RESPONSIBILITIES OF THE VARIOUS EMERGENCY RESPONSE ORGANIZATIONS

Each Nuclear Installation is responsible for the recognition, assessment and where possible remediation of a nuclear accident at their site, for the execution of on-site countermeasures and the timely and continuous transmission of relevant information to off-site authorities.

The Radiological Emergency Organization (EOR) and its NAZ is responsible for the protection of the population following any radiation accident affecting Switzerland. The EOR has the legal competence to request the cooperation of any public or private specialists or services needed in an emergency and reports directly to the Government through an Emergency

Management Board (LAR). This Board is made up of the Directors of the relevant Federal Agencies.

Effective operation of the NAZ is key to the Swiss national response to a nuclear emergency. The staff of the NAZ perform a number of specific specialist tasks such as Information Officer, Monitoring Data Coordinator, Advisor on Countermeasures, etc. If individuals are unavailable in the real event there are no predefined back-up personnel. Staff have some competencies in other roles but are not specifically trained to perform more than one. This situation could compromise the effectiveness of this key organization.

HSK is responsible for judging the adequacy of the on-site countermeasures instigated by the Operator and for providing advice to the NAZ regarding potential off-site radiological consequences.

The NAZ is responsible for the transmission of warnings and alerts to the cantonal authorities and initial countermeasures for protection of the public. Once established the LAR takes over these responsibilities but continues to receive advice from the NAZ.

The cantonal authorities are responsible for alerting the communities and coordinating the protective and rescue measures undertaken by the local authorities.

8.3. RESPONSE AND TRAINING OF HSK EMERGENCY RESPONSE STAFF

All HSK staff have responsibilities in the event of a nuclear emergency which are clearly defined in procedures. In addition, a number of staff have defined roles for which they receive specialist training such as the “picket” engineers who provide a 24 hour contact point for the NPPs and other organizations in the case of an emergency. Their response is also periodically rehearsed in exercises and drills.

General emergency response training has been undertaken by all staff and each has a response manual which clearly defines the roles within the HSK Emergency Response Center GENORA.

In the event of an emergency HSK staff are alerted by pager and assume roles upon arrival at the GENORA according to competency. Two members of staff, one with Health Physics and one with Reactor Safety experience are also dispatched from the GENORA to the affected site to monitor the actions of NPP staff and to report back to HSK. Each has clear written responsibilities during an accident which include the securing of evidence, the keeping of a formal written log and intervention if actions proposed by the NPP are against the advice of HSK. Such disagreements are usually settled between the Head of Operations in the GENORA and the Head of the NPP but if required the Head of Operations in the GENORA has the authority to Order the NPP to undertake such action as HSK deem necessary.

8.4. ALERTING THE PUBLIC

Nuclear emergency planning in Switzerland is based upon the assumption that there are a number of hours before any release of radioactivity occurs. However, for fast breaking accidents each NPP requires the authority of the canton before it can sound the sirens local to the plant (Zone 1). If an immediate release to atmosphere occurs the time delay involved may be unacceptable. This shortfall is recognized in the new Federal Concept on Emergency Planning in the Vicinity of NPPs but is not yet implemented. It is proposed that in the case of an immediate release to atmosphere the NPP can contact the Canton directly and receive the authority of the Police to sound the sirens in Zone 1. The Police then have the responsibility to ensure that a prerecorded message advising the public on what to do is broadcast on the radio.

8.4.1. Recommendations and Suggestions

The following are based upon international good practice and IAEA draft Requirements Document Preparedness and Response for Nuclear and Radiological Emergencies.

- (1) **BASIS** - Nuclear emergency planning in Switzerland is based upon the assumption that there are a number of hours before any release of radioactivity occurs. Arrangements for the sounding of sirens in the vicinity of the NPP and information to the public in this zone is based upon this assumption. The delay in alerting the public to an immediate release of radioactivity from the NPP may be unacceptable, and a new Federal Concept has been issued but as yet not fully implemented which corrects this deficiency. This shortfall was first recognized during the OSART mission to Beznau as early as 1995.
 - a) **Recommendation:** HSK should pursue the timely implementation of the new Federal Concept for Emergency Planning in the Vicinity of NPPs.
- (2) **BASIS** - A significant delay between the sounding of the sirens in the vicinity of a NPP and issue of the public information message could lead to anxiety. However, sheltering without information is preferable to not sheltering at all if a release has occurred.
 - a) **Suggestion:** Arrangements to ensure the timely provision of public information after the sounding of the sirens in Zone 1 for all accident scenarios including those resulting in an immediate release of radioactivity should be made and tested.
 - b) **Suggestion:** Diverse means of ensuring an alert may also be considered. Both the police and the NPP could activate the sirens and authorize the broadcast of the prerecorded public information message in the event of an immediate release of radioactivity.
- (3) **BASIS** - The calculated Zone 1 around both Beznau and Leibstadt NPPs have been amalgamated into a single practical Zone 1 as they are very close. Each NPP is responsible for sounding the sirens in Zone 1. However, in practice they can only trigger the sirens around their own plant which automatically triggers the sirens around the other plant. The community triggers the sirens in the remainder of Zone 1 which could introduce a significant delay in alerting all those living in Zone 1.
 - a) **Suggestion:** The triggering of all sirens in Zone 1 surrounding the Beznau and Leibstadt plants from one central point should be considered.

(4) **BASIS** - The NPP is responsible for the installation and replacement of alerting sirens both close to the NPP (Zone 1) and out to 20km (Zone 2). They are also responsible for the maintenance and testing of sirens within Zone 1. HSK is responsible for ensuring that their technical guidance on the design, maintenance and testing of alerting sirens is complied with. (The maintenance and testing of sirens in Zone 2 is the responsibility of the cantons/communities). In practice the cantons and NPPs test all sirens annually and the NPPs furnish HSK with the result for Zone 1.

a) Suggestion: The Ordinance on Emergency Protection (Notfallschutzverordnung) and the HSK Guidelines on design, installation, maintenance and testing of sirens should be discussed with the NPPs, cantons and communities and the Guidelines amended to reflect the agreed position.

8.5. HANDLING THE MEDIA

There is no overall coordination of media briefing in Switzerland in the event of a nuclear emergency. The basic principle applied is that each organization is responsible for briefing the media in areas for which they have responsibility. Hence, the affected NPP could be expected to issue press briefings about the state of the plant and the well being of plant workers while the canton and/or communities may brief the media on countermeasures that are being implemented in the early phases of an accident.

The Information Centre of the Federal Chancellery has overall responsibility for communications with the cantonal authorities and for providing authoritative information to the public based upon data supplied by the NAZ and EOR.

The quality and timing of information to the media is crucial if speculation is to be avoided which could lead to misinformation to the public and even panic. Evidence from recent federal exercises have demonstrated the need for better coordination of media briefing.

8.5.1. Recommendations and Suggestions

(1) **BASIS** - In the event of a nuclear emergency the quality and timing of information to the media is crucial if speculation is to be avoided which could lead to misinformation to the public and even panic.

a) Suggestion: HSK may wish to suggest to all other emergency response organizations (e.g. NPPs, cantons, communities, NAZ, the Information Center of the Federal Chancellery, etc.) that an overall media coordination plan is agreed and rehearsed during national exercises.

b) Suggestion: HSK, the Information Centre of the Federal Chancellery, the NAZ, cantons and communities should together identify possible locations for Media Briefing Centres. These should be in locations convenient to both the affected NPP and its appropriate cantonal authority responsible for the implementation of off-site counter-measures. In addition, testing the implementation of such facilities during national exercises should be considered.

8.6. EMERGENCY EXERCISE PROGRAMME

Guideline HSK-R-45/e outlines the requirements for the planning and execution of emergency exercises at NPPs and HSK-R-25/d covers other major sites such as PSI and storage facilities.

HSK-R-45/e covers both nuclear plant safety emergency demonstrations required by HSK and security demonstrations required by the Section for Nuclear Technology and Safety (NS) within the Federal Office of Energy.

NPP staff are responsible for on-site accident management and the production, maintenance and testing of the on-site emergency response plan. HSK is responsible for assuring adequate on-site emergency preparedness and formally approves the on-site emergency response plan.

The Federal Commission on Emergency Preparedness (KOMAC) is responsible for the assurance of off-site emergency preparedness and the NAZ is responsible for off-site accident management. The NPP has no responsibility for off-site accident management.

General Emergency Exercises are designed to test the overall response to a nuclear accident both on and off-site and the interfaces between each response organization at the local, canton, NPP, regulatory and federal level including international interfaces. Planning for these exercises is coordinated by KOMAC. One such exercise is held every two years on a rotational basis so that for each NPP there is a national exercise every eight years.

In addition, each NPP undertakes specific exercises and training with some of the organizations that it interfaces with in the event of an emergency, i.e. fire brigade, police, local authorities, etc. However, there is no overall matrix of exercise planning to systematically ensure that all interfaces are regularly tested.

On-site exercises are either designed to rehearse security issues and are planned in conjunction with NS Section and witnessed by them and HSK, or are designed to rehearse technical response issues and are planned in conjunction with HSK and witnessed by them. Each type of exercise is further subdivided into staff exercises and plant exercises, i.e. those that concentrate on command and control and emergency management and those that also address physical actions on the plant such as damage assessment and repair, casualty retrieval, etc. Again, additional exercises are undertaken by the NPP possibly in conjunction with external organizations. These are not regulated by HSK to assure a systematic assurance that all interface and on-site competencies are demonstrated over a given period.

The guideline clearly provides for adequate planning, execution and review of exercises in a timely manner to ensure that the „lessons learned“ are incorporated in emergency procedures and planning. The guideline also requires an annual demonstration exercise of one type or another. Security exercises must be undertaken on a four yearly cycle and replace the technical exercise demonstration to HSK. Hence, a full demonstration of the on-site nuclear emergency response plan, in either a „Plant Emergency Exercise“ or as part of a „General Emergency Exercise“ may not take place each year.

8.6.1 Recommendations and Suggestions

- (1) **BASIS** - IAEA Draft Requirements Document Preparedness and Response for Nuclear and Radiological Emergencies states that “*emergency response exercises for facility personnel shall be held at least once per year*”. At Swiss NPPs a full demonstration of the on-site nuclear emergency response plan is not undertaken annually. Once every four years a security exercise replaces the nuclear exercise. Although emergency management personnel are exercises during such exercises other nuclear emergency response staff are not. However, additional drills are undertaken by the NPP which may exercise these staff but these are not witnessed by HSK.
- a) **Recommendation:** HSK should require that an exercise of all on-site nuclear emergency response functions at the NPP is undertaken annually.
- b) **Suggestion:** HSK should either require that an on-site technical exercise is undertaken annually or they may consider a modular exercise approach which takes benefit from those functions demonstrated during a security exercise and additional on-site exercises which specifically test those functions not exercised during a security exercise.

8.7. TRAINING

Article 25 of the Ordinance on the Protection of the Population in the Vicinity of Nuclear Installations in Case of an Emergency places a duty on each emergency response organization to train and exercise its own staff in their emergency response duties.

The legal responsibility for training of Canton/Community emergency response personnel lies with the Canton. However, they rely upon the expertise of HSK to comply with this responsibility. HSK has limited resources (only 2 members of staff) who deliver this training. They also have to train HSK staff to comply themselves with Article 25.

9. RADIOACTIVE WASTE MANAGEMENT AND DECOMMISSIONING

Experts: D. Reisenweaver, P. O'Donnell

The legal framework for the management of radioactive waste and decommissioning is provided by the Federal Act on the Peaceful Use of Nuclear Energy (23 December 1959), as amended; the Federal Decree with respect to the Atomic Energy Act (6 October 1978); the Radiological Protection Act (22 March 1991) and the Radiological Protection Ordinance (22 June 1994). These documents provide the regulatory authority for HSK to regulate the waste generated from nuclear power plants and Paul Scherrer Institute (PSI). It also authorizes HSK to regulate waste that is collected at the PSI from medical, industrial and research facilities that are regulated by the Federal Office of Public Health (BAG). This regulatory authority granted to HSK is for the practices of collection, packaging, pretreatment, conditioning, storage and disposal of all radioactive waste from NPPs and PSI.

All radioactive waste generated in Switzerland other than from NPPs is collected by BAG and brought to PSI, processed when appropriate and placed into interim storage awaiting final disposal. There are two interim storage facilities for this waste. The federal interim storage facility (BZL) is located at PSI. It started operation in 1992. A new Central Interim Storage facility is currently being constructed adjacent to PSI which will store all classifications of radioactive waste to include spent nuclear fuel. This facility will be operated by a private company formed by the nuclear utilities.

9.1. CLASSIFICATION OF WASTE

The classification of radioactive waste is not specified in Swiss legislation or regulations. The terms low, intermediate and high level waste are used throughout the nuclear industry in Switzerland, but there is no legal definition of these terms. Since not all of the waste that is processed by PSI comes from HSK regulated facilities, confusion on waste categories could cause concerns during processing and treatment at PSI. The terms of reference for waste generated at BAG regulated facilities (research, medical and industrial facilities) may be different than those used by HSK although a waste declaration system is in force. This could cause PSI to exceed licensing or effluent limits if BAG licensed facilities do not understand the acceptance criteria.

9.1.1. Recommendations and Suggestions

- (1) **BASIS** - IAEA Safety Series Number 111-G-1.1 which is a Safety Guide entitled “Classification of Radioactive Waste” recommends an approach and a proposed system for the classification of radioactive waste.
 - a) **Recommendation:** **A consistent waste classification system should be established for all facilities and activities generating nuclear waste within Switzerland. Definitions for waste types within the classification system should be developed by HSK.**

9.2. REGULATORY AUTHORITY FOR HISTORICAL WASTE MATERIAL

In many countries, radioactive waste and orphaned sources from past practices are found many years after they have been used. This material is normally found in an unregulated area. An old uranium exploration gallery in Switzerland which had been used in the early 1960's was brought to the attention of the regulatory authorities. An evaluation had to be made as to the radiation risk associated with the tailings material and waste that had been stored in the gallery. HSK was requested to provide assistance in performing an assessment of the radiation risk. Article 127 of the Radiological Protection Ordinance establishes that BAG is responsible for the regulation of activities outside nuclear installations and PSI. This facility would seem to fall under BAG's jurisdiction.

9.2.1 Recommendations and Suggestions

- (1) **BASIS** -. This conclusion concerning responsibility for historical waste and orphaned sources could lead to misunderstandings and the loss of control for old historical waste or orphaned sources.
 - a) **Recommendation - A policy should be clarified concerning regulation and control of old historical waste or orphaned sites. Responsibilities should be defined and authorities clearly established.**

9.3. FINAL WASTE DISPOSAL

Low and intermediate level waste will be disposed in a repository tentatively scheduled to be constructed at Wellenberg. The further exploration of this site has been blocked by local opposition. The high level waste repository has been scheduled for operation in 2020. Both of these repositories will be constructed and managed by private companies formed by the nuclear power utilities.

As previously stated, the goal of the high level waste repository programme has been to have a disposal facility available by 2020. NAGRA has recently announced personnel and budgetary cutbacks in support of this programme. NAGRA wants to strengthen its position as a national central office for radioactive materials and offer corresponding services in the waste management field on a national and international level. At the same time, it has suggested that the high level repository be delayed from 2020 to 2050 or later. It appears that NAGRA is delaying this important project so as to be able to expand its commercial activities. This proposed action has the appearance of a potential conflict of interest. The KSA has stated that the date should not be delayed unless it can be justified by safety-related considerations.

9.3.1. Recommendations and Suggestions

- (1) **BASIS** - IAEA Safety Series Number 111-F which is a Safety Fundamentals document entitled „The Principles of Radioactive Waste Management“, Principle 5 states that „*radioactive wastes shall be managed in such a way that will not impose undue burdens on future generations*“. It also states that „*the responsibility of the present generation includes developing the technology, constructing and operating the facilities, and providing a funding system, sufficient controls and plans for the management of radioactive waste*“. By delaying the high level waste repository by 30 or more years, it should be interpreted that the burden is being passed on to future generations.
- a) Recommendation:** HSK should review and evaluate KSA's recommendation concerning the further delay in the development of the high level waste depository.
- b) Recommendation:** A formal funding system for final waste disposal activities similar to that implemented for decommissioning should be established.

9.4. DECOMMISSIONING REGULATORY STRUCTURE

Decommissioning is a major phase in the life of a nuclear facility. The management of these activities require strong project management and significant regulatory input. It requires a combination of input from many disciplines throughout the regulatory agency. The regulatory authority for decommissioning nuclear power reactors, university research reactors and all facilities using radioactive material at PSI is the HSK. HSK is not responsible for ensuring that appropriate funding is available for decommissioning. There are nuclear facilities under HSK regulatory authority that are currently being decommissioned.

Currently, HSK performs the regulatory functions regarding decommissioning on an ad hoc basis. Most countries that have nuclear power plants, including developing countries, have established formal groups within their regulatory organizations to monitor decommissioning activities and provide guidance to the licensees. The regulatory requirements that are in place in Swiss legislation only state that the nuclear facility must be decommissioned after its use is no longer required and that the licensee must provide appropriate funding for decommissioning. The evaluation of the funding requirements is done by an independent commission and HSK has no input into the evaluation process.

9.4.1. Recommendations and Suggestions

- (1) **BASIS** - IAEA Safety Series Number 105 which is a Safety Guide entitled “The Regulatory Process for the Decommissioning of Nuclear Facilities” provides recommendations for establishing the regulatory process for decommissioning nuclear facilities and the general approach that could be followed in evaluating a decommissioning process. It includes information on the overall regulatory process, planning for decommissioning, cost estimation and funding, considerations relevant to deferred decommissioning, post-decommissioning considerations and responsibilities and functions of parties in decommissioning.
- a) Recommendation:** HSK should establish and provide appropriate resources for a formal group within its organization with the responsibility to monitor

decommissioning activities and provide project management for reviewing regulatory required decommissioning documents and inspection of decommissioning projects.

- b) Recommendation: HSK should identify the necessary documents that are required to support the licensing requirements for decommissioning.
- c) Suggestion: HSK should evaluate the decommissioning cost data from a technical standpoint to determine if the activities described in the cost estimate are appropriate and the basis for the costs are appropriate. The independent commission should have the responsibility for controlling the money once they are deposited in the established fund.
- d) Suggestion: HSK should develop regulatory guidance for the format and content of key regulatory documents such as the decommissioning plan and the decommissioning cost estimates.

10. RADIATION PROTECTION

Experts: P. O'Donnell and D. Reisenweaver

10.1. LEGISLATIVE FRAMEWORK

The legislative and regulatory framework for radiation protection is established in the Radiological Protection Act, a Federal Law approved in 1991, and the Radiological Protection Ordinance, which has been revised and came into force in 1994. The former document is based mostly on the latest recommendations of the ICRP but were issued before the IAEA BSS and EU Directive were published.

The Radiological Protection Ordinance establishes a limit of the effective dose of 20 mSv per year for occupational exposed individuals. For those people who are required to carry out exceptional jobs, a limit of 50 mSv per year, but not exceeding 100 mSv in five preceding years including the current year, can be authorized by HSK.

This legislation covers all radiation sources including all natural and artificial sources used in medicine, industry, nuclear power and research. Regarding the natural sources there is a specific mention of airline crew exposures (art. 41 of Radiation Protection Ordinance) and elevated Radon concentrations (Section 3 of Radiation Protection Ordinance). This last case is thoroughly elaborated and state limits and reference values, measurements, regulation in buildings and areas, remedial actions and creates the Radon Technical and Information Center.

The legislation is clear with respect to exclusion, exemption and clearance of material. In the case of exemption the Radiation Protection Ordinance provides two basic criteria, one based on article 125 and the other on article 2.2. Because of these two criteria, it is possible to have radioactive material at a facility above the exemption level that is not licensed, but must meet requirements of the Radiological Protection Ordinance.

There is not an explicit legal provision to deal with abandoned sources. However in article 34.2 of the Radiological Protection Act (SR 814.50, 22.03.91), the situations in which the licence expires is established. In some cases this process can assist in avoiding some scenarios in which sources could become abandoned.

10.2. REGULATORY CONTROL

The Radiological Protection Act and Ordinance define the Federal Office of Public Health (BAG) as the general licensing authority for medical, industrial and research activities. For nuclear installations, activities carried out in the Paul Scherrer Institute (PSI) and the radioactive waste of nuclear installations, the licensing authority is the Federal Office of Energy, from which the Nuclear Safety Inspectorate (HSK) is part. At least three Advisory Committees are involved also in the licensing process concerning radiation protection: The Swiss Federal Nuclear Safety Commission (KSA), the Swiss Federal Committee for Radiation Surveillance (KUeR) and the Swiss Federal Committee for Radiation Protection (EKS).

The Swiss Federal Nuclear Safety Commission (KSA) is an advisory committee to the Federal Council and the Federal Department of Environment, Transport, Energy and Communication for questions involving radiation protection aspects (in addition to nuclear safety) in the licensing process.

The Swiss Federal Committee for Radiation Surveillance (KUeR) has the function of issuing its opinion on environment's radioactivity, the results of the environmental monitoring and the resulting radiation dose for the population (See paragraph 10.6).

The Swiss Federal Committee for Radiation Protection (EKS) gives its opinion on the interpretation and appraisal of international recommendations in radiation protection and setting up “further development of uniform principles for the application of radiation protection measures” (art. 9 of Radiation Protection Ordinance). For further information see paragraph 10.8.

10.2.1. Good Practice

- (1) **BASIS** - According with the SS-50-C-G (Rev 1) and Draft Requirements to supersede it, entitled Code on the safety of nuclear power plants: governmental organization, states that “the government or the regulatory body can choose to give formal structure to the processes by which expert opinions and assistance are provided to the regulatory body”. The new draft is finishing with the following statement: “Any advice offered shall not relieve the regulatory body of its responsibilities for making decisions and recommendations”.
 - a) **Good Practice: The Swiss Federal Committee for Radiation Surveillance (KUeR) and the Swiss Federal Committee for Radiation Protection (EKS), created in the field of radiation protection, have a valuable role in Switzerland in terms of criteria harmonization, quality assurance and overview opinions.**

10.3. OPTIMIZATION PRINCIPLE

The Optimization principle for practices is not included in the Radiological Protection Act (SR 814.50, 22.03.91). In art. 6 of the Radiological Protection Ordinance (SR 814.501, 22.06.94) provides guidelines on determining if optimization has been considered. It does not provide definition for the term. The principle only apply to those activities leading dose exceeding 0.1 mSv for occupational exposure and 0.01 mSv for the public. Provisions for dose constraints have been defined, especially for the public, in art. 7 of the Radiological Protection Ordinance.

There exists a reporting requirement for jobs with a predicted collective dose of more than 50 Person-mSv (HSK R-15). Typically, the nuclear power plants apply this requirement to 2 or 3 tasks per year, and the optimization review varies from plant to plant where it ranges from a checklist to a thorough analysis that include cost-benefit analysis.

There are no requirements from HSK concerning optimization organizational aspects, and there are not established optimization committees and optimization Coordinators in NPPs.

10.3.1. Recommendations and Suggestions

- (1) **BASIS** - IAEA Fundamentals on Radiation Protection and the Safety of Radiation Sources, par. 4.9 (SS-120): “*In relation to exposures from any particular source within a practice, except for medical exposures in radiodiagnosis and radiotherapy, protection and safety shall be optimized in order that the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposures all be kept as low as reasonably achievable, economic and social factors being taken into account, with the restriction that the doses delivered to individuals by the source be subject to dose constraints*”.
- a) **Recommendation:** The definition of the optimization principle as it is presented in the international standards should be included in the Swiss legislation at the appropriate level.
 - b) **Suggestion:** The current value of 50 Person-mSv is relatively high, HSK should consider reducing the collective dose threshold for the reporting requirement.
 - c) **Suggestion:** HSK should provide guidance to NPPs concerning a standard format for analyzing optimization planning.
 - d) **Suggestion:** HSK should consider the possibility of requiring a specific optimization structure or explicit responsibilities in the existing NPP organization.

10.3.2. Good Practice

- a) **Good Practice:** The collective dose of the Swiss NPP are within the lowest in world-wide context, taking into account their design, age and technology. Therefore, the practical implementation of optimization criteria are applied on a regular basis.

10.4. INVENTORY OF SOURCES

The Nuclear Safety Inspectorate (HSK) is responsible for the regulation and supervision for nuclear installations and activities carried out in the Paul Scherrer Institute (PSI), and the Federal Office of Public Health (BAG) is responsible for those operations where it is the public that requires protection, particularly medical, research and education. For those activities where the employee requires protection, above other considerations, the Swiss National Accident Insurance Organization is responsible for regulatory matters.

There is an adequate process in place to ensure that the regulatory body receives notification of all radiation sources in the country and the lists are updated yearly. However, as the licence holders are regulated by different agencies according to its activity, at least two different inventories are maintained in Switzerland: one at the HSK and another at the BAG. The legislation does not ensure that there are no gaps in responsibility or undue overlap, and this could lead to a small amount of duplication and there may be some sources which are not registered.

10.4.1. Recommendations and Suggestions

- (1) **BASIS** - IAEA Fundamentals on Radiation Protection and the Safety of Radiation Sources, par. 6.10 (SS-120): “*a system of source security comprising measures to prevent loss, theft, damage or unauthorized use of sources is an important aspect of safety. An inventory of sources shall be maintained and periodic checks conducted to confirm that they are in their assigned locations and are secure*”.
- a) **Recommendation:** In order to avoid any possibility of duplication or any missing sources due to some gap in the responsibility, the Government should consider the establishment of a mechanism to cross the information between the two existing national inventories or the establishment of a central source inventory.

10.5. ENVIRONMENTAL PROTECTION

The HSK, through art. 104 of Radiological Protection Ordinance (SR 814.501, 22.06.94), is in charge of monitoring the ionizing radiation and radioactivity in the vicinity of nuclear installations and PSI, whilst the Federal Office of Public Health (BAG) is responsible of monitoring the rest of environment. There are other organizations which are required to co-operate in establishing a programme for sampling and measurements, which include the National Accident Insurance Organization (SUVA), the National Alarm Center and the Cantons. There is not an explicit obligation in the legislation for the operators of NPP to carry out any measurement in the vicinity of the plant, although some articles of the Radiological Protection Ordinance can be interpreted in this sense. Nevertheless, the NPP participates in these programmes.

SUeR defines, within an attachment of HSK plant specific rules, the complete monitoring program for a particular plant (or PSI) which includes the requirements for the measuring devices, how the measurements are to be performed and which measurement and sampling are assigned to each organization. The environmental surveillance includes dose rate around the plants and regular sampling and measurements of air, water, soil, plants and foodstuff.

In addition, HSK performs supplemented measurements of the emissions from the plants and compares the actual emission data with the limits stated in the licence. They also calculate the dose from the measured emissions for persons in the vicinity of the plant, and compare with the source related dose guideline value.

The HSK guideline R-11 establishes a source related dose value of 0.3 mSv per year for each NPP. In accordance with this guidance, plant emissions shall not cause a corresponding dose than 0.2 mSv per year, leaving a maximum of 0.1 mSv per year due to direct radiation. The HSK guide R-41 defines the model and parameters for the calculation of doses due to emissions.

The results of the actual emission data, the dose estimation and a summary of the results of the environmental radiation surveillance is published in the annual report of the Federal Office of Public Health and submitted to the Swiss Federal Committee for Radiation Surveillance (KUEr). A German Technical Society is performing regular intercomparison with the Swiss environmental surveillance.

10.5.1. Recommendations and Suggestions

- (1) **BASIS** - In accordance with the IAEA SS-115, International Basic Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, and according with the generally acceptable international practice, the licensees are responsible to establish and perform an environmental monitoring programme.
- a) **Recommendation: HSK should consider a requirement for the NPP to implement a monitoring programme for the areas immediately surrounding the NPP.**

10.6. EMERGENCY PREPAREDNESS

Within the emergency preparedness system established in HSK headquarters emergency center, it is possible to receive current information on the radiological situation around any NPP (mainly dose rates), through the automatic transmission system (MADUK). In addition this system is connected with the HSK and NAZ personnel paging system. If any abnormal incident occurs that provokes dose rates over a threshold level, a signal is automatically activated in the paging system and the on duty group is alerted.

Up to 25 plant parameters from each of the Swiss NPP can be accessible for HSK, as required, via the ANPA system. The Accident Diagnostic Analysis and Management system (ADAM), now being developed, will provide the HSK emergency organization a support for interpretation of the ANPA data and indicate how the accident is developing and what its consequences may be. This system uses simplified plant specific models and can determine the current plant status using ANPA data.

10.6.1. Good Practice

- a) **Good Practice: The Automatic Transmission System (MADUK) is connected with the HSK and NAZ personnel paging system. If any abnormal incident occurs that provokes dose rates over a threshold level, a signal is automatically activated in the paging system and the on duty group is alerted.**

10.7. DOSIMETRY SERVICES

The HSK grant accreditation of Personal Dosimetry Services when they are related to areas they regulate. At the present, there are 12 Personal Dosimetry Services in Switzerland, 5 of which are within the area regulated by HSK: 4 in NPP sites and 1 in PSI. The accreditation is valid for 5 years. Traceability is determined in individual cases by the Federal Office of Metrology (EAM). Currently, only the PSI Dosimetry Service has asked and received the corresponding certification by EAM.

Within the Federal Commission of Radiation Protection (EKS), an Expert Group of Dosimetry is in charge to perform regular intercomparison campaigns among the different

dosimetry services. This is performed yearly for external dosimetry and once each three years in the case of internal dosimetry. This Expert Group is also in charge of the review of the procedures and criteria for the certification of the Dosimetric Services.

The Federal Office of Public Health (BAG) keeps a register of doses accumulated by occupationally exposed persons in Switzerland (Central Dose Register).

10.7.1. Good Practice

- a) Good Practice: Within the Federal Commission of Radiation Protection (EKS), an Expert Group of Dosimetry is in charge to perform regular intercomparison campaigns among the different dosimetry services. This is performed yearly for external dosimetry and once each three years in the case of internal dosimetry.**

10.8. INSPECTIONS AND ENFORCEMENT

Inspections concerning radiation protection matters are focused in shutdown phases, with an objective of spending 1 day each week of the outage. Normally these inspections are planned joint with the radiation experts of the plant and they are centered on activities with a predicted dose of more than 50 Person-mSv. Other routine inspections are performed in every plant during operation in addition to specific inspections focused in special topics.

The findings of the shutdown inspections are included in the conditions of the Start-up permits.

10.8.1. Good Practice

- a) Good Practice: The inclusion of requirements from the radiation protection shutdown inspections in the conditions of the Start-up permits is a good practice to empower the HSK enforcement in this concern.**

10.9. RADIATION PROTECTION EXPERT QUALIFICATION

The need for qualified experts in radiation protection is provided in art. 6 and 16 of the Radiological Protection Act. Art. 16 and 18 of the Radiological Protection Ordinance establishes the necessary training and a final test recognized by the regulatory body.

In addition, HSK-R-37 first and more recently the Ordinance on Radiation Protection Training in Authorized Activities (15.09.98) developed the requirements for three different levels: Radiation Protection Officer (1 year experience and 6 weeks advanced course on radiation protection), Radiation Protection Technicians (3 year experience and 3 months course in radiation protection and 3 months course in management) and Radiation Protection Specialist (3 months experience in at least two different plants and 1 month RP course). HSK grants the licence and participates in the training course of these radiation protection personnel.

Furthermore, the Shift Supervisor and the Picket Engineer, who are also licensed by HSK, require radiation protection training at least at the same level than the Radiation Protection Officer. In this case, this compensate the lack of a RP qualified expert in the shift team.

10.9.1. Good Practice

- (1) **BASIS** - According with the IAEA SS-115, “*International Basic Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*”, qualified experts shall be identified and made available for providing advice on the observance of the standards. Additionally, the definition included in the glossary refers qualified expert as “*an individual who, by virtue of certification by appropriate boards or societies, professional licences or academic qualifications and experience, is duly recognized as having expertise in a relevant field of specialization*”.
 - a) **Good Practice: The implementation of three different levels of Radiation Protection Qualified Experts, licensed by HSK in the area regulated by it, goes further than safety standards of IAEA and international practices.**

11. TRANSPORT OF RADIOACTIVE MATERIAL

Expert: G.J. Dicke

HSK responsibility with regard to compliance with the regulations for the transport of radioactive material covers considerably more than can be addressed with the current resources. Attention to the highest priorities with the current resources and possibly a high level of compliance by the consignors of radioactive material shipments has prevented unacceptable occurrences. However, in case of an accident or incident with the transport of radioactive material the consequences of insufficient compliance assurance could be serious in particular if a radiation dose is involved.

11.1. LEGISLATIVE AND GOVERNMENTAL RESPONSIBILITIES

11.1.1. Applicable Regulations and Competent Authority

The applicable regulations for transport of radioactive material in Switzerland and for international transport to or from Switzerland are currently based on the 1985 Edition (as amended in 1990) of the IAEA „Regulations for the Safe Transport of Radioactive Material“ (Safety Series 6). This basis is provided through federal ordinances which prescribe the latest versions of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR regulations) for road transport, the Regulations concerning the International Carriage of Dangerous Goods by Rail (RID regulations) for rail transport, the International Civil Aviation Organization (ICAO) technical instructions for air transport, the International Maritime Dangerous Goods (IMDG) Code for sea shipments under the Swiss flag and European regulations for transport on the Rhine river (ADNR). These prescribed regulations are international regulations for the transport of all dangerous goods by the various modes of transport. Where these regulations address the transport of radioactive material they essentially use the above mentioned IAEA Transport Regulations which are applicable to all modes of transport.

The Swiss federal ordinances related to transport of radioactive material by road, rail and on the Rhine river identify HSK as the Swiss competent authority with regard to the radioactive material transport regulations. Transport of radioactive material on inland waters other than the Rhine river appears not to be covered under Swiss regulations. The ordinances which specify the applicable radioactive material transport regulations for air transport and for sea shipments under the Swiss flag do not identify the competent authority but HSK appears to be considered as the competent authority with regard to the radioactive material transport regulations in Switzerland.

11.1.2. HSK activities concerning the transport of radioactive material

Transport package design approvals

Switzerland does not manufacture Type B packages or packages for fissile material. Where such packages are required HSK validates the original package approval certificates and when fissile material is involved HSK independently checks the criticality assessment.

Shipment approvals

Shipment approvals, as required for shipment of Type B(M) packages, for packages containing fissile material and shipments under special arrangement are issued by HSK. HSK specifies the compensating measures applicable to special arrangement shipments.

Each shipment of fresh or spent nuclear fuel as well as the import or export of nuclear fuel is subject to authorization under Nuclear Law by the Federal Office of Energy (BFE). A certificate of compliance (with the transport regulations) issued by HSK is a prerequisite for BFE to grant their authorization.

Authorization to Transport Radioactive Material

In addition to approvals for shipments of radioactive material when required there is also the need for those involved in transporting radioactive material to be authorized to transport these materials. Authorization to transport radioactive material is issued by HSK for NPPs and by the Office of Public Health for other organizations. The conditions for authorization by HSK are outlined in article 76 of the Radiological Protection Ordinance (22 June 1994). These conditions include the requirements for a QA system for the transport of radioactive material which needs to be approved by HSK.

Inspections

Inspections have been made, mostly during the preparation of shipments of spent fuel. Shipment approvals for high activity materials such as spent fuel require that there are detailed procedures for the preparation of such shipments. Such procedures facilitate a thorough inspection.

Other Activities (including Education and Training)

HSK participates in working groups of international organizations involved in the development of the radioactive material transport regulations. HSK is involved in training courses given by PSI for persons responsible for the transport of radioactive materials. HSK ensures dissemination of mutual information between Swiss authorities involved in the transport of radioactive material and HSK gives advice to anyone having questions concerning the transport of radioactive material.

11.1.3. Competent authority responsibilities according to the IAEA transport regulations

The IAEA transport regulations, (Safety Series 6, 1985 Edition as amended in 1990) (paragraph 103) state that “Transport shall be deemed to comprise all operations and conditions associated with and involved in the movement of radioactive material; these include the design, fabrication and maintenance of packaging and the preparation, consigning, handling, carriage, storage in transit and receipt at the final destination of packages. Transport includes normal and accident conditions encountered in carriage and in storage during transit”.

In paragraph 107 it is stated that “Quality assurance involves plans and actions byand competent authorities to ensure that all requirements applicable to packages and consignment are properly met. Compliance assurance involves reviews, inspections and other actions aimed at confirming that the provisions of these regulations are met in practice”.

Paragraph 116 states „Competent authority shall mean any national or international authority designated or otherwise recognized as such for any purpose in connection with these Regulations”.

11.1.4. Consignor responsibilities

Consignor responsibilities are very important responsibilities because if properly taken care of as required by the regulations, then most requirements of these regulations have been met. According to paragraph 448 of the IAEA transport regulations, the consignor shall include in the transport documents a declaration in the following terms or in terms having an equivalent meaning:

“I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled, and are in all respects in proper condition for transport by (insert mode(s) of transport involved) according to the applicable international and national governmental regulations.”

11.2. Recommendations and Suggestions

The following recommendations are based on the above mentioned requirements specified in the IAEA Regulations for the Safe Transport of Radioactive Material, 1985 Edition as amended in 1990. These requirements are also incorporated in the above mentioned regulations applicable to transport of radioactive material in Switzerland.

- (1) **BASIS** - The responsibilities of the Competent authority with regard to transport of radioactive material, as specified in the IAEA transport regulations require considerably more activities than can be carried out by HSK with the limited resources available (80% of one person and 20% of another person). Addressing the highest priority areas, essentially related to the transport of high activity material (fuel) required for the operation of the NPPs, is very important but is not sufficient. It takes care of only a small percentage of all shipments of

radioactive material. There are likely to be many shipments not involving NPPs. For example, the shipments of radioactive sources used for medical, industrial, educational and research applications.

- a) **Recommendation:** HSK should address and fulfill its full range of competent authority responsibilities concerning the transport of radioactive material not related to NPPs.
- b) **Suggestion:** HSK has the competent authority responsibility with regard to the radioactive material transport regulations concerning all who are authorized to transport radioactive material in Switzerland. It is recognized that significant resources may be required with regard to this responsibility. If the work involved cannot be carried out within the resources of HSK then the required activities should be delegated to another organization or the competent authority responsibility should be shared with another organization or transferred to another organization. In case of change in responsibilities the related legal basis for these responsibilities should also be amended.

(2) **BASIS** - Most shipments of radioactive material do not require the accident resistant Type B packages and the regulatory requirements for shipments in all other prescribed packages (Excepted packages, Industrial packages Type 1, 2 and 3 and Type A packages) are such that in the event of an accident a release of radioactive contents is possible. Such release may be acceptable if all the regulatory requirements for preparation of the shipment have been met. Accidents or incidents in the transport of radioactive material will not be considered acceptable if the applicable requirements of the regulations have not been met. Although the consignor has the responsibility to meet the requirements of the regulations, the competent authority is responsible for compliance assurance, including compliance assurance with regard to the many shipments which do not involve shipments of high activity material from NPPs.

- a) **Recommendation:** HSK should fulfill its responsibilities concerning compliance by NPPs and other organizations authorized to transport radioactive material. This requires activities by HSK beyond the currently performed highest priority activities. The specific requirements for these additional activities should be determined and then be taken care of.
- b) **Suggestion:** HSK could refer to the consignor responsibilities, listed in the consignor's declaration with each shipment of radioactive material, for a good overview of the subjects for related compliance assurance activities.

(3) **BASIS** - The "understanding" with regard to responsibilities of other organizations involved may not be sufficient to deal adequately with compliance concerning the transport of radioactive material. "Understandings" may also be insufficient where competent authority responsibility is not formalized.

- a) **Recommendation:** HSK should carry out some additional formalizing of understandings with regard to responsibilities related to the transport of radioactive material.
- b) **Suggestion:** HSK should request the appropriate authorities to formalize its competent authority status with regard to the regulations for air transport of

radioactive material, for the sea transport of radioactive material under Swiss flag and for inland water transport other than the transport on the Rhine river.

- (4) **BASIS** - A complete assessment of regulatory efficiency with regard to the transport of radioactive material requires that there is also assessment of the implementation of the regulations by the users.
- a) **Suggestion: HSK should arrange for the review of implementation of the transport regulations by one or more organizations authorized to transport radioactive material in order to obtain a more complete assessment of the regulatory effectiveness in this area.**

12. INTERFACE AUTHORITY UTILITY

Experts: A. Carnino and H. Eichenholz

For dealing with this aspect, interviews were conducted at two NPPs with Plant Directors and with the Head of HSK.

12.1. EXCHANGE OF INFORMATION MEETINGS

Two meetings per year are conducted at the top management level, general manager of NPP, plant director and deputy -Head of HSK and his deputies and, as necessary, representative of the utility Board of Directors.

Meetings are also regularly conducted at lower levels of management such as:

- operation meeting two-times per year comprising senior staff and plant director and senior staff of HSK;
- more frequent meetings between department/division heads (mechanical, electrical...).

All meetings have an agenda and a report is established which may request actions from the NPPs. These meetings are considered to be very useful and leading to an open exchange of information and eventually to decisions.

The process could be further improved by increasing the lead time for the agenda preparation.

12.1.1. Good Practice

- a) Good Practice: The well established process of meetings between the HSK and the plants/ utilities in an organized and documented fashion.**

12.2. PLANT ORGANIZATION FOR SAFETY ANSWERS TO HSK

One designated plant individual is in charge of the official answers to HSK request for information, requirements. He is informed of the actions being taken by all departments and of all the information issued in response to HSK. He follows the status and backlog if necessary. The communication with HSK is judged open.

In addition there are monthly and quarterly reports written for HSK on plant safety status as required by HSK Guidelines R-15.

The responsible individual in charge reports to the plant director or his deputy.

Each plant has a Safety Advisory Committee whose role is to advise the plant director on safety matters. The Committee, as such, has no direct contact with HSK, although every member can individually contact HSK. It is informed of HSK requests and decisions. The composition of the Committee varies essentially in the fact that another NPP representative is invited as a full member or not. Usually also a member of the utility Board of Directors is sitting on the Committee.

12.3. INFLUENCE OF ELECTRICITY MARKET DEREGULATION

It seems that the current electricity production costs are low enough that unreasonable pressure does not appear to exist, although some studies or discussions with HSK are taking place for further savings or cost reductions. Safety is nevertheless affirmed as being a priority. The Boards of directors of the companies as described by senior plant management support the safety financing needs.

HSK should stay vigilant on this issue in the future in order to ensure that deterioration of this priority to safety has not and will not occur.

12.4. MAINTAINING COMPETENCE

There is presently no problem in recruiting technical qualified people on the utility side.

There will be quite a number of retirements in the coming years but training and transfer of knowledge is actively being addressed. The plant staff has usually done their careers within the utility and has been the case ever since the construction or operation of the NPP.

There are very few examples of exchange of personnel between utilities and HSK. The HSK staff should consider acquiring a more in depth knowledge in plant operation and operational safety through additional exchanges with other countries' NPPs in operation, especially those that reflect similar culture and constraints. Such experience is really necessary for HSK to reinforce its credibility and respect by the NPP staff.

12.5. REGULATORY APPROACH

For the utilities, HSK is clearly recognized as the Regulatory Authority and the almost exclusive interlocutor in safety. The safety approach, although non prescriptive appears to be generally understood and accepted. The HSK capability in safety assessment and analysis is a recognized strength.

On the inspection programmes and execution, different opinions were expressed. On the question on the usefulness of the inspections for the utilities the answers indicated in one case that HSK inspections do not bring added value and are mainly compliance checking by inspectors who are not always experienced enough to be self-confident and inspections are too numerous as well as paper work inducing. In the other case, the inspections are seen as positive, combining compliance and performance checking. Obviously, HSK is tolerated but not needed in the first case, the utility estimating itself as self sufficient in safety matters while the second is considering HSK as a useful process for ensuring safety in addition to the plant safety programme and performance. It is difficult to understand why both utilities could describe the regulatory body in such different light and therefore any judgment on this matter would be indeterminate.

The inspection report is sent for comments to the plants. HSK should reconsider this practice which can be seen as giving the impression that its inspectors are not competent. This issue is being addressed in the area of Inspection and Enforcement.

12.5.1. Recommendations and Suggestions

- (1) **BASIS** - The number of inspections performed at each plant by HSK inspectors is not homogenous without an obvious link to a safety concern. There is a certain reluctance to inspect plants that are very confident of their operational capabilities and who challenge HSK on its findings. In a longer term, this could lead other NPPs to adopt the same approach with HSK.
 - a) **Recommendation:** **HSK should make sure that all NPPs receive an appropriate and similar level of attention directed at actual operational safety performance unless special concerns need to be addressed at a given NPP.**

12.5.2. Recommendations and Suggestions

The adequacy of the HSK inspection programme and inspection personnel performance is addressed in recommendations contained in the area of Inspection and Enforcement.

12.5.3. Recommendations and Suggestions

- (1) **BASIS** -It is usually recognized internationally that regulatory inspections bring an added value to the plant operational safety.
 - a) **Recommendation:** **HSK should initiate an internal performance improvement programme in a timely manner to demonstrate the added value brought forward by their regulatory inspections in operational safety.**
- (2) **BASIS** - HSK through its present supervision does not appear to construct a global evaluation of the overall operational safety of each installation.

- a) **Recommendation:** The performance improvement programme recommended above should also establish provisions for an integrated and comprehensive safety performance of each individual NPP.

12.6. SAFETY CULTURE

The utilities have analyzed the KSA report on Safety culture. It resulted in one case to no direct action plan, but in the other, in combination with recommendations of a previous review mission, an action plan was developed, implemented and leads to improved safety culture behavior of personnel.

HSK has also contracted the Bern University for producing a report on guidance for safety culture assessment and enhancement. After 2 years of effort including interviews at plant level, the work is still in progress and is already being thought as too theoretical and lacking practical value.

Openness to international safety reviews is a sign of safety culture and the answer indicated at a given plant showed such reviews as inevitable although not needed. This in itself is a concern because unless a utility enters the process in an open minded and positive approach, the benefits will be minimal and short lived. HSK should keep a view on utilities that view matters in this fashion.

12.6.1. Recommendations and Suggestions

- (1) **BASIS** - Safety culture is internationally recognized as a major contributor to safety in operations. It is international good practice to have the NPPs performing their self assessment levels and achievements in safety culture. The federal government has only requested a safety culture assessment of one NPP on the occasion of the last operating licence for KKBII. It followed a recommendation of KSA, made in a KSA report on safety culture in February 1997 for all Swiss NPPs.
 - a) **Recommendation:** HSK should request all NPPs to perform their own safety culture assessment and report to HSK on the evaluation.
 - b) **Suggestion:** HSK should develop an approach to an independent evaluation of plants safety culture.

**ANNEX I - LIST OF DOCUMENTS SUBMITTED TO THE
IRRT IN ENGLISH**

| Art of document | Title | |
|------------------------|--|--|
| | | |
| Laws | | |
| 1 | Atomic Energy Act <i>Atomgesetz</i> | Federal Act on the Peaceful Use of Nuclear Energy (Atomic Energy Act), as at 1 st January 1996 <i>Bundesgesetz über die friedliche Verwendung der Atomenergie (Atomgesetz), Stand am 1. Januar 1996</i> |
| 2 | Federal Decree 1978 (complement to Atomic Energy Act) <i>Bundesbeschluss zum AtG, 1978</i> | Federal Decree with respect to the Atomic Energy Act (dated of 6 th October 1978) <i>Bundesbeschluss zum Atomgesetz (Vom 6. Oktober 1978)</i> |
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| | Ordinances | |
| 3 | Supervision (HSK) <i>HSK-Verordnung</i> | Ordinance concerning the Supervision of Nuclear Installations of 14 th March 1983 <i>Verordnung betreffend die Aufsicht über Kernanlagen vom 14. März 1983</i> |
| 4 | Advisory Committee KSA <i>KSA-Verordnung</i> | Ordinance on the Federal Nuclear Safety Commission of 14 th March 1983 <i>Verordnung über die Eidgenössische Kommission für die Sicherheit von Kernanlagen vom 14. März 1983</i> |
| 5 | Emergency preparedness <i>Notfallschutz</i> | Ordinance on the Emergency Protection in the Vicinity of Nuclear Installations, as at 1 st October 1987 <i>Verordnung über den Notfallschutz in der Umgebung von Kernanlagen, Stand am 1. Oktober 1987</i> |
| 6 | Fees <i>Gebührenverordnung</i> | Ordinance on the Fees in the Field of Nuclear Energy, as at 30 th September 1997 <i>Verordnung über die Gebühren auf dem Gebiet der Kernenergie, Stand am 30. September 1997</i> |
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| | HSK Guidelines | |
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| 7 | HSK-R-011/e | HSK Guideline: Objectives for the Protection of Persons against Ionising Radiation in the Area of Nuclear Power Plants, Reprint January 1993, <i>Ziele für den Schutz von Personen vor ionisierender Strahlung im Bereich von Kernkraftwerken, Neudruck Januar 1993</i> |
| 8 | HSK R-15/e (including new Table 1) | HSK Guideline R-15: Reporting on the Operation of Nuclear Power Plants, August 1996 (including new Table 1 „Criteria for reportable occurrences“) <i>HSK Richtlinie R-15: Berichterstattung über den Betrieb von Kernkraftwerken, August 1996, mit Tabelle: Kriterien für meldepflichtige Vorkommnisse</i> |
| 9 | HSK-R-30/e (Text including only Annex 2) | HSK Guideline R-30: Supervisory Procedures for the Construction and Operation of Nuclear Installations, Reprint January 1993, with Annex „Survey of the Licensing and Supervisory Procedures for Nuclear Power Plants“ <i>HSK Richtlinie R-30: Aufsichtsverfahren beim Bau und Betrieb von Kernanlagen, Neudruck 1993, mit Anhang „Übersicht über das Bewilligungs- und Aufsichtsverfahren bei Kernkraftwerken“</i> |
| | Licences granted by the government | |
| 10 | Operating Licence for KKB II (1 st December 1994) <i>Betriebsbewilligung 01.12.94</i> | Decision of the Federal Council on the Operating Licence for the Beznau II NPP of 1 st December 1994 <i>Bundesrat-Bewilligungsbescheid für KKB II vom 1. Dezember 1994</i> |
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| | HSK Releases (execution permits) | |
| 11 | NOK/KKB Application for HSK release concerning installation <i>KKB-NOK-Brief-Montagefreigabe</i> | Letter from NOK to HSK: Beznau NPP, Units 1 and 2 Pending item 95-051: Replacement of the Nuclear instrumentation, Application for the Release for Installation, 28 th January 1998 <i>Brief von NOK an HSK: Kernkraftwerk Beznau, Block 1 und 2 Pendenz 95-051: Ersatz Nuklearinstrumentierung: Antrag um</i> |

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| | | <i>Montagefreigabe, 28. Januar 1998</i> |
| 12 | HSK Release for Installation at KKB <i>KKB, Montagefreigabe</i> | from HSK to NOK (Beznau NPP, Release for Installation), 31 st March 1998 <i>von HSK an NOK (KKB, Montagefreigabe), 31. März 1998</i> |
| 13 | HSK Concept release for backfitting at KKG <i>KKG-Koordinatenfahrwerk</i> | HSK Letter to the Gösgen NPP: Backfitting of the Refuelling Device with a Co-ordinate Travelling Gear: Concept Release, 15 th July 1998 <i>HSK Brief an KKG: Nachrüstung der Brennstabwechselvorrichtung mit einem Koordinatenfahrwerk: Konzeptfreigabe, 15. Juli 1998</i> |
| 14 | HSK Release for use of special fuel assemblies (KKL) <i>Freigabe des Einsatzes von BE im KKL</i> | HSK Letter to the Leibstadt NPP: Release for the Use of Precursor Fuel Assemblies of the SVEA-96/L OPTIMA Type, <i>HSK Brief an KKL: Freigabe des Einsatzes von Vorläuferbrennelementen des Typs SVEA-96/L OPTIMA,</i> |
| 15 | HSK Release for new startup at KKG (1998) <i>KKG-Freigabe nach Revision und BW</i> | HSK Letter to Gösgen NPP: Release for Restart after Revision and Refuelling in 1998 <i>HSK Brief an KKG: Freigabe Wiederinbetriebnahme nach Revision und Brennstoffwechsel 1998</i> |
| 16 | HSK Release for new startup at KKL (1997) <i>KKL-Freigabe Betriebszyklus</i> | HSK Letter of Release to the Leibstadt NPP for the 14 th Operating Cycle after the Revision Outage and Refuelling in 1997, 11 th September 1997 <i>HSK Freigabebrief an KKL für den 14. Betriebszyklus nach dem Revisionsstillstand und Brennstoffwechsel 1997, 11. September 1997</i> |
| 16 bis | KKL Application to HSK Release for new start up at KKL (1998) <i>KKL-Antrag auf Freigabe für Betriebszyklus nach Revision 1998</i> | Application for release for the 15 th operating cycle after revision in 1998 (19 August 1998) <i>Antrag auf Freigabe für den 15. Betriebszyklus nach Revision 1998 (19. August 1998)</i> |
| | Inspection reports | |
| 17 | KKB II Revision 1998 <i>Revisionsstillstand 1998 im KKB 2</i> | Inspection Report of the HSK on the Revision Outage 1998 at the Beznau II NPP, 4 th August 1998 <i>HSK Inspektionsbericht: Revisionsstillstand 1998 im KKB 2, 4. August 1998</i> |
| 18 | KKM Modification of Recirculation Pumps | HSK Inspection Report: Mühleberg NPP, Modification of the Reactor Recirculation Pumps, 31 st August 1998 |

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| | <i>KKM Umbau Reaktorumwälzpumpen</i> | <i>HSK-Inspektionsbericht: KKM, Umbau der Reaktorumwälzpumpen, 31. August 1998</i> |
| 19 | KKM radiological protection during outage 1998 <i>KKM-Stillstand-1998</i> | HSK Memo: Outage Mühleberg NPP 1998 - Radiation Protection Inspection, 27 th August 1998 <i>HSK Memo: Stillstand KKM 1998 - Inspektion Strahlenschutz, 27. August 1998</i> |
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| Modifications, Backfitting | | |
| 20 | KKB Nuclear instrumentation <i>KKB-Tabelle- Nuklearinstrumentie- rung</i> | Table: Replacement of the Nuclear Instrumentation at the Beznau NPP; Source and Intermediate Range, Rev. 1 dated 26 th March 1998 <i>Tabelle KKB/Ersatz der Nuklearinstrumentierung Quell- und Zwischenbereich, Rev. 1 vom 26. März 1998</i> |
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| Experience feedback, (information requirements, advices) | | |
| 21 | Oskarshamn | HSK to Beznau, Gösgen, Leibstadt, Mühleberg NPPs (Oskarshamn), 13 th January 1998 <i>HSK an KKB, KKG, KKL, KKM (Oskarshamn), 13. Januar 1998</i> |
| 22 | Oskarshamn | Letter from the Leibstadt NPP to HSK: Event in Oskarshamn, IRS-Report No. 7066 of the IAEA, Unavailability of a Safety System during Restart, 5 th March 1998 <i>Brief von KKL an HSK: Ereignis in Oskarshamn, IRS-Bericht Nr. 7066 der IAEA, Nichtverfügbarkeit eines Sicherheitssystems beim Wiederanfahren, 5. März 1998</i> |
| 23 | Oskarshamn | HSK to Leibstadt NPP (Oskarshamn), 17 th April 1998 <i>HSK an KKL (Oskarshamn), 17. April 1998</i> |
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| KSA Safety Statements | | |
| 24 | KSA 15/147-e Table of Contents Chapter 2 Chapter 8 | Statement on the Application for a Permanent Operating Licence for the Beznau NPP, Unit II, April 1994 - Table of Contents |

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| | <p>Chapter 9 <i>Inhalt</i> <i>Kap. 2</i> <i>Kap. 8</i> <i>Kap. 9</i></p> | <p>Chapter 2 - State of the Art Chapter 8 - Statement on the Expert Opinion of the HSK Chapter 9 - Summary and Conclusions</p> <p><i>Stellungnahme zum Gesuch unbefristete Betriebsbewilligung für KKBII von April 1994</i></p> <p><i>Inhaltsverzeichnis</i> <i>Kapitel 2 - Stand der Wissenschaft und Technik</i> <i>Kapitel 8- Stellungnahme zum Gutachten der HSK</i> <i>Kapitel 9- Zusammenfassung und Schlussfolgerungen</i></p> |
| 25 | <p>KSA 21/124-e radioactive waste management, final storage <i>Entsorgung radioaktiver Abfälle</i></p> | <p>Current Issues Related to the Disposal of Radioactive Waste in Switzerland - Standpoint of the Federal Nuclear Safety Commission (KSA) 22nd September 1998 (KSA 21/124) <i>Aktuelle Fragen zur Entsorgung radioaktiver Abfälle in der Schweiz, KSA 21/124 vom 22. September 1998</i></p> |
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| | KSA Progress Report | |
| 26 | <p>KSA-AN-2013-e KSA Progress Report 1997 (including summary) <i>KSA Tätigkeitsbericht 1997</i></p> | <p>Report on the Activities of the Federal Nuclear Safety Commission (KSA) for the Year 1997 August 1998 (KSA-AN-2013) <i>Tätigkeitsbericht der KSA für das Jahr 1997 von August 1998 (KSA-AN-2013)</i></p> |

ANNEX II - SYNOPSIS OF IRRT RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Recommendations

- R.1. HSK should have the responsibility of drafting the final nuclear safety licence of any decision concerning nuclear installations.
- R.2. The independence of the Regulatory Body should be ensured in a reorganization of governmental supervisory bodies. The Atomic Energy legislation should be revised accordingly.
- R.3. A more independent position should be given to HSK with added legal staff.
- R.4. HSK should be enabled to discuss directly its budget with the department in charge of finance. Then, according to this accepted budget, the level of fees should be established.
- R.5. All staff of HSK should be well aware of the legal enforcement powers of HSK. HSK should establish additional procedures for enforcement and designate the level at which enforcement decisions can be made.
- R.6. HSK shall have the formal authority to represent Switzerland in foreign organizations (like the Department of Nuclear Safety -NS- of the IAEA) or in exchanges with other foreign regulatory bodies in matter concerning safety.
- R.7. In any reorganization of the regulatory body KSA should be retained as the advisory committee to the Federal Council and in addition in the future be also the advisory committee to the regulatory body.
- R.8. A review of the resources of the HSK Sections should be performed taking into account the duties and responsibilities of those sections.
- R.9. Full-time Section Heads should be nominated to all HSK Sections to strengthen the line management of the Divisions in question.
- R.10. The research funding available to the HSK has been decreasing in recent years. To maintain the nuclear expertise, which is important also from HSK's point of view, adequate research funding should be provided by the Government for nuclear and radiation safety research.
- R.11. While the present situation for licensing continues, the licence should, in one of its paragraphs, make explicit reference to the Safety Evaluation Report (SER) of HSK and to the KSA statements, so that all recommendations or requirements can be pursued through the permit process.
- R.12. HSK should establish formal general safety requirements for all topics related to licensing stages. HSK should therefore issue additional guidelines on a priority basis on topics,

such as: Quality Assurance, Fire Safety, Seismic Design, Decommissioning and Periodic Safety Reviews.

- R.13. HSK should send the guideline defining PSR requirements to all licencees and should indicate the exact dates at which the next PSRs are to take place.
- R.14. Taking into account the number and type of Swiss NPPs, HSK should increase the human resources available to the Reactor Design and Safety Analysis Division, RST Section in particular, considering the extent, diversity and highly specialized activities.
- R.15. HSK should ensure that the licensee should provide them with reports of the national and international operating experience analysis. Actions applicable to Swiss plants should be assessed and agreed by HSK.
- R.16. HSK should develop and implement an Inspection Program that is both systematic and comprehensive in nature.
- R.17. HSK should ensure that their inspection program has an appropriate focus on operational safety issues so that its implementation will provide an effective verification of the level of operational safety performance established at an NPP.
- R.18. HSK should assess inspection resource in a manner that takes into the account the integrated nature of their supervisory responsibilities. Specific attention to resource needs should address the elements of program development, monitoring the effectiveness of inspection oversight, the development of personnel competencies, and reactive inspections for event follow-up at the sites.
- R.19. During the development of the comprehensive and systematic inspection program (as recommended elsewhere), HSK should determine the training and development program necessary to meet program goals and objectives; ensure that the personnel who perform inspections are appropriately trained and qualified in effective methods of inspection, and maintain technical competence.
- R.20. HSK should develop a plan to address the loss of personnel due to retirements. This plan should also take into account the issue of loss of nuclear competence within the country given the current stagnation in the NPP industry.
- R.21. HSK should provide specific and detailed guidance for the approach, conduct, methods, and expectations necessary to be carried out for inspections. Additionally, this guidance should ensure that a proper level of supervisory attention is focused on the selection of HSK personnel that employ the proper inspection and technical competencies.
- R.22. HSK should review its current guidance on the production of inspection reports.
- R.23. HSK should improve the technical accuracy of inspection reports and stress the necessity for improved performance by inspection personnel in this area.
- R.24. HSK should generate an Enforcement Policy that clearly lays out the practices and procedures to be followed by HSK personnel for the implementation of enforcement actions that are used to ensure compliance by licensees with regulatory requirements.

- R.25. HSK should develop adequate guidelines for inspection personnel performance when potential safety issues or potential non-compliance with licenced conditions are identified during the conduct of inspections. These guidelines should reinforce the principle that the licensee is responsible for safety.
- R.26. In the future Nuclear Energy Act under preparation, or in some other relevant law or ordinance, a clear authorization to HSK to issue guidelines should be presented to clarify and strengthen the role and status of the HSK Guidelines.
- R.27. The process for preparation of the HSK Guidelines should be documented in the internal guides of HSK. HSK should review existing guidelines and should make plans to update them, if necessary, and to assess the need to expand the scope of guidelines. Greater management attention should be paid to the issue.
- R.28. HSK should pursue the timely implementation of the new Federal Concept for Emergency Planning in the Vicinity of NPPs.
- R.29. HSK should require that an exercise of all on-site nuclear emergency response functions at the NPP is undertaken annually.
- R.30. A consistent waste classification system should be established for all facilities and activities generating nuclear waste within Switzerland. Definitions for waste types within the classification system should be developed by HSK.
- R.31. A policy should be clarified concerning regulation and control of old historical waste or orphaned sites. Responsibilities should be defined and authorities clearly established.
- R.32. HSK should review and evaluate KSA's recommendation concerning the further delay in the development of the high level waste depository.
- R.33. A formal funding system for final waste disposal activities similar to that implemented for decommissioning should be established.
- R.34. HSK should establish and provide appropriate resources for a formal group within its organization with the responsibility to monitor decommissioning activities and provide project management for reviewing regulatory required decommissioning documents and inspection of decommissioning projects.
- R.35. HSK should identify the necessary documents that are required to support the licensing requirements for decommissioning.
- R.36. The definition of the optimization principle as it is presented in the international standards should be included in the Swiss legislation at the appropriate level.
- R.37. In order to avoid any possibility of duplication or any missing sources due to some gap in the responsibility, the Government should consider the establishment of a mechanism to cross the information between the two existing national inventories or the establishment of a central source inventory.
- R.38. HSK should consider a requirement for the NPP to implement a monitoring programme for the areas immediately surrounding the NPP.

- R.39. HSK should address and fulfill its full range of competent authority responsibilities concerning the transport of radioactive material not related to NPPs.
- R.40. HSK should fulfill its responsibilities concerning compliance by NPPs and other organizations authorized to transport radioactive material. This requires activities by HSK beyond the currently performed highest priority activities. The specific requirements for these additional activities should be determined and then be taken care of.
- R.41. HSK should carry out some additional formalizing of understandings with regard to responsibilities related to the transport of radioactive material.
- R.42. HSK should make sure that all NPPs receive an appropriate and similar level of attention directed at actual operational safety performance unless special concerns need to be addressed at a given NPP.
- R.43. HSK should initiate an internal performance improvement programme in a timely manner to demonstrate the added value brought forward by their regulatory inspections in operational safety.
- R.44. The performance improvement programme recommended above should also establish provisions for an integrated and comprehensive safety performance of each individual NPP.
- R.45. HSK should request all NPPs to perform their own safety culture assessment and report to HSK on the evaluation.

Suggestions

- S.1. The Statement of the advisory Commission KSA should be sent by the Federal Department of Environment, Transport, Energy and Communication to HSK for consideration in the drafting of the licences.
- S.2. Policies of the Government that could conflict with the assigned responsibilities of the regulatory body should not be applied to the regulatory body; thus general decisions of reducing staff of public offices or level of taxes recovered by State Departments should only be applied to the nuclear safety regulatory body if they do not jeopardize its efficiency and capability.
- S.3. Fees should be imposed to all operating organization, private, public, international or scientific. In case of difficulties some special budget could be provided to organizations that have difficulties for paying their fees.
- S.4. HSK should consider having some legal staff or allocate a staff member the responsibility for enforcement matters in order to be able to deal with enforcement matters and train HSK personnel in them.
- S.5. The first steps to introduce formal QA within the activities of the HSK, in addition to the on-going project, should be to start preparing a QA Manual and internal audits to establish whether existing internal guidelines are followed.

- S.6. HSK should consider self-assessment seminars for the whole staff. The purpose of these seminars would be to assess and develop activities based on, e.g. some international or national Quality Award Criteria and/or organizational assessment methods.
- S.7. The HSK should consider ways to increase the participation of staff and corresponding resources in the nuclear safety assistance programmes, because they provide possibilities for learning.
- S.8. HSK and KSA should establish a formal procedure to resolve discrepancies between their technical recommendations prior to the drafting of the final licence.
- S.9. For future PSRs effective arrangements should be made in order to ensure consistency. HSK should write the guideline defining PSR requirements for the next PSRs based on the experience gained in Gösgen NPP.
- S.10. The minimum achievable scope and objectives of the operating experience programme should be specified by HSK.
- S.11. To provide a clear understanding to the licensees, HSK should prioritize the pending safety issues in accordance with their safety significance.
- S.12. HSK should establish a programme to review the surveillance programme of the safety systems of NPPs. In particular, it should review the acceptance criteria and verify the exhaustiveness of the testing programme and the consistency between the testing procedures and the technical specifications.
- S.13. HSK should develop a formal and unique criterion that considers both design-basis accidents and beyond-design basis accidents or demonstrate that the current practice of using separate criteria achieves consistency.
- S.14. HSK should consider the use of Section 335 of IAEA Safety Guide 50-SG-G4 in the development of a systematic and comprehensive inspection programme.
- S.15. The focus on operational safety issues could be accomplished by specifying that this element of the inspection program is the responsibility of all HSK individuals that conduct inspections at NPPs and ensuring that specific guidance (including management expectations) is included within inspection program documents.
- S.16. HSK should consider the allocation of responsibility for the management and performance of the inspection program's operational safety verification activities to the KOA Site Coordinator.
- S.17. HSK should confer with Member States that share similarities in their nuclear power programs (philosophy, resource allocations) to identify effective policies and objectives that can be emulated at HSK for the development of a comprehensive inspection program.
- S.18. HSK should develop training profiles for each individual performing inspections, which records training experience and prescribes refresher and further training needs; conduct team-building training for HSK personnel to enhance inspection performance; and consider broadening the practice of temporary assignment of inspectors to foreign NPPs

to gain relevant operational experience and insights into the various phases of plant operations (refueling, start-up and shut-downs, etc.)

- S.19. HSK should consider discontinuing the practice of submitting draft inspection reports to the utility for comment.
- S.20. Arrangements to ensure the timely provision of public information after the sounding of the sirens in Zone 1 for all accident scenarios including those resulting in an immediate release of radioactivity should be made and tested.
- S.21. Diverse means of ensuring an alert may also be considered. Both the police and the NPP could activate the sirens and authorize the broadcast of the prerecorded public information message in the event of an immediate release of radioactivity.
- S.22. The triggering of all sirens in Zone 1 surrounding the Beznau and Leibstadt plants from one central point should be considered.
- S.23. The Ordinance on Emergency Protection (Notfallschutzverordnung) and the HSK Guidelines on design, installation, maintenance and testing of sirens should be discussed with the NPPs, cantons and communities and the Guidelines amended to reflect the agreed position.
- S.24. HSK may wish to suggest to all other emergency response organizations (e.g. NPPs, cantons, communities, NAZ, the Information Center of the Federal Chancellery, etc.) that an overall media coordination plan is agreed and rehearsed during national exercises.
- S.25. HSK, the Information Centre of the Federal Chancellery, the NAZ, cantons and communities should together identify possible locations for Media Briefing Centres. These should be in locations convenient to both the affected NPP and its appropriate cantonal authority responsible for the implementation of off-site counter-measures. In addition, testing the implementation of such facilities during national exercises should be considered.
- S.26. HSK should either require that an on-site technical exercise is undertaken annually or they may consider a modular exercise approach which takes benefit from those functions demonstrated during a security exercise and additional on-site exercises which specifically test those functions not exercised during a security exercise.
- S.27. HSK should evaluate the decommissioning cost data from a technical standpoint to determine if the activities described in the cost estimate are appropriate and the basis for the costs are appropriate. The independent commission should have the responsibility for controlling the money once they are deposited in the established fund.
- S.28. HSK should develop regulatory guidance for the format and content of key regulatory documents such as the decommissioning plan and the decommissioning cost estimates.
- S.29. The current value of 50 Person-mSv is relatively high, HSK should consider reducing the collective dose threshold for the reporting requirement.
- S.30. HSK should provide guidance to NPPs concerning a standard format for analyzing optimization planning.

- S.31. HSK should consider the possibility of requiring a specific optimization structure or explicit responsibilities in the existing NPP organization.
- S.32. HSK has the competent authority responsibility with regard to the radioactive material transport regulations concerning all who are authorized to transport radioactive material in Switzerland. It is recognized that significant resources may be required with regard to this responsibility. If the work involved cannot be carried out within the resources of HSK then the required activities should be delegated to another organization or the competent authority responsibility should be shared with another organization or transferred to another organization. In case of change in responsibilities the related legal basis for these responsibilities should also be amended.
- S.33. HSK could refer to the consignor responsibilities, listed in the consignor's declaration with each shipment of radioactive material, for a good overview of the subjects for related compliance assurance activities.
- S.34. HSK should request the appropriate authorities to formalize its competent authority status with regard to the regulations for air transport of radioactive material, for the sea transport of radioactive material under Swiss flag and for inland water transport other than the transport on the Rhine river.
- S.35. HSK should arrange for the review of implementation of the transport regulations by one or more organizations authorized to transport radioactive material in order to obtain a more complete assessment of the regulatory effectiveness in this area.
- S.36. HSK should develop an approach to an independent evaluation of plants safety culture.

Good Practices

- G.1. The agreement between the Federal Department UVEK/DETEC, the Federal Office of Energy, and HSK which allows HSK the competency to deliver, according to the situation or level of urgency, on its own behalf, press releases for affairs or events concerning safety in Switzerland.
- G.2. The publication of the expert opinion of HSK and of the statement of the advisory commission KSA in the licensing processes.
- G.3. The establishment of an advisory body staffed by senior and experienced people to provide an independent input to the assessment process.
- G.4. The thorough investigations of PSA results and the development of independent calculations capabilities, including severe accident management are achievements that go beyond normal international practices.
- G.5. Carrying out independent operating experience analyses regarding to Swiss NPPs and international experience in a systematic way at HSK by means of an ad-hoc group with different specialties in the nuclear field.

- G.6. In parallel to the co-ordination made by the KOA engineer, copies of the letter from the licensee proposing the modifications are sent to the division heads of HSK, allowing an independent check of the safety significance of the proposed modifications.
- G.7. The efforts of HSK to assess the safety of the NPPs using the combination of probabilistic and deterministic tools.
- G.8. HSK has recognised that organisational factors encompass all levels and areas of nuclear power plant operation. As such, HSK has identified that they need to be observed and recorded by safety oriented inspections that are part of the inspection programme. These include radiation protection, engineering and operational safety verifications. The HSK initiative, MOSAIC (Organisational Factor Inspection Checklist) provides a means for the individual inspectors to focus on organisational deficiencies as part of their regular inspections. MOSAIC is a systematic approach for the planning, conducting and reporting on inspections and focuses on organisational factors and has the potential to optimise inspection resources.
- G.9. When reviewing the NPP application for start-up, the HSK makes an extensive assessment of the core design, periodic testing and maintenance, modifications performed and of the radiation protection aspects.
- G.10. The Swiss Federal Committee for Radiation Surveillance (KUeR) and the Swiss Federal Committee for Radiation Protection (EKS), created in the field of radiation protection, have a valuable role in Switzerland in terms of criteria harmonization, quality assurance and overview opinions.
- G.11. The collective dose of the Swiss NPP are within the lowest in world-wide context, taking into account their design, age and technology. Therefore, the practical implementation of optimization criteria are applied on a regular basis.
- G.12. The Automatic Transmission System (MADUK) is connected with the HSK and NAZ personnel paging system. If any abnormal incident occurs that provokes dose rates over a threshold level, a signal is automatically activated in the paging system and the on duty group is alerted.
- G.13. Within the Federal Commission of Radiation Protection (EKS), an Expert Group of Dosimetry is in charge to perform regular intercomparison campaigns among the different dosimetry services. This is performed yearly for external dosimetry and once each three years in the case of internal dosimetry.
- G.14. The inclusion of requirements from the radiation protection shutdown inspections in the conditions of the Start-up permits is a good practice to empower the HSK enforcement in this concern.
- G.15. The implementation of three different levels of Radiation Protection Qualified Experts, licensed by HSK in the area regulated by it, goes further than safety standards of IAEA and international practices.
- G.16. The well established process of meetings between the HSK and the plants/ utilities in an organized and documented fashion.

ANNEX III - TEAM COMPOSITION

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| Ms. A. Carnino | IAEA, Director Division of Nuclear Installation Safety Department of Nuclear Safety |
| Mr. G. Caruso | Nuclear Regulatory Authority Argentina |
| Mr. G. Dicke | IAEA, Radiation Safety Section Division of Radiation and Waste Safety Department of Nuclear Safety |
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