Sixth International Exchange Forum on
"Safety Analysis for Nuclear Power Plants of VVER and RBMK Types (Forum-6)"
8-12 April 2002, Kiev, Ukraine

IAEA ACTIVITIES IN THE AREA OF WWER REACTOR NUCLEAR SAFETY

J. Misak, International Atomic Energy Agency, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Tel.: +43 1 2600 22007, Fax: +43 1 26007, e-mail: J.Misak@iaea.org

1. Introduction

WWER reactor safety, in particular for countries in Central and Eastern Europe, has become a very important technical, but not only technical, issue. The work of the IAEA is strictly limited to technical issues, concentrating on providing assistance to Member States in evaluating, maintaining and improving the level of nuclear safety of their WWER nuclear power plants (NPPs). The strengthening of the capabilities of national nuclear safety regulatory bodies is another essential component to help the countries achieve sustainable improvements in nuclear safety.

This paper provides an overview and some results obtained within the framework of IAEA activities performed recently or planned in the near future in the area of nuclear safety. . Special attention is devoted to those activities that are closely related to WWER reactor safety. Importance of the IAEA Extra-budgetary Programme on WWER and RBMK Safety (1991-1998) and International Conference on Strengthening of Nuclear Safety in Eastern Europe (June 1999) for concentration of IAEA activities is underlined. At present, the IAEA activities include the development of the IAEA Safety Standard Series and other safety related publications, safety services, training courses, technical meetings, extra-budgetary programmes (EBPs), co-ordinated research programmes (CRPs), and technical co-operation (TC) projects. Activities performed during the past year and envisaged for the next year are addressed in greater detail. In particular, overview of the guidance documents related to the safety analysis will be presented.

The presentation is based mainly on activities involving the staff of the Division of Nuclear Installation Safety, several of them performed in cooperation with the Department of Technical Co-operation. Nevertheless, it provides a sufficiently comprehensive overview of the broad spectrum of the IAEA's work in the area of WWER reactor safety.

2. Extra-budgetary Programme on WWER and RBMK Safety

In 1991, the Agency started the Extra-budgetary Programme on WWER and RBMK Safety to assist countries in Eastern Europe and the former Soviet Union in evaluating the safety of WWER and RBMK reactors. The programme was completed in 1998, and a final report was published by the IAEA. International consensus has been

established on the major safety issues for these reactors and their safety significance. The greater part of the EBP centred on the development of the Safety Issue Books for the different types of reactors: WWER-440/230, WWER-440/213, WWER-1000/320, and 'small series' WWER-1000, based on the safety review for these reactors. From 200 to 3100 experts participated in the EBP in different years (highest manpower involved in the EBP was in 1994). The total contributions of the EBP from donor countries exceeded 13.6 mill. USD. Within the framework of the EBP, 130 technical documents were published on WWER reactor safety. It was concluded that substantial improvements in the safety of these reactors are feasible and that it is necessary to reflect these improvements in the upgrading of the Safety Analysis Reports (SARs).

After completion of this EBP, the IAEA was requested to continue providing nuclear safety assistance within the framework of both its Nuclear Safety Programme and its TC projects. In this connection, assisting in strengthening the national nuclear regulatory authorities in the countries operating WWER NPPs was considered an important element.

The EBP also indicated the following areas where assistance was still needed:

- classification and qualification of components and systems;
- improvement of I&C;
- control rod insertion reliability;
- reactor coolant system integrity;
- containment integrity;
- physical and functional separation of safety systems;
- fire safety;
- seismic safety;
- low power and shutdown operation;
- anticipated transient without scram protection;
- severe accident analysis and management;
- operational safety; and
- safety assessment (Probabilistic Safety Assessment (PSA), SAR).

3. International Conference on Strengthening of Nuclear Safety in Eastern Europe

The International Conference on Strengthening of Nuclear Safety in Eastern Europe, organized jointly by the IAEA, EC, and NEA, was held in Vienna from 14 to 18 June 1999. The Conference was intended as a follow-up to the EBP to review the results of various international and national programmes aimed at enhancing WWER safety.

The conference discussed three key areas of nuclear safety:

- regulatory aspects of NPP safety;
- status of safety improvements; and
- status of SARs.

The conference provided a comprehensive overview of the present situation and future plans in the field. It was reconfirmed that considerable progress had been made, particularly in the efforts to strengthen the independence and technical competence of nuclear regulatory authorities. With respect to the operators of the NPPs, these had also demonstrated clear progress in operational safety improvements. The implementation of design safety improvement programmes was recognized, although the level achieved in different countries varied significantly; implementation was affected primarily by individual economic conditions. In the conclusions of the conference it was stated that consistency in approaches was advisable and could be reached through a systematic exchange of information among the East European countries. The Agency should contribute to further strengthening such an exchange of information.

The conference also indicated areas where assistance, at least in some countries, is still needed. These include:

- further strengthening of regulatory bodies;
- analysis of operating experience feedback;
- engineering solutions and implementation of safety modifications;
- development of unit specific safety analysis reports in accordance with best international practices;
- improvements in quality of PSA studies; and
- implementation of the results of the SARs as well as follow-up Periodic Safety Reviews.

4. Present IAEA Activities

4.1. IAEA Safety Topics in the Area of Nuclear Safety

The subdivision into areas and topics of ongoing activities in the IAEA Division of Nuclear Installation Safety is presented in Table 1. For each of the topics, the related IAEA services offered to Member States are also shown.

4.2. Present Approach of the IAEA Assistance to Countries Operating WWER Reactors

IAEA activities in the area of nuclear safety cover all reactor designs and a broad variety of different tasks. Specific activities devoted to WWER reactors are typically performed either if there is a sponsorship specifically devoted to this kind of reactor, typically through the EBPs, or if there is a specific interest either of a majority of countries within a particular geographic region (TC regional projects) or of one specific country (national projects).

Following the end of the EBP, further IAEA assistance is based on the Integrated Strategy for Assisting Member States in Establishing and Strengthening their Nuclear

Safety. The central element of this strategy is the development of country specific nuclear safety profiles and action plans tailored to the specific areas where assistance is needed.

This assistance includes:

- independent peer design safety review services;
- providing a forum for exchange of information on specific issues (organizing technical meetings, workshops, etc.);
- organizing CRPs on selected issues of interest;
- further developing/updating guidance documents;
- providing operational safety services;
- preparing overview reports on the safety of WWER reactors; and
- organizing training courses, seminars, fellowships, and scientific visits.

In particular, activities within the framework of the Technical Co-operation Programme are defined on a yearly basis to respond to the needs of the relevant Member States.

4.3. IAEA Safety Services

One mechanism to facilitate the application of the IAEA Safety Standards is through safety review and advisory services. These services are provided exclusively at the request of Member States and organized as peer review missions conducted by international experts.

The services are intended to cover issues related to governmental (regulatory) organizations, to the various nuclear installations and various phases of their lifetime, from early siting studies to design, construction, pre-operation, and operation. At present, the following safety services are available:

Evaluation of Legal and Governmental Infrastructure
IRRT - International Regulatory Review Team

Evaluation of the Safety of Individual Nuclear Installations
DSRS - Design Safety Review Service
SSRS - Seismic Safety Review Service
FSRS - Fire Safety Review Service
AMAT - Ageing Management Advisory Team
SSRS - Software Safety Review Service
RAMP - Review of Accident Management Programmes
OSART - Operational Safety Review Team
PROSPER - Peer Review of Operational Safety Performance Experience
SCEP - Safety Culture Enhancement Programme
IPSART - International Probabilistic Safety Assessment Review Team
ISARR - Integrated Safety Assessment of Research Reactors

Area	Topic	Related safety service (*)
Safety assessment development	Safety analysis and accident management	RAMP, DSRS
	Safety management tools	IPSART
	Safety of nuclear installations in South East Asia, Pacific and Far East Countries (EBP)	
Design and engineering safety	External/internal events and safe siting of NPPs	DSRS, SSRS
	Safety aspects of NPP ageing	AMAT
	Computer based systems important to safety	DSRS, SWSRS
	Small and medium reactors including those for desalination and district heating	DSRS
Communication of safety issues		INES, NEIS
Operational safety	Performance based operational safety service	OSART
	Operating experience safety service	PROSPER
	Management of operational safety and safety culture	SCEP
	Integrated operational safety service	OSART, PROSPER, SCEP
Research reactor safety	Safety in design and operation of research reactors	INSARR
	Regulatory supervision of research reactors	INSARR, IRRT
	Experience feedback on safety issues of research reactors	IRSRR
Regulatory activities related to nuclear safety	Regulatory body effectiveness and efficiency	IRRT
	Event reporting and analysis	IRS

(*) for explanation of acronyms see Section 4.3.

Table 1. Ongoing activities in the IAEA Division of Nuclear Installation Safety

Information Systems
IRS - Incident Reporting System
IRSRR - Incident Reporting System For Research Reactors
INES - International Nuclear Event Scale
NEWS - Nuclear Events Web-based System

This list of services should not be seen as restrictive: the IAEA offers to perform other safety related services, based on a specific request from the country. At present, the IAEA is developing the approach of Integrated Safety Evaluation, which is intended to provide a comprehensive view of the regulatory authority and of the safety of nuclear installations in the country and will identify the most important country needs.

4.4. Development of the IAEA Safety Standards

As one of its basic functions, the IAEA has developed a comprehensive set of Safety Standards in the field of nuclear safety, radiation safety, radioactive waste safety and radioactive materials transport safety. At present, the complete set of Standards is being updated to reflect contemporary means of achieving a high level of safety.

Typically, these Standards do not distinguish among different reactor designs. Often, examples in the Standards are provided based on experience gained from Pressurized Water Reactors (PWRs), but no distinction is made between PWRs and WWERs. The structure of the Safety Standards is presented in Fig.1. The present status in developing a revised set of Safety Standards related to NPP nuclear safety is shown in Table 2.

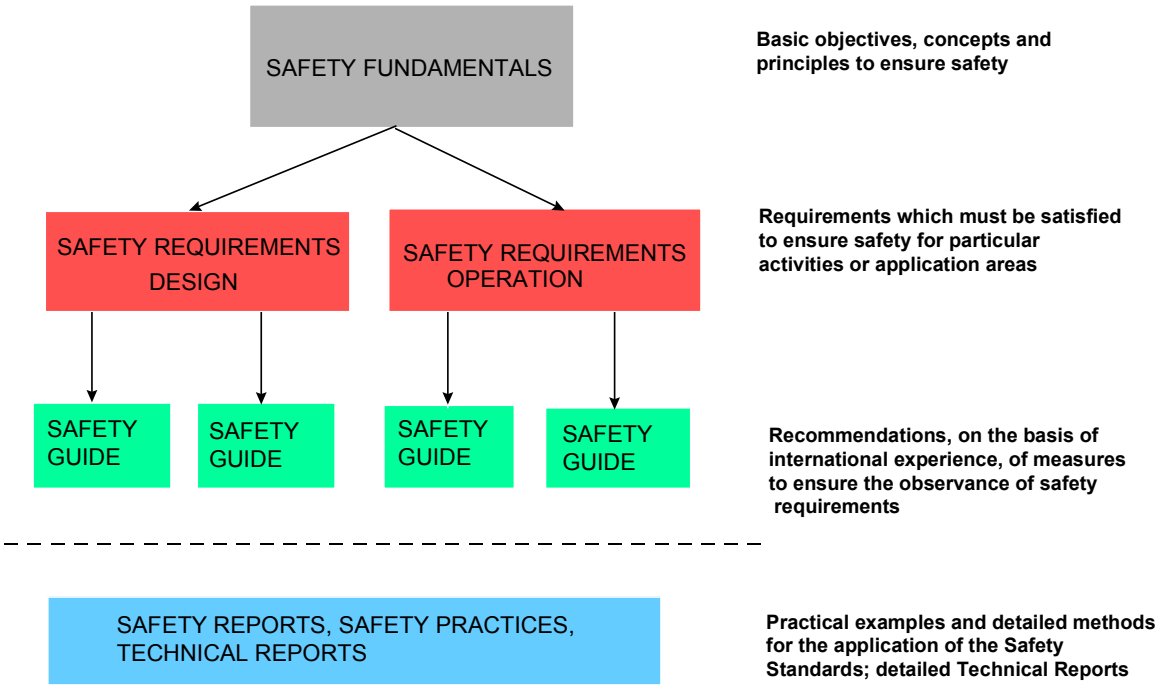

Fig. 1. Hierarchy of the IAEA Safety Standards Series

No. or Working No.	Cate-gory	Title	Expected publication
GS-R-1	SR	Legal and governmental infrastructure for nuclear, radiation, radioactive waste and transport safety	published
DS 247	SG	Management, organization and staffing of the regulatory body for nuclear facilities	2002
DS 309	SG	The format and content of Safety Analysis Reports for NPPs	2003
DS 248	SG	Review and assessment of nuclear facilities by the regulatory body	2002
DS 289	SG	Regulatory inspection of nuclear facilities and enforcement by the regulatory body	2002
DS 290	SG	Documentation to be produced or required in regulating nuclear facilities	2002
DS 305	SR	Safety of Nuclear Power Plants: Site Evaluation	2003
NS-G-3.1	SG	External human induced events in site evaluation for NPPs	in publication
NS-G-3.2	SG	Dispersion of ra-material in air and water and consideration of population distribution in site evaluation for NPPs	in publication
DS 302	SG	Seismic hazard evaluation for NPPs	2003
DS 300	SG	Geotechnical aspects of NPPs site evaluation and foundations	2003
DS 280	SG	Flood hazard for NPPs on coastal and river sites	2004
DS 184	SG	Meteorological events in site evaluation for nuclear power plants	2002
NS-R-1	SR	Safety of nuclear power plants: Design	published
NS-G-1.1	SG	Software for computer based systems important to safety	published
NS-G-1.2	SG	Safety assessment and verification for NPPs	published
NS-G-1.3	SG	Instrumentation and control systems important to safety in NPPs	in publication
DS 301	SG	External events (excluding earthquakes) in relation to NPPs design	2002
DS 306	SG	Protection against fire and fire induced explosions in NPPs	2003
DS 299	SG	Protection against internal hazards (other than fire and explosions)	2003
DS 282	SG	Reactor coolant systems and associated systems in NPPs	2002
DS 303	SG	Emergency power systems in NPPs	2003
DS 276	SG	Fuel handling and storage systems in NPPs	2002
DS 296	SG	Design of reactor containment systems for NPPs	2003
DS 283	SG	Reactor core design in NPPs	2003
DS 304	SG	Seismic design and component qualification for NPPs	2003
NS-R-2	SR	Safety of nuclear power plants: Operation	published
NS-G-2.1	SG	Fire safety in operation of NPPs	published

NS-G.2.2	SG	Operational limits and conditions and operating procedures for NPPs	published
NS-G-2.3	SG	Modifications to NPPs	published
NS-G.2.4	SG	The operating organization for NPPs	published
NS-G-2.5	SG	Core management and fuel handling for NPPs	2001
DS 287	SG	The recruitment, qualification and training of NPP personnel	2002
DS 273	SG	Maintenance, surveillance and in-service inspection in NPPs	2002
DS 291	SG	Commissioning of NPPs	2002
DS 307	SG	Periodic Safety Review of NPPs	2003
DS 288	SG	National system for feedback of experience from events in NPPs	2003

Table 2. Status in developing a revised set of IAEA Safety Standards

4.5. Present WWER Specific IAEA Activities

4.5.1. Safety Services

Typically, WWER operating countries are active in their use of IAEA services to evaluate safety issues related to regulatory work as well as to review safety aspects and safety upgrading programmes of their NPPs. The services foreseen for 2001, together with the expectations for the next year, are summarized below.

Over the last four years, IRRT missions have already taken place in all the countries operating WWER reactors with the exception, for the time being, of Armenia and Russian Federation. In 2001, IRRT missions were carried out in the Czech Republic and Ukraine; for 2002, a mission is scheduled for Armenia, and follow-up missions to Hungary and Slovakia.

Every year, there are around ten activities of various kinds (missions, seminars) related to OSART services. In 2001, four out of five OSART missions (pre-OSART, OSART and follow-up visits) took place at WWER NPPs (Dukovany and Temelin in the Czech Republic; Paks, Hungary; and Kozloduy, Bulgaria). No OSART is planned at WWER NPPs for the next year, but some are envisaged again for 2003.

In 2001, there were three missions in the area of engineering safety review services organized to WWER NPPs in Europe (two at Armenian NPP, one at Temelin NPP). A similar number of missions is also expected for next year. There were also several missions to non-European WWERs (Bushehr in Iran and Tianwan in China).

In 2001, there were three IPSART missions to WWER NPPs (Novovoronezh, Zaporozhe and Mochovce). There was one PROSPER mission carried out in Armenia and several training seminars/workshops in other countries held in 2001. In support of the

safety culture enhancement programmes in WWER operating countries, several workshops and seminars were delivered in 2001 by the IAEA.

4.5.2. Training Courses

Training activities are important in assisting Member States to develop sustainable technical competence in nuclear safety. Most commonly, training activities are implemented within the framework of TC projects and EBPs. Each year, over 60 training courses of different kinds and other training activities, such as workshops, are organized in the field of nuclear safety. To date the main topics have been the safety of design and operation of NPPs, safety assessment methods (both deterministic and probabilistic) and regulatory control. The framework for education and training in nuclear safety is presented in Table 3. The Basic Professional Training Course on Nuclear Safety is among the most important training courses; in 2001, the course was offered in Saclay, France, and at Argonne National Laboratory in the USA. Examples of more specialized training include two week courses on regulatory control of NPPs, on safety assessment of NPPs, and on operational safety.

LEVEL OF BASIC KNOWLEDGE			
Basic Professional Training Course on Nuclear Safety			
LEVEL OF SPECIALIZED KNOWLEDGE			
Regulatory Control of Nuclear Power Plants	Safety Assessment of Nuclear Power Plants	Operational Safety of Nuclear Power Plants	Safety of Research Reactors
LEVEL OF SPECIFIC EXPERT KNOWLEDGE			
Regulatory Framework	Accident Analysis Methods	Safety Culture and Management of Safety	Regulatory Aspects and Safety Documentation
Organization of the Regulatory Body	Probabilistic Safety Assessment	Interface between Nuclear Plant Operator and Regulator	Safety Analysis
Authorization Process	Accident Management	Operational Experience and Feedback	Safety in Operation and Utilization
Inspection and Enforcement	Ageing Management	Operational Practices	Management of Ageing
Regulatory Effectiveness	Safety Assessment of Plant Modifications		Safe Shutdown and Decommissioning
PRACTICAL EXPERIENCE			
Scientific visits, fellowships, observers in IAEA safety review missions			

Table 3. Framework for Education and Training in Nuclear Safety

4.5.3. Development of Technical Documents

Consistently with the revised set of Safety Standards, many technical documents are being developed, providing practical examples and detailed description of methods based on good practices worldwide. An example of such documents applicable for NPP safety assessment is shown in Fig. 2. All these technical documents (except specific documents developed for other specific reactor designs) are applicable for WWER reactors and some of them are developed specifically for WWER reactors.

4.5.4. Technical Meetings

A typical way to develop technical documents is through the organization of Technical Meetings (TMs) (usually with the participation of 15-30 experts) and Consultants Meetings (from one to five consultants being invited). These meetings do not normally focus on a specific reactor design, but representatives of WWER operating countries are always invited. Because of the large number of documents produced, it is not practical to present here the list of all consultants meetings. A list of the TMs planned for 2002 that are related to PWR (WWER) safety are presented below:

Technical Meetings 2002 (only the most relevant)

- TM on Use of CFD codes for safety analysis of reactor systems, including containment, 11-15 November 2002, Vienna
- TM on Safety analysis for research reactors, 3-7 June 2002, Vienna
- TM to Develop guidance document on the development and review of EOPs, 27-31 May 2002, Vienna
- TM to Develop a technical document on the status of safety analysis related to lifetime extension of existing NPPs, 9-13 September 2002, Madrid, Spain
- TM to Prepare a technical document on use of PSA in the regulatory framework, 23-27 September 2002, Vienna
- TM on Enhancing safety and performance of nuclear plants using insights from IAEA project on Safety aspects of NPP ageing, 24-26 June 2002, Vienna
- TM to Compile information on major safety issues identified by Periodic Safety Reviews and on associated corrective actions and safety improvements, 2Q 2002, Vienna
- TM on Early termination of NPPs, 2Q 2002, Barseback, Sweden
- TM on Advancing the management of safety and safety culture, 2Q 2002, Vienna
- TM on Development of guidance on integrated safety assessment methodology for fuel cycle installations, 4Q 2002, Vienna

4.5.5. Technical Cooperation Projects

4.5.5.1. Regional Projects

In spite of the long time that has elapsed since the completion of the projects, it is worth mentioning here the Regional Projects RER/9/002 on Computer Aided Safety Analysis and RER/9/004 on Safety Analysis of WWER Type Reactors, later updated under the modified project title Evaluation of Safety Aspects for WWER-440 Model 213 Nuclear Power Plants. These projects made an exceptionally significant contribution to increasing the level of safety analysis in the majority of countries operating WWER reactors. The projects led to the regular use of modern computer codes for deterministic accident analysis, an improved methodological framework and transfer of expertise in the area of comprehensive safety assessment, and also, in their final phase, provided quite complex plant specific safety related insights obtained from the analyses carried out in the project. Both design and operating safety issues were addressed, in particular within the framework of RER/9/004 project.

Only Technical Co-operation Projects directly related to design, operation and regulatory supervision of WWER NPPs will be considered here. At present, there are also several regional projects active for countries in the Europe region that are closely related to WWER safety or to the regulatory supervision of the WWER NPPs. These are:

- RER/9/061 Enhancement of Nuclear Safety Regulatory Authority Effectiveness;
- RER/9/066 Strengthening Management of Operational Safety at NPPs and Utility Organizations;
- RER/9/068 Harmonization of Probabilistic Safety Assessment Methodologies;
- RER/9/069 WWER-1000 Design Basis Documentation Management Systems; and
- RER/9/070 Strengthening Safety Assessment Capabilities of NPPs.

Regional projects offer an opportunity to operators and regulators from all the countries operating WWER reactors (at least in the Europe region) to share their views and harmonize their approaches. As a special case, numerous activities of the Forum of WWER Regulators are supported within the framework of project RER/9/061.

A number of workshops/technical meetings are also organized within the framework of TC projects. The workshops not only serve as a forum for sharing experience among specialists from the participating countries, but also summarize the general status in the field under consideration and provide a momentum for further developments in the field.

For example, in 2001 the workshops/technical meetings were devoted to assessing NPP modifications, accident management, periodic safety reviews, development and review of Safety Analysis Reports, fuel safety criteria, harmonization of PSA studies, comparison of thermal-hydraulic analysis for PSA applications, strengthening management of plant operational safety, managing early termination of operation of NPPs,

and safety culture enhancement programme support. Meetings aimed at improvements in regulatory effectiveness were devoted to operator/regulator interfaces, regulatory review of Safety Analysis Reports, tools for enhancement of regulatory effectiveness, and regulatory review of licensees' safety programmes. Similarly, examples of meetings within the IAEA regional TC projects in 2002 include workshops on risk informed decision making, use computer codes for licensing type accident analysis, safety analysis related to lifetime extension, safety analysis needed for plant modifications, on harmonization of PSA approaches, use of PSA for optimization of limits and conditions and support of maintenance planning, on PSA Level 2 modelling techniques, modeling of primary-to-secondary leaks, human reliability analysis, the training course on use of computer codes for accident management.

IAEA TC projects are also used to support participation from WWER operating countries at the international meetings organized by other organizations, such as the International Seminars on Horizontal Steam Generators organized in Finland or International Information Exchange Forum on Safety Analysis for NPPs of WWER and RBMK Type, organized by the US DOE in Russia. Many IAEA missions (Safety Services) and training courses are also organized within the framework of regional or national technical co-operation projects.

Besides several regional projects for Europe, there is also one regional TC project for countries in Asia, devoted to Strengthening Management of Operational Safety of NPPs.

Regional projects can reflect very flexibly real needs of the WWER operating countries; it is up to them to specify their needs and wishes at annual co-ordination meetings.

4.5.5.2. National Projects

Currently, harmonization of safety approaches among WWER countries in Europe takes place mainly in the framework of regional TC projects and the number of country specific projects related to NPP safety is rather low (for example, there is no relevant TC project for Czech Republic, Hungary and Slovakia). Intensive work is still ongoing for Armenian NPP (on Seismic Safety Re-evaluation of Armenian NPP, Centre for Technical Support and Safety Analysis, Ageing Control of the Armenian NPP, and Accident Analysis for the Armenian NPP). Seismic re-evaluation is also the subject of one project for Bulgaria. Further strengthening of the nuclear safety authorities is reflected in the projects for Bulgaria and Ukraine. There are also two national projects for the Russian Federation, one devoted to Safety Review of NPPs and the other to Development of a Regulatory Basis for NPP Licence Renewal/Extension of NPP Operation.

Within the framework of one of the Russian projects, not only a number of missions, seminars and workshops were organized, but also an accident analysis and simulation system for severe accidents for WWER-440/213 reactors was developed, based

on the MELCOR 1.8.4 computer code. A similar system is now under development for the Armenian NPP.

IAEA support is being provided to the new countries that will eventually join the WWER operators, namely China and Iran. Projects for China include Severe Accident Countermeasures and Management Procedure, Seismic Safety Study of Pressurized Water Reactor and Preparation of the Chinese Utility Safety Requirements on Evolutionary NPPs). For Iran, the projects are oriented towards regulatory infrastructure for licensing and on review of SAR of Bushehr NPP.

4.5.6. Extra-budgetary Programmes

As has already been demonstrated in Section 2, extrabudgetary funds, in particular for such specific purposes as WWER reactor safety, can constitute a very significant tool for identifying and resolving safety issues. At present, extrabudgetary funds are more typically used for RBMKs (two EBPs ongoing) rather than for WWER reactors. As far as WWER reactor safety is concerned, there is only one active EBP on the Safety of Nuclear Installations in South East Asia, which (because of the Chinese nuclear programme) is partially also devoted to WWER-1000 reactors. There is another new EBP on safety aspects of continuing operation of WWER and RBMK NPPs at present under consideration.

Extrabudgetary funds are also provided to support activities of WWER regulators within the framework of the Co-operation Forum of the Nuclear Safety Authorities of the Countries Operating WWER Type of Reactors. Similarly, a significant portion of extrabudgetary funding is provided to specific national TC projects oriented towards WWER safety (e.g. for Armenia).

4.5.7. Co-ordinated Research Programmes

CRPs constitute a very effective means for exchanging information and furthering the growth of expertise among a group of institutions within the time frame of, typically, three to four years. A group of organizations from several advanced and developing countries co-ordinate their activities aimed at resolving commonly shared issues. The co-ordination role of the Agency is formalized through research contracts and research agreements. The Agency contributes only to financing a small portion of the work, which, to a major extent, is performed supported through the resources of the participating institutions, and to financing the organization of Research Co-ordination Meetings.

The following CRPs are active at present or planned to begin in 2002; some of these CRPs are specifically devoted to WWER reactors:

- Round-robin Exercise on WWER-440 RPV Metal Irradiation, Embrittlement and Annealing (1996-2004);

- Development and Application of Indicators to Monitor NPP Safety Performance (1999-2003);
- Investigation of Methodologies for Incident Analysis (1997-2001);
- Seismic Evaluation of Existing NPPs (follow-up of CRP on Seismic Analysis of WWER-type NPPs) – completion 2002;
- New CRP: Assessment of the Interfaces between Neutronic, Thermal-hydraulic, Structural and Radiological Aspects in Accident Analysis - with specific application for WWER-440 reactors (starting in 2002); and
- New CRP: Safety Significance of Near Field Earthquakes (starting in 2002).

5. Conclusions

During recent years, the IAEA has contributed to significant progress in the nuclear safety level in those countries operating WWER reactors. Remaining safety issues have been identified within the framework of the Extra-budgetary Programme on WWER and RBMK Safety. Addressing these safety issues is continuously monitored by means of IAEA safety services, technical meetings, and technical cooperation projects. IAEA guidance documents are based on the experience gained in advanced countries; they are contributing to harmonization of approaches and to the dissemination of the safety level reached in the most advanced countries to the whole nuclear community. Above mentioned components of the IAEA work, together with Co-ordinated Research Programmes, will also continue to remain an essential tool for providing further assistance by the IAEA to countries constructing or operating nuclear power plants with WWER reactors. The Agency will perform its activities in accordance with country based needs and requests.

IAEA nuclear safety related activities in the near future will be devoted to the following areas, which are also relevant for WWER NPPs:

- Maintaining a high level of safety of existing installations (NPPs, research reactors, installations of the fuel cycle);
- Increasing openness and transparency on safety matters in order to maintain public confidence in the nuclear energy option;
- Demonstrating a higher safety level in new reactor designs, evolutionary or innovative concepts; and
- Maintaining national/international competence in nuclear safety.

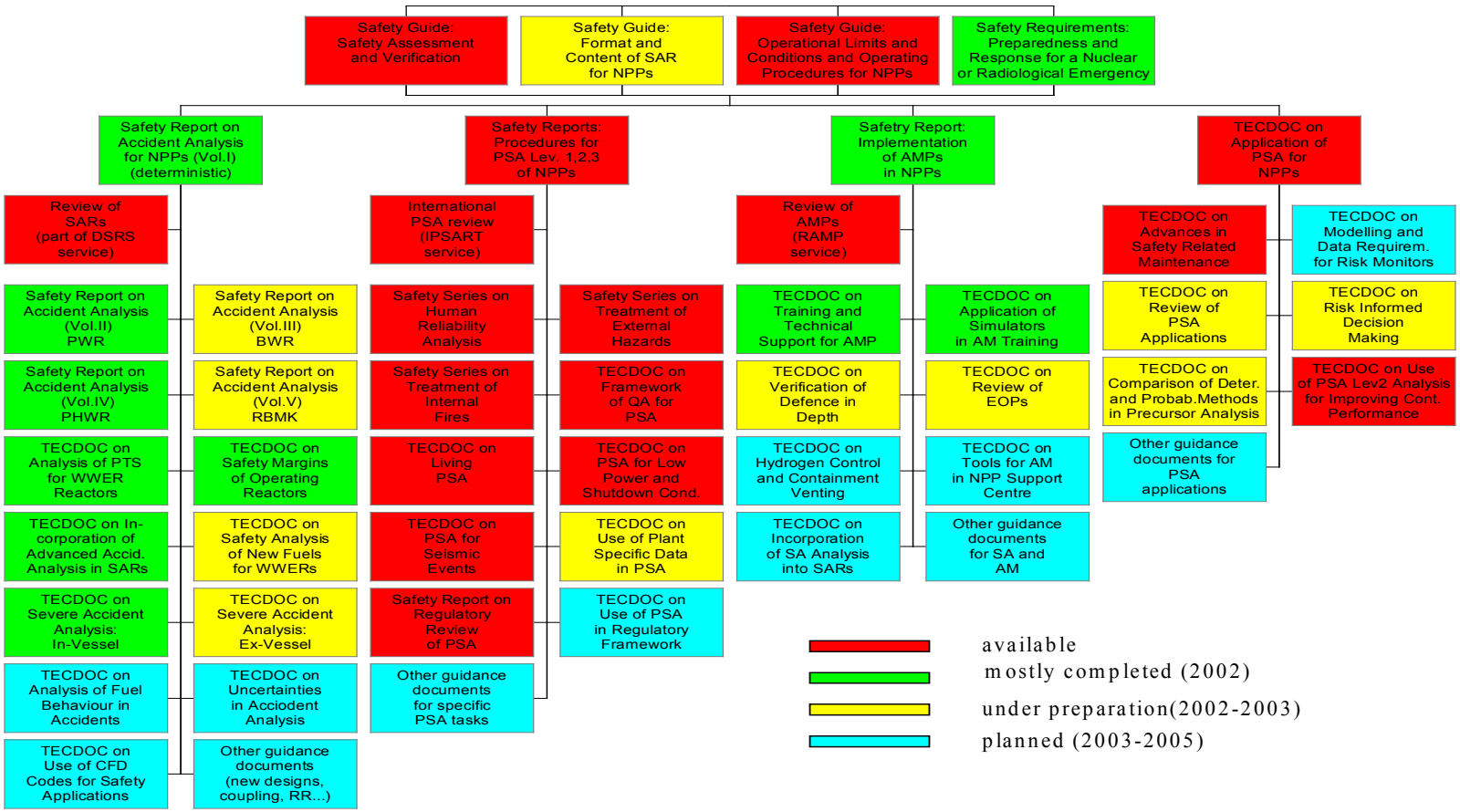

Fig.2. IAEA technical documents related to safety assessment for NPPs