EBP-ASIA-134
LIMITED DISTRIBUTION
DECEMBER 2003

FINAL REPORT OF PHASE I AND STRATEGY FOR PHASE II

EXTRABUDGETARY PROGRAMME ON THE SAFETY OF NUCLEAR INSTALLATIONS IN THE SOUTH EAST ASIA, PACIFIC AND FAR EAST COUNTRIES

INTERNATIONAL ATOMIC ENERGY AGENCY

TABLE OF CONTENTS

1. FINAL REPORT OF PHASE I (1997-2003)

1.1. BACKGROUND

The IAEA established the Extrabudgetary Programme on the Safety of Nuclear Installations in the South East Asia, Pacific and Far East Countries (EBP) in 1997. The impetus for the programme grew from realization that rapid expansion of nuclear power utilization was taking place in the region, with Japan and the Republic of Korea having mature but growing programmes, China embarking on significant growth, and other countries in the region operating research reactors, with some investigating the use of nuclear power to meet expected high electricity demand growth. The need for cooperation in nuclear safety in the region was emphasized the year before during the Moscow Nuclear Safety Summit in April 1996, and again at the Tokyo Conference on Nuclear Safety in November 1996. In both instances, it was recognized that no focused mechanism existed to help countries establish their nuclear safety infrastructure.

Additional need for an IAEA nuclear safety assistance programme in the region was heightened by the realization that the countries in the region were in different stages of nuclear development and that their needs for assistance in nuclear safety would be substantially different. Nonetheless, it was recognized that regional cooperation in nuclear safety would be advantageous for all the countries to have so as to learn from each other, from experience accumulated in operation of research reactors and mature nuclear power programmes, from demonstrable safety measures established under IAEA nuclear safety standards, and, so as to be able to mutually assess progress made in nuclear safety. An added benefit was to enhance public understanding and confidence in nuclear safety.

Thus, the objective of the programme was, and is, to strengthen nuclear safety in the countries of the region, and in particular, to enhance the technical capabilities of regulators, operators, and supporting technical organizations; to improve nuclear safety infrastructure; and, to further human resource development. The programme was designed to strengthen national standards to be consistent with internationally accepted IAEA safety standards, while recognizing that safety remained the national responsibility of each country.

Activities under the EBP have included providing assistance in the following areas:

- Education and training in nuclear safety.
- Strengthening national regulatory frameworks and technical and management capabilities including: nuclear legislation, regulations, safety assessment, licensing, inspection and enforcement.
- Emergency planning and preparedness.
- Promotion of safety culture concepts.
- Provision of information to decision makers and to the public to build understanding and confidence in nuclear safety.

- Development and revision of country profiles and specific action plans for prioritising IAEA assistance in nuclear safety matters related to nuclear power plants (NPPs) and research reactors.
- Development of an Integrated Safety Evaluation (ISE) process to assess countries safety regimes against IAEA nuclear safety standards.
- Establishment of a regional forum to exchange information to harmonize the implementation of nuclear safety concepts.

From the initial consultative meeting in July 1997, and the first kick-off meeting in October of that year, the core group of recipient countries was determined: they were, and are, China, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. Donor countries are Japan, France, Germany, the Republic of Korea, Spain, and the United States. Donors provide in-kind and/or financial support to the EBP, including, but not limited to, funding cost free experts to participate in meetings and missions, and hosting training activities.

1.2. IMPLEMENTATION

The EBP was implemented initially taking into account the concept of the IAEA "Integrated Strategy for Establishing/Strengthening Nuclear Safety in Member States," developed jointly by the Departments of Nuclear Safety and of Technical Cooperation. The strategy was used as a basis to establish nuclear safety profiles and action plans for assistance/cooperation and to help provide a focused, solution oriented, and cost effective approach to nuclear safety related assistance. Joint development and utilization of the strategy helped ensure that there would be optimum utilization of Agency resources and minimum duplication between the two Departments in ensuring safety assistance in the region.

Participants at the initial July 1997 consultative meeting directed the IAEA to provide the necessary information and guidance for development of Country Nuclear Safety Profiles (CNSPs). Indeed, development of country specific nuclear safety profiles, describing the current nuclear safety situation in the Member States, was recognized as the first step in implementation of the EBP. Nuclear safety profiles were developed jointly by the Agency and recipient Member States during the initial phase of the EBP (1997-1998) and continue to be updated as circumstances change. The CNSPs include general information on a country's energy sector (from other existing sources operated by the Agency) as well as specifics of its power situation, its regulatory framework, the safety of its nuclear power plants and/or research reactors, and delineation of international and bilateral agreements to which the country is a signatory.

The CNSPs provided a reference point from which Action Plans for Agency assistance have been developed. Their development, likewise, began early in the programme, such that by the second quarter of 1998, Agency technical visits to recipient countries were underway to identify gaps and identify specific assistance needs. The Action Plans, like the CNSPs, have not been static. As implementation progresses, both the Member States and the Agency continue to appraise the effectiveness of the measures, to correct weaknesses, and optimise the use of resources.

Participants at the July 1997 meeting also requested the IAEA to create a database to store the information compiled and the Action Plans for IAEA assistance to the countries in the region. The Extrabudgetary Programme Asia (EBPASIA) Database was created in 1999 to manage implementation of the EBP and to provide easy access to information on the programme.

Today, the EBPASIA Database contains detailed and up-to-date information and reports of all activities of the programme (it is updated on a continuous basis), operates via Internet and is accessible only to countries participating in the EBP through a password protected web page. For each activity, basic information on dates, location, status, technical officers, and counterparts is presented, as are objectives, results achieved, summaries and full reports. In addition, the database provides access to current Country Nuclear Safety Profiles and Nuclear Safety Action Plans. The database is user-friendly, allowing it to be interrogated in several ways: by country, by type of activity, or by year. For training activities the database contains the actual material presented by lecturers. Information about other relevant IAEA Technical Cooperation projects, and projects relative to the countries participating in the EBP also can be retrieved.

The 1997 meeting participants also agreed that an important benefit of the project would be to establish a regional forum to enhance networking and to exchange information on the safety of nuclear installations. To date, many regional workshops and training courses have facilitated information exchange. However, a true regional forum will only be realized with the full implementation of the Asian Nuclear Safety Network (ANSN). The ANSN will be discussed later in this report.

The October 1997 kick-off meeting defined the programme scope and developed a course of action for the initial phases of the EBP (1997-1998 and 1999-2000, respectively). Participants also firmly established the EBP coordination mechanism with a Secretariat in the Division of Nuclear Installation Safety. Since that time, the Secretariat has submitted semi-annual progress reports, usually in March and November, to participating members.

An Advisory Group (AG) – composed of representatives from countries providing and receiving assistance – was established to annually review and evaluate the progress made in the implementation of programme activities and to advise the IAEA on future activities based on achievements. The AG further:

- Advises the Agency on the major programme activities including the preparation of training workshops, missions and topical meetings;
- Is a forum for the exchange of information on safety matters of common interest to the countries of the region;
- Advises on matters requiring coordination between the IAEA and other international activities; and
- Advises on the consistency between country nuclear safety profiles and action plans for IAEA assistance.

From the beginning, the EBP has been an action-oriented programme. Drafting of Country Nuclear Safety Profiles, training, technical and scientific visits, and experts' missions began immediately after the 1997 kick-off meeting. The first regional workshop was held in China in the first quarter of 1998.

Since then, nearly 190 activities have been, or will be implemented under this phase of the EBP, including regional training courses; national and regional workshops; reviews of regulatory bodies; and safety reviews of research reactors and NPPs. Activities have ranged from providing regional training in basic principles of nuclear safety for current and next generation designs of NPPs, practical exercises at national and regional levels using Agency-provided software for accident simulation and analysis, and national safety review services to

assist regulatory bodies to conceptual design review and probabilistic safety assessments (PSA) for specific power plants. The table below summarizes activities by type (regional or national) and by subject matter. Additional information on work done by country by year is available in Appendix 1.

TABLE I. SUMMARY OF EBP ACTIVITIES BY TYPE (NUMBER OF EVENTS)

Activity	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Country Totals**
Education and Training								
Regional		2	1	5	4	4	2	18
China	4	3	3	6	4	5	4	29
Indonesia				2		2	3	7
Malaysia					1			1
Philippines							0	0
Thailand			1					1
Vietnam				3	1		1	5
Assistance to Regulators								
China			1	1		1	1	4
Indonesia			1		1		2	4
Malaysia			1				2	3
Philippines							1	1
Thailand					1	1	2	4
Vietnam			1			1	1	3
Assistance to Research Reactor Operating Organizations								
China					1			1
Indonesia	1	1	2	2	1	3	2	12
Malaysia		1		2		1	1	5
Philippines		1		2	1		1	5
Thailand		1	1	2	1	1	2	8
Vietnam		1	1	2	2	2	1	9
Assistance to NPP operators								
China	3	3	9	6	4	7	3	35
TOTALS	8	13	22	33	22	28	29	155

Since the beginning of the programme, the annual budget has been typically on the order of $1.5 million and the programme has been implemented with due regard to cost effectiveness.

1.3. MAJOR RESULTS

1.3.1 Education and Training

Education and Training (E&T) has been a principal activity in the Extrabudgetary Programme (EBP) since the beginning of the programme, mirroring the IAEA statutory functions to "foster the exchange of scientific and technical information" and "encourage the exchange and training of scientists and experts." As shown in Table I, to date, some 34 regional and 150 national training events have been conducted. Over all, more than ….. professionals from regulatory bodies, NPP operating organizations, technical support organizations and research institutes have attended the various training courses and workshops. At the regional level, training courses and workshops were held covering the main topics important to safety, such as, safety analysis, siting, nuclear safety concepts, regulatory aspects and safety documentation for research reactors. At the national level several workshops have been organized dealing with functions and responsibilities of the regulatory body (e.g., inspection and enforcement, and safety assessment). Other topics of national courses and workshops included probabilistic safety assessment techniques, fire inspection safety, severe accident policy (China), and external events. See Appendix 1 for additional information.

The September 2000 General Conference (44)/RES/13 reinforced the special importance of education and training in radiation protection, nuclear safety and waste management. The Secretariat was urged, in particular, to assist Member States at regional and national training centres.

In response to the direction from the General Conference, an advisory group was convened in 2001 by the IAEA to review E&T. The group recommended a strategy for helping Member States to ensure sustainable E&T in nuclear safety. To implement the strategy, the Agency was requested to prepare standard training material and to train the trainers.

In line with the E&T strategy, a large volume of standard training material has been developed, used in training events, and made available to countries participating in the EBP. The material includes full text lectures, viewgraphs, videos and multimedia CD-ROMs. The latter contain full video recording of lectures and associated viewgraphs and other supporting material.

A six-week Basic Professional Training Course on Nuclear Safety was conducted in 2001 at the Argonne National Laboratory, USA. Much of the content of the course was video-recorded and edited into a set of 34 CD-ROMs. Similarly, a one-week training course on IAEA nuclear safety standards has been recorded and edited in a set of 14 CD-ROMs. A twenty-minute video also was produced, illustrating the IAEA's Nuclear Safety Requirements on Legal and Governmental Infrastructure in Nuclear Safety.

Other standard training packages have been prepared in areas such as: regulatory aspects and documentation related to research reactor (RR) safety, preparedness for and response to emergencies in RR, ageing management for RR, basic training in level 1 PSA and PSA applications, management of operational safety at NPPs and NPP safety assessment.

During 2001-2002, a series of four workshops was conducted, hosted by the Korea Institute of Nuclear Safety, to provide specialized training on safety analysis methodology and the use of computer codes. The training involved classroom exercises and homework assignments. Participants were requested to demonstrate knowledge to model their specific research reactor configuration. A group of thirteen professionals successfully completed the training.

E&T material also has been prepared to support self-study and distance learning. In this context, training modules on reactor physics and thermal hydraulics have been completed and are available on the Internet and/or CD-ROM.

Similarly, a course on Regulatory Control of NPPs, published by the IAEA under the training course series (number 15), was adapted for self-study, including a workbook of exercises. This course also is available on the Internet and/or CD-ROM.

A regional workshop to "Train the Trainers" was conducted at Argonne National Laboratory, USA using the standard training packages developed by the IAEA.

In 2001, a Nuclear Safety E&T review service was established. Specific guidelines were established to assist Member States to develop and to maintain a sustainable and adequate E&T programme in nuclear safety. The programme was required to be consistent with IAEA safety standards and international good practices, while giving due recognition to national conditions. The review service addresses three key areas relative to the E&T safety programme of a Member State. These are:

- The basis and framework for nuclear safety E&T;
- Competencies and training in nuclear safety; and,
- Maintenance and improvement of competencies and training.

In order to address these three areas, the review considers E&T in safety at all levels in the Member State, including the national system of universities and technical institutes, the system of professional training, and the provisions for job-specific training. Organizations to be consulted in the review include those whose primary function is providing E&T, such as universities, technical institutes, and training organizations, as well as those that are primarily users of trained personnel. The internal training programmes of these recipient organizations, such as regulatory bodies, plant owners and operators, research reactor operators, and technical support organizations are also taken into account. The review service encourages the recipient Member States to first conduct a thorough self-assessment of the required competencies and skills (see also Section 4.2.2).

Pilot E&T review missions have been conducted in Indonesia, Malaysia, Thailand and Vietnam. In addition, a national workshop on E&T was organized by the IAEA in Beijing, China with the participation of experts from the regulatory body, NPP operators, research institutes and the universities. The workshop was a forum for a broad self-assessment of E&T including the main stakeholders.

1.3.2 Assistance to Regulators

The Convention on Nuclear Safety (CNS) [INFCIRC/449, July 1994] and the draft Code of Conduct on the Safety of Research Reactors [GOV/2003/7, 6 February 2003] require the establishment and maintenance of a legislative and regulatory framework to govern the safety of nuclear installations, and the establishment or designation of a regulatory body entrusted

with the implementation of the legislative and regulatory framework. The IAEA Safety Standards series publication entitled "Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety: Requirements, GS-R-1 (2000)", provides a general consensus reference for the practices necessary for a national organization to fulfil the regulatory purposes and discharge the regulatory functions.

Within the framework of the EBP, the IAEA carried out several activities aimed at assisting participating Member States in reviewing the adequacy of their legal and governmental infrastructure (LGI). In this way, areas needing improvement could be identified and addressed. Foremost among these activities were the International Regulatory Review Team (IRRT) Missions, the Expert Missions to review the LGI for nuclear safety, and the Expert Missions to provide assistance for either drafting or reviewing nuclear legislation. All these activities were based on the IAEA safety standards and other related documents. The IRRT Missions and the Expert Missions to review the LGI for nuclear safety (a reduced scope version of the IRRT Missions) are based on the IAEA safety standard GS-R-1 and, depending on the scope, review the following areas:

- Legislative and governmental responsibilities;
- 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; and,
- Radiation protection

The IRRT Missions were conducted and the reports prepared according to the Guidelines for IAEA International Regulatory Review Teams (IRRTs), IAEA Safety Services Series No. 8 (2002), and using a set of questionnaires based on the IAEA safety standard GS-R-1. Follow-up IRRT Mission were carried out subsequently to review the progress made with respect to the recommendations and suggestions of the first mission. The results of both these missions were used to complete the corresponding section of the ISE report (see Section 4). Within the reporting period, such missions were carried out to China, Indonesia, Malaysia, Thailand and Vietnam.

The Expert Missions to provide assistance for either drafting or reviewing nuclear legislation were based on the draft Handbook on Nuclear Law. This document is closely linked to the IAEA safety standard GS-R-1 [ ] for the relevant Sections. Within the reporting period, such missions were conducted in Thailand and Vietnam. These missions were conducted jointly with the IAEA Office of Legal Affairs within the framework of the TC Project RAS/9/023 "Legislation for Safe and Peaceful Nuclear Applications".

The IRRT Missions and the Expert Missions show that none of the countries have a comprehensive nuclear law with all the required elements as outlined in the Handbook on Nuclear Law. As a consequence, although all the countries have a regulatory body, the

designated regulatory body often lacks the required authority, independence and resources. In most cases, there is no clear separation between the regulatory and promotional roles of the government. It is also of concern that in most cases the updated safety analysis report (SAR) for the individual research reactors is not yet available and that regulatory body does not have adequate capability to carry out an independent evaluation of the updated SAR, which is a prerequisite for the licensing of the facility.

In reviewing the regulatory functions, the following issues were identified:

Licensing/Authorization

- Regulatory acceptance criteria should be developed, especially if different designs need to be considered;
- Guidance on requirements and time schedule for periodic safety reviews should be developed;
- Guidance on regulatory control of modifications should be developed.

Review and assessment

- Clearly defined procedures should be developed for the review and assessment of submissions.

Inspection and enforcement

- The regulatory bodies in most countries have little or no experience with inspections as related to nuclear facilities;
- Written inspection policy and inspection guidelines should be developed;
- A minimum baseline of inspections should be established to ensure safety at all the facilities.

With respect to emergency preparedness and response, the following issues were identified:

- An emergency plan needs to be developed, taking into account national and international commitments;
- All parts of the emergency plan should be systematically tested to ensure that the roles and responsibilities can be effectively discharged;
- The emergency plan should be exercised at periodic intervals and the means of communication tested (key emergency response functions and organizational interfaces.

Other assistance activities for regulators conducted during the reporting period included workshops and missions on specific topics of the LGI, such as, Inspectors Training, Inspection and Enforcement, and Licensing of Research Reactors. For a summary refer to Table 1; for more detailed information, refer to Appendix 1.

1.3.3 Assistance to Research Reactor Operating Organizations

In the past few years, the IAEA has strengthened its activities in the area of safety of research reactors and has conducted numerous safety missions to review the safety of these reactors in

Member States. Some of the reviews (INSARR) had a broad spectrum covering the various aspects of operational safety. Others were dedicated to specific topics, such as the review of the safety analysis report, and review of the safety analysis. The prime objective of these missions has been to provide advice in line with IAEA Safety Standards. Some of the most important issues identified in many countries, including, in general, the countries participating in the EBP, indicate:

- Inadequate regulatory supervision;
- Insufficient systematic (periodic) reassessment of safety;
- Lack of Quality Assurance programmes;
- Lack of clear utilization programmes;
- Inadequate emergency preparedness;
- Inadequate safety documentation (e.g. safety analysis report, operational limits and conditions, operating rules and procedures, emergency plan);
- Weak safety culture;
- Lack of staff succession planning;
- Loss of expertise and corporate memory; and,
- Inadequate training and qualifications of regulators and operators as a consequence of limited in-house training activities.

The EBP has addressed some of the abovementioned issues through training activities conducted on a regional and national level as well as through safety missions.

Inadequate safety documentation, in particular, an outdated safety analysis report, is a frequent issue in research reactors, especially for those countries participating in the EBP. To increase awareness of the importance of having updated safety documents and to provide information on format and content for such documents, several training activities were conducted. These included: a regional Training Course on the Safety of Research Reactors held in Japan in 1999; a Training Course on Regulatory Aspects and Safety Documentation held in the USA in 2000; and a Workshop on Operation and Maintenance of Research Reactors, held in Indonesia in 2002. Moreover, support to improve the SAR was provided to Indonesia through an expert mission to the RSG-GAS facility in 2002, and in a follow-up INSARR mission, the SAR of the Bandung and Kartini reactors were reviewed. In Malaysia, an expert mission on guidance for SAR preparation was conducted in 2000; and in Vietnam, three missions to improve the SAR were conducted in 2000, 2001, and 2003.

Outdated safety analysis is generally due to the lack of qualified personnel and/or reduced allocation of resources in the operating organizations. In some research reactors, the original safety analysis performed by the suppliers of the reactor is the only one available and no updates have been performed. To enhance competency, training was provided through the National Training Course on Safety Analysis in Indonesia in 2000; the Regional Workshop in Accident Analysis Methodology and Computer Code Utilization, held in two phases in 2001 and 2002; and, the Workshop on Reactor Core Calculations, held in Indonesia in 2003.

As identified through IAEA safety missions, the lack of adequate, comprehensive, and tested emergency procedures is a safety issue among the research reactor community. Training on emergency planning and preparedness was provided in a regional level on three occasions: the regional Training Course on the Safety of Research Reactors in 1999; the Workshop on Safety of Research Reactors in 2000; and the Training Workshop on Accident Management and Emergency Planning for Research Reactors in 2002. Review of the status of emergency plans were conducted in Indonesia for the RSG-GAS in 1999, and in Thailand for the TRR1/M1 in 2003. Additionally, a review of the radiological impact for the TRR-2 in Thailand was conducted in 2000

Other important issues addressed during the present phase of the EBP are: quality assurance, maintenance; operational safety (conduct of operators including operators qualification), siting, seismic evaluation, fire protection, long term shutdown, and safety culture.

Because of these activities, progress was observed on the technical qualification of the staff of operating organizations and on the safety level of the facilities visited (mainly in relation to the SAR). Nevertheless, there are several areas in which improvements are still needed to comply with the IAEA Safety Standards for research reactors. Areas continuing to need improvement, and which should be the focus for future assistance, include: quality assurance, emergency planning; operational limits and conditions, and safety culture.

Assistance to China in the area of research reactor safety was very limited in the first phase of the EBP; in fact, only one mission has been performed – a national workshop on ageing of research reactors, organized in 2001. Follow up, and IAEA assistance requests have not been determined by the relevant Chinese organizations.

Similarly, the situation in the Philippines is of concern. Because no final decision has been made about the future of the research reactor, no progress has taken place to ensure safety during the long-term shutdown and/or decommissioning of the reactor. Reconstruction plans, presented by Philippine delegate at the EBP annual meeting, reflect this lack of a decision and have little technical substance or material commitment.

1.3.4 Assistance to NPP Operators

This type of assistance has been provided only to China. Focus was on assistance to review design aspects of Tianwan (WWER-1000) NPP. A large number of missions have been conducted by the IAEA dealing with topics such as:

- Containment design and safety systems;
- Application of leak before break concept;
- Probabilistic safety assessment levels 1 and 2;
- Fuel assembly design;
- Instrumentation and control;
- Severe accident mitigation;
- Reactor core design and refuelling strategy;

- Fire risk analysis; and,

- Self-assessment of operational safety management.

Peer reviews have been conducted by teams of international experts under the leadership of the IAEA Secretariat. Russian and German designers have participated as to provide relevant design information needed and to be informed on the review findings and recommendations. The reviews proved valuable to the Chinese and to the NPP designers, and insights of the reviews have been considered in the final plant design.

Assistance also has been provided to Qinshan I NPP for the plant to conduct a periodic safety review. Other assistance to Qinshan I and III, including training, also has been provided by the IAEA in the frame of TC projects.

Assistance also was provided to China for the review of the safety of China's Experimental Fast Reactor. Areas identified for further improvements include: defence in depth considerations, basic strategy for accident classification, verification of applied computer codes and independent assessment of the PSAR.

1. 4. INTEGRATED SAFETY EVALUATION (ISE)

1.4.1 Concept

Introduction of the Integrated Safety Evaluation (ISE) process into the EBP context is a logical next step for the countries of the region. For, despite the safety achievements realized under the EBP, there is still much to be accomplished for all the countries in the region to achieve and maintain a high level of safety in their nuclear installations. The ISE is a process that reviews and evaluates a country's safety regime against IAEA nuclear safety standards and forms the basis for planning and implementing necessary improvements. It makes use of the results of the EBP safety reviews and training that focused on legal and governmental infrastructure and on specific technical areas of installation safety. The ISE evaluates a country's utilization of guidance and recommendations for safety improvements that were provided under the safety reviews. The advantage, and underlying concept, of the ISE is that it looks beyond individual assessments and integrates all technical and institutional aspects related to nuclear safety and evaluates them both with respect to the specifics of each installation and to the national nuclear safety infrastructure. The ISE identifies achievements as well as policy and technical issues requiring further attention. For the IAEA, the ISE report is a main tool to focus and prioritise activities in relation to the Member State.

For the country concerned, the report represents an independent and unbiased peer review of the comprehensive national nuclear safety profile. The ISE is ideally suited to evaluate progress in safety achieved by countries participating in the EBP. Focus of the report is on the topics related to the scope of the EBP, namely:

- Enhancing the legal and governmental nuclear safety infrastructure and technical competence of regulatory bodies;
- Enhancing the safety of research reactors;
- Enhancing the safety of NPPs (currently only relevant to China); and
- Enhancing E&T in nuclear safety.

Implementation of the review is a two-step process. Step one (*vertical integration*) involves a review of past IAEA safety review missions relating to NPP and RR siting, design and operation, legal and governmental infrastructure, education and training, and radiation, waste and transport safety. This sectorial integration considers the evolution of safety in the country and elicits the current status, the most relevant actions taken, the unresolved issues, and priority actions required.

Step two (*horizontal integration*) provides analysis of each of the relevant areas of nuclear safety and provides a comprehensive picture of nuclear safety in the country. This analysis reveals issues common to various areas, their causes, inter-linkages, trends and priority actions.

As noted, ISE reports are structured to reflect the results of IAEA safety reviews with respect to the country's application of IAEA safety standards and actions taken in response to IAEA recommendations. For each topic in a given area, an evaluation of progress achieved should be performed. Evaluations are based on either a previous IAEA evaluation (e.g., IRRT, INSARR, E&T reviews, or expert missions) or, if no evaluation exists, a self-assessment by the country. This self-assessment should be on the basis of IAEA safety standards and guidelines for the relevant issue or area. Under this scenario, the IAEA should verify the conclusions reached by the country.

Chapters are structured according to relevant IAEA safety requirement documents. Each topic area is treated in a separate chapter of the report and areas subsequently are split into topics that specifically deal with IAEA safety requirements. Additionally, the ISE provides for individual evaluation of each facility in a given country.

In the Guidelines for Integrated Safety Evaluation of Nuclear Installations (EBP-ASIA-120), a scale of four levels is incorporated to measures progress in the various areas of evaluation. The levels are defined as:

Level 1 - No action taken

Level 2 - Work under development

Level 3 - Work development complete but not implemented

Level 4 - Work implemented, sustainability should be insured

The lowest level means that no improvements have been made in the safety situation and that the issue/problem may need priority attention. The highest level (4) means that the work is complete or nearly so on all recommendations, so that the facility is approaching full compliance with IAEA Safety Standards. See Appendix 2 for further explanation of the levels, and Appendix 3 for tables illustrating the application of the rating scheme.

These four levels were originally developed for use in evaluation of progress in responding to specific recommendations from IAEA Missions. In the ISE, the levels are to be used in evaluation of progress in more broadly defined areas. Therefore, the evaluator must make a judgment about the progress made in an area when responding to the recommendations relevant to that area, and not just to the specific recommendation.

Ideally, both the IAEA and the participating country are in accord on the level of achievement that has been reached. However, this has not always been the case in the first round of effort reported below. In multiple instances, these initial efforts have shown discrepancies between

recommendations that were not totally satisfied and the level of achievement attributed to the topic by the in-country facility staff or organization. This has shown the need for a better understanding of the ISE process, additional training in self-assessment and evaluation, and, in particular, a better understanding of IAEA Safety Standards.

1.4.2. ISE Results

This section deals with the findings that were generic to most of the EBP countries. Details are available in the individual ISE reports prepared on each of the countries.

1.4.2.1. Legal and governmental infrastructure

ISE reports were completed on legal and governmental infrastructure (LGI), using the results of either International Regulatory Review Team (IRRT) Missions, or one or more Expert Missions. The latter included missions to review the LGI for nuclear safety, follow-up missions to review the progress made with respect to the preceding mission, and/or Expert Missions to provide assistance for either drafting or reviewing nuclear legislation. Within the reporting period, ISE reports were completed for Indonesia, Malaysia, Thailand and Vietnam. The initial IRRT missions had identified several priority items that needed to be addressed in almost all the countries. These issues concerned, in particular, the legislative framework and the need to establish a strong, competent and well-resourced regulatory body. The follow-up missions showed that, at least in some of the countries, a major effort had been made to address these identified weaknesses and to resolve them. However, it is recognized that further efforts are still necessary in most of the countries.

All the countries have a law or a decree to regulate the use of radiation sources. In most cases, the legislation does not clearly define nuclear facilities, thus, does not explicitly address them. Some countries have addressed this problem in the more recent revisions to their legislation. However, a comprehensive nuclear law with all the required elements, as outlined in the Handbook on Nuclear Law, either does not exist, or is only in the process of being developed in all the countries concerned. This leads to some, or all, of the following weaknesses:

- The designated regulatory body lacks the required authority, independence and resources;
- There is no clear separation between the regulatory and promotional roles of the government;
- The existing nuclear facilities are not subject to licensing;
- The prime responsibility for safety, which should rest with the operator of the facility, is not clearly defined and assigned.

In most of the countries, the regulatory body lacks the capabilities required to carry out all the regulatory functions, as defined in IAEA Safety Standard GS-R-1 on Legal Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety. In several of the countries, the activities of the regulatory body have concentrated primarily on the regulation of nuclear materials and ionising radiation sources. More recently they have had to deal with the licensing of nuclear facilities. The regulatory bodies of most of the countries currently do not have the capability to carry out an independent evaluation of the updated safety analysis report (SAR) of an existing facility – a prerequisite for licensing the facility. This expertise will need to be developed, both for licensing and supervision of existing

facilities, and for new facilities that may be constructed. For the review and assessment work, establishment of a technical support organization could be considered, but it would need to be independent of the operating organization. In the short term, external assistance may be necessary (such as cooperation with other regulatory bodies in the region), since the required capabilities may not be available in the country.

Within the framework of the EBP, the IAEA organized several training courses and workshops on topics related to nuclear safety to help regulatory bodies acquire the competencies required to carry out their regulatory functions (see section I.3.1.). The knowledge acquired through these activities should now be utilized, and competencies further developed, e.g., by better allocation of specific tasks to specific persons, or groups of persons, who attended the related training activities, and/or by training others within the regulatory body.

1.4.2.2. Safety of Research Reactors

The procedure adopted for the preparation of the reports, in most cases, consisted of discussions with national counterparts on progress in implementing recommendations provided in previously conducted safety missions and on major areas of future work. Review of documents and field activities to confirm the progress achieved were not conducted except for the Dalat Research Reactor in Vietnam and the Bandung Research Reactor in Indonesia where recent INSARR follow-up missions were conducted.

In general, most of the recommendations provided in previous missions were addressed and the technical qualifications of the staff of the operating organizations showed improvement, largely as a result of the number of training activities conducted in the region.

Improvements in the level of safety of facilities varied significantly. In some areas, considerable progress was achieved, but in others, little or no progress was observed, primarily from lack of local expertise or inadequate financial support.

Areas in which common results were observed are presented below. Other results that are more facility specific may be obtained in the corresponding ISE reports

Safety Analysis Report: The quality of the safety analysis report (SAR) in several facilities has improved. Updating and structuring of the SAR following the IAEA recommendations was a major activity in some organizations. In other cases, despite the support provided, little progress was achieved, and on more than one occasion, scheduled IAEA missions to review new versions of the SAR were cancelled or postponed.

Safety Analysis: The first missions under the EBP programme identified the fact that very limited technical competence was available in several operating organizations, and that the safety analyses were the original ones provided by the vendors. Training activities and expert missions were conducted under the EBP programme to develop local competencies and support the preparation of updated safety analyses. The present situation indicates that in several organizations, local expertise was created and activities to update the safety analysis were initiated.

Quality Assurance: Quality assurance programmes (QA) didn’t exist, or were very incipient at the beginning of the EBP. In recent years, a decision to establish QA programmes was taken but further implementation is needed.

Emergency Planning: Emergency planning exists in most of the facilities, but procedures in case of accidents are not always available. A major issue is that emergency drills are not performed regularly to guarantee that planning is feasible and adequate.

Operational Limits and Conditions: Operational Limits and Conditions (OLC) are established based on the results of the safety analysis. As indicated previously, safety analyses updating are under way in several facilities. As a result, the OLC generally are incomplete or do not reflect the present status of the reactor.

Site Evaluation: As an example, the lack of analysis of seismic tolerance of buildings and systems was observed and identified as an issue in several facilities. Very limited, or no progress, was observed in this area. No expertise is available in most of the facilities and external support is needed to address the issues identified.

Ageing Management: Programmes to follow the degradation of systems and components due to facility ageing are very limited. This will become even more of an issue as more facilities reach the end of their useful life and are not replaced.

1.4.2.3. Education and training

ISE reports were completed on education and training (E&T), using the results of the pilot education and training review missions. Within the reporting period, ISE reports were completed in the E&T area for Indonesia, Malaysia, Thailand and Vietnam.

Ideally, prior to an ISE, the individual country conducts a self-assessment of the capabilities and competencies required of its regulatory body and of its operating entity to carry out specific functions and duties. The ISE mission would then focus on: reviewing whether these capabilities and competencies were available in the organization; determining what education and training would be required to fill possible knowledge gaps; and, assessing whether these gaps could be filled using the education and training system available in the country. However, a self-assessment on education and training really was never done by any of the countries of the region prior to the missions. Countries are encouraged still to systematically evaluate the required capabilities of their regulatory bodies and operating organizations, both with respect to existing nuclear programmes, as well as any future developments. Within the reporting period, Malaysia has indicated that this work has been done, to a certain extent, at the operating organization and that a review is underway at the regulatory body.

The ISE reports show that most of the countries currently do not have a policy relating to nuclear safety education and training. This applies especially at the national level, but in some cases, also reflects the lack of a policy within the regulatory body and within the operating organization. An assessment of the education and training available in the countries showed that the universities and training institutes generally offer courses focusing on the use of radioisotopes and radioactive material, rather than on reactor safety.

The ISE reports also showed that thus far, the countries have not utilized fully the training available through the IAEA or through other countries; nor has there been optimum utilization of the staff that has received training. The respective organizations in the individual countries are encouraged to prepare and maintain an inventory of the staff that have been trained by the IAEA and abroad, and list the competencies acquired by them. These staff, and especially those that participate in “Train the Trainers” courses, should be used to ensure the multiplicative and sustainable effect of education and training. Within the reporting period, individual countries (e.g. Indonesia and Vietnam) have established plans to conduct their own

national training courses, using the standard training material that has been made available by the IAEA (e.g. multimedia, CD-ROMs, textbooks, PowerPoint presentations).

As mentioned earlier, a systematic evaluation of the competencies and capabilities required by the individual organizations (self-assessment) was not done in any country prior to the missions. However, in the time available to them, the pilot E&T review mission teams did do a brief analysis of the gaps between what is currently available and what would be required. This work was based on the IAEA-TECDOC-1254 for regulatory bodies. For the operating organization, the competencies were examined in the areas of reactor operation (reactor managers and control room operators), ageing assessments, and licensing activities related to possible new reactors.

The pilot E&T review missions also provided feedback on the areas where the current "Guidelines for the IAEA Nuclear Safety Education and Training Review Services" need to be improved. This is especially applicable to the area of self-assessment by the individual organizations in the individual countries. (Note: The "Guidelines" document is in the process of being revised and updated, with completion targeted for the end of 2003.)

In China a self-assessment of E&T was carried out in a national workshop attended by experts from the regulatory body, the Atomic Energy Authority, NPP operating organizations, research institutes, and universities. A group of international experts and the IAEA Secretariat participated in the workshop to share international experience and to provide guidance for the self-assessment. Good practices and challenges to improve E&T have been identified along with further assistance to be provided by the IAEA. The interest and participation of experts from all institutions involved in E&T demonstrated the importance being given to E&T in China.

1.5. SHARING KNOWLEDGE

There is general agreement that effective communication, exchange of information and sharing knowledge are essential tools to achieve a sustainable nuclear safety infrastructure and a high level of safety of nuclear installations worldwide. Core to the EBP has been, and continues to be, efforts to improve information exchange and networking throughout the region.

To date, as noted elsewhere in this document, considerable progress has been made – through regional workshops and training, through ISEs, through access to the EBP database – to expand both the mechanisms and the actuality of sharing knowledge and networking.

However, also as noted, considerable progress remains to be made. This is particularly important in the light of the ageing workforce and small engagement of new students in the nuclear field that has been occurring for a number of years.

The IAEA convened a Meeting of Senior Officials on Managing Nuclear Knowledge in June 2002 to examine ways in which the Agency could enhance networking and knowledge management. Meeting participants concluded that the IAEA has an obligation to lead activities toward preservation and enhancement of nuclear knowledge. Participants examined such mechanisms as:

- Creation of knowledge databases – best practices, expert directories, etc.
- Active process management – of knowledge gathering, classifying, storing, etc.

- Development of knowledge centres – focal points for knowledge skills and facilitating knowledge flow.
- Networking – connecting individuals with common interests to share knowledge; such knowledge webs often transcend organizational boundaries.
- Introduction of collaborative technologies – intranets or groupware for rapid information access.
- The possible designation of someone at a senior level, with specific responsibility to initiate new knowledge practices within an organization and/or region and to develop knowledge sharing and infrastructures.

Meeting participants agreed that the top priority activities should deal with the integration of information in the Agency and Member States in the form of an easily accessible Nuclear Knowledge Portal and Networking of Institutions for Education and Training.

In September 2002, the General Conference adopted a resolution welcoming the conclusions and recommendations of the June 2002 meeting.

A new Technical Cooperation Regional Project has been approved for 2003 to assist Asian countries on Knowledge Management, and will be implemented in close cooperation with the EBP and the ANSN.

1.5.1. Asian Nuclear Safety Network (ANSN)

The ANSN has been developed to help ensure that information relevant to the safety of nuclear installations is analyzed, catalogued, and shared worldwide. In Asia, in particular, relevant safety information is accumulating rapidly, as construction and operation of nuclear power plants of differing designs continues at a more rapid rate than elsewhere in the world. This information may include, among other data, results from IAEA and other international and national technical meetings, peer reviews, feedback from operational experience, and other nuclear safety developments.

The major functions of the Asian Nuclear Safety Network are to support the sustainability of national nuclear safety infrastructures and to make optimum use of existing and new nuclear safety information. This will be achieved through:

- Education and training;
- Information assessment from knowledge management; and,
- Communication among experts.

The Network is to be implemented using modern information technology (IT) tools for communication among Hubs and national centres worldwide. In the initial phase of implementation, it is anticipated that the IAEA will take a more active role and initiative to establish a common technical basis for information assessment, knowledge management, and communications protocol. Individual Hubs and national centres will be charged to extract, analyze and import data according to the knowledge base structure (see Fig. 1).

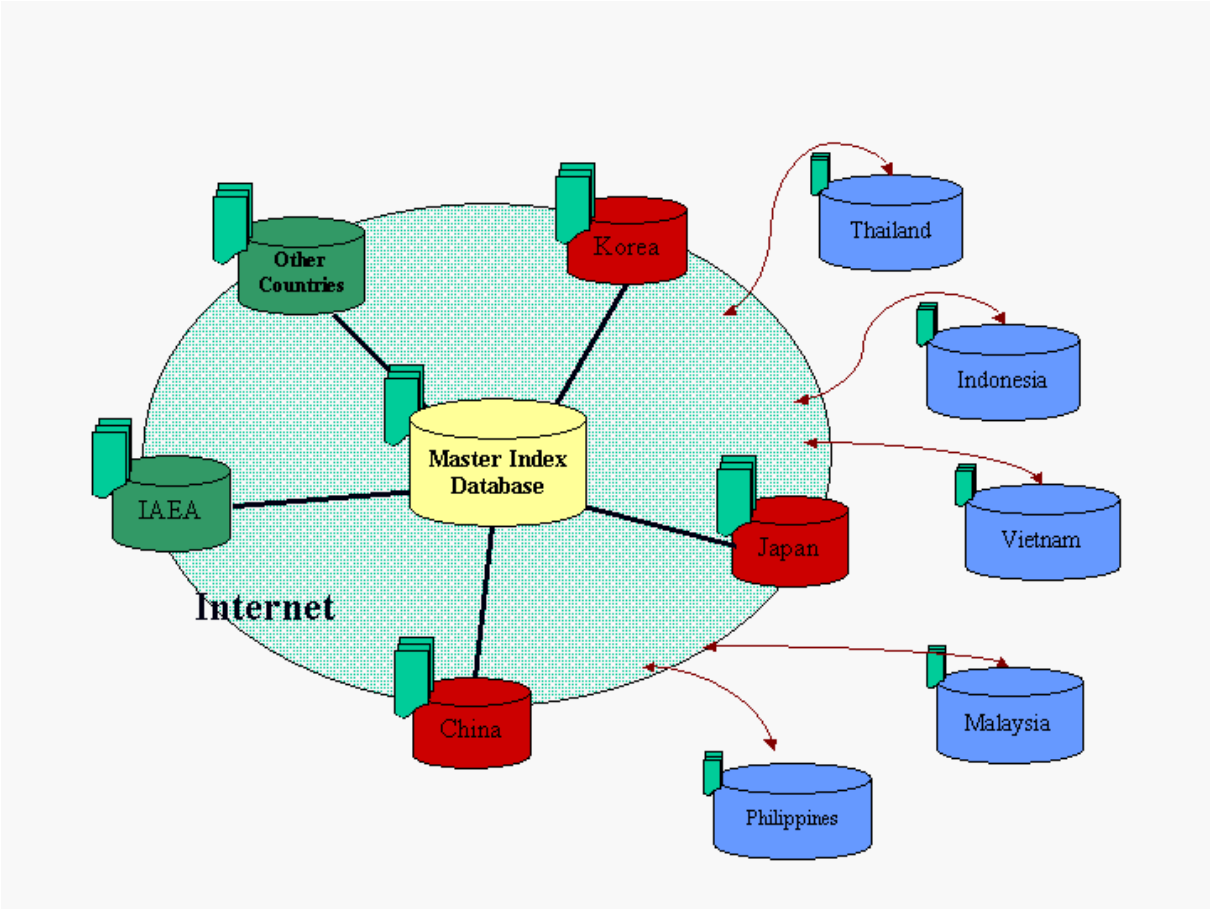

FIG. 1. Asian Nuclear Safety Network

In order to implement the aforementioned concept of the ANSN, a step-by-step approach has been undertaken, starting with a pilot project to demonstrate the feasibility and value of the network. The pilot project was prepared in 2002 and is being implemented in 2003, with the expectation of starting regular operation in 2004 in the frame of the next phase of the EBP. The pilot project has been focused on pooling and sharing information on education and training for nuclear safety, both because education and training is a major ANSN objective, and because a large volume of relevant material already exists in the EBP donor countries and in the IAEA. Some relevant E&T material for the pilot project was also drawn from China.

The knowledge base developed for the pilot project has been structured on the basis of IAEA Nuclear Safety Standards and is consistent with the strategy agreed upon at the 2001 Advisory Group Meeting on Education and Training. To date, the basic structure of the knowledge database has been constructed and the information technology requirements, including the operational concept of the network, have been identified. A Master Index has been developed to demonstrate and facilitate the web based search and retrieval system. The Index displays the categories and other attributes of data (in accordance with the agreed taxonomy for education and training materials) that is/will be stored at the ANSN hubs and that will be retrievable when the system is fully operable.

ANSN portal sites at the hubs in China, Japan, Korea and at ANL/USA, BMU/GRS, Germany and at the IAEA were developed for the pilot project. Each site selected a certain amount of material on education and training; uploaded key words and other search attributes of the material into the Master Index; and have a goal of making the sites and test data available for retrieval through the ANSN by year-end 2003.

Consultation Meetings were held in Japan in 2002, and in Korea and at the IAEA in 2003, to discuss the ANSN concept and taxonomy for the pilot project in Education and Training. Other technical meetings have been convened by the IAEA in Vienna to co-ordinate database development, communication, protocols and other IT matters.

1.6. OUTLOOK

In line with its statutory functions, the IAEA formulated an overall long-term *vision* for nuclear safety as:

"A strong, sustainable and visible global safety regime that provides for protection of people and the environment from effects of ionising radiation, minimization of the likelihood of accidents or malicious acts that could endanger life and property, and effective mitigation of the effects of any such events".

Under the global safety regime envisaged:

- Comprehensive national and international safety infrastructures provide the framework for achieving high levels of safety and continuous improvements;

- Widespread subscription to intergovernmental agreements on safety helps to promote the pursuit of high levels of safety worldwide;

- A comprehensive, coherent and authoritative suite of internationally accepted safety standards embody the current best safety practices;

- Integrated and harmonized approaches are adopted in applying these international safety standards; and,

- Self-sustaining regional and global networks for exchanging knowledge and experience provide the supporting technical infrastructure for continuous learning and improvement of safety.

The first two of these features are largely under the control of the Member States, although the Agency has some influence. The last three are more consistent with the Agency's mandate, and so form the basis for the overall objectives of the EBP.

Results to date indicate that in the countries participating in the EBP, considerable achievements have been reached towards:

- Establishing a legal and governmental nuclear safety infrastructure;

- Enhancing safety of nuclear installations (RR, NPPs);

- Enhancing technical capabilities of the professional staff; and

- Establishing sustainable education and training programmes in nuclear safety.

The specific situation varies, however, from country to country and involves technical and policy matters and different organizations. Owing to the many missions, expert missions, technical meetings, and training events, a wealth of knowledge has been accumulated. However, this has not been fully analyzed and shared among the countries of the region. It is essential that this knowledge be consolidated, elicited from the results of all activities under the EBP and other projects, properly codified and shared within each country and among the countries.

Two major initiatives closely interrelated have been initiated in 2003 to address the above concerns, and are the basis for building up the EBP strategy for 2004 and beyond. These initiatives are:

- Integrated Safety Evaluations (ISE); and

- Asian Nuclear Safety Network (ANSN).

The first, ISE reports establish the technical and institutional assessments necessary to implement a focused approach to prioritise nuclear safety needs and to identify the assistance required to meet both technical and policy concerns. ISE reports are being completed in 2003 jointly by the IAEA and by participating countries, as described in Part I, Section 4.

The latter, the ANSN, should ensure the consolidation of existing, and new safety knowledge, and provide for its proper dissemination and use. Again, as noted earlier, a pilot project in education and training was carried out in 2003. Elaboration of the ANSN concept and modalities for its implementation are discussed in Part II.

2. STRATEGY FOR PHASE II

2.1. INSTITUTIONAL CHANGES

As noted in Part I, the objective of the first Phase of the EBP was to strengthen nuclear safety in Asia, and in particular, to enhance the technical capabilities of regulators, operators, and supporting technical organizations; to improve nuclear safety infrastructure; and, to further human resource development. Indeed, the first phase of the EBP (1997-2003) can be best characterized by the assistance provided to Member States to identify weaknesses and to develop corrective actions. To date, however, implementation of safety improvements is in different stages of completion in various countries, which serves to highlight the need for continued effort by donor and recipient countries alike.

Therefore, the overall objective of the second phase of the EBP is to assist participating countries to further strengthen safety of their nuclear installations and to maintain a continuous process of safety improvements.

The programme scope remains focused on assisting NPP and RR regulators and operators through the conduct of safety review missions, expert advice and training.

The successful implementation of the next phase of the EBP should lead to sustainable national nuclear safety regimes which are the required building blocks for the global safety regime discussed in section (1.6) above.

The strategy for the new phase of the EBP is to develop mechanisms through which "recipient" countries can strengthen their "ownership" of the institutional knowledge and policy decisions needed to sustain the progress that has been made thus far. The technical expertise that has been developed needs to be combined with commitment at the highest levels of government to fully utilize the resources developed under the EBP. Government institutions, for example, need to recognize the potential resources available among the cadre of technical experts who have participated in EBP "Train the Trainer" programmes and to institutionalise programmes to further expand education and training.

Both the ISE reports and the ANSN, the major elements of the new phase of the EBP, are vehicles to help recipient nations expand their own roles in increasing regional nuclear safety. Both emphasize self-analysis and mechanisms to pool, extract, analyze, and effectively share (through the ANSN) existing and new nuclear safety knowledge.

2.2. ELEMENTS OF EBP ASSISTANCE

The new phase of the EBP proposed for 2004 and beyond should focus on assisting countries to:

- Continue implementing safety improvements, both technical and organizational with the aim of maintaining a high level of safety of nuclear installations (through IAEA safety services, expert missions and workshops);

- Consolidate sustainable education and training programmes and training of trainers (through standard training material provided by the IAEA, locally sponsored and managed training courses and workshops);

- Complete and maintain up to date integrated safety evaluations to monitor progress in each country (through self-assessment and IAEA expert's advice);

- Establish knowledge management systems to compile, analyze and share information at national and international levels (through national efforts including the establishment of the national centre); and

- Establish a Nuclear Safety Network among the EBP countries to elicit relevant nuclear safety knowledge and share it effectively (through ANSN).

2.3. PRIORITIES

Priorities for EBP assistance will be agreed on a yearly basis by all countries participating in the EBP. The Advisory Group, established during Phase I, will continue to meet once a year to ensure country requests and the IAEA evaluations are fully based on the results of the EBP Phase I and on the current situation, as reflected in the ISEs.

To address the weakness related to analysis of information, and eliciting and sharing knowledge, the Asian Nuclear Safety Network (ANSN) should move to full implementation.

The successful demonstration of its operability with the pilot project on Education and Training in 2003, encourages its utilization as a main tool for knowledge creation and self-learning.

The highest priority of Phase II of the EBP is to consolidate the knowledge generated in Phase I and to ensure its proper sharing among the participating countries. This involves an in-depth analysis of the available information to extract lessons and existing knowledge, and consideration of experience feedback to generate new knowledge. The process should become autonomous and self-sustaining with full participation of all countries involved.

2.4. SPECIFIC ACTIVITIES

As described above, the focus is on consolidation and management of knowledge, both existing and new, and its proper sharing. Therefore, the following specific activities are proposed:

a. Pooling and analyzing results of EBP Phase I

This activity should be performed considering specific subject areas related to regulatory control, safety of RRs and NPPs, and education and training. For each subject area, an in-depth analysis of results to date will be performed and accumulated according to a general agreed-upon taxonomy.

b. Knowledge dissemination

This activity also involves further efforts to prepare standard training material and train the trainers to achieve sustainability of E&T programmes in participating countries.

A major element under this activity is the establishment and full operation of the ANSN. A full description of the ANSN is in Section II.5.

c. Knowledge application

This involves continuous efforts to bridge the gaps between the current situation in each country and the situation envisaged by the applications of the IAEA NS Standards. This activity involves assistance through expert missions and IAEA safety services such as IRRT, OSART and INSARR.

d. Programme evaluation

It is generally recognized that it is essential to monitor not only the service or products delivered by the Agency (output), but also the change resulting from the use, application, and implementation of Agency work (outcome).

The ISE will be used as the main tool for the programme evaluation. This requires commitment from the countries participating in the EBP to implement recommendations and guidance that they receive, and to work to overcome other institutional problems of a domestic nature.

During the second phase of the EBP a dedicated effort will be made to further develop and keep ISEs up to date, and to monitor trends and changes at national and international levels.

2.5 KNOWLEDGE MANAGEMENT

The effective management of nuclear knowledge, and in our case nuclear safety knowledge, is essential for the safety of nuclear installations. This is particularly important in the light of the ageing workforce and the small engagement of new students that has been occurring in the past years. It is therefore timely to take advantage of the way business models are being used to manage organizations' intellectual capital. The intention is to build learning organizations and establish processes to generate and propagate knowledge.

Typical projects found within organizational knowledge initiatives include:

- Creation of knowledge databases – best practices, expert directories, etc.
- Active process management – of knowledge gathering, classifying, storing, etc.
- Development of knowledge centres – focal points for knowledge skills and facilitating knowledge flow.
- Networking – connecting individuals with common interests to share knowledge; such knowledge webs often transcend organizational boundaries.
- Introduction of collaborative technologies – intranets or groupware for rapid information access.

Business models usually recommend appointment of a Chief Knowledge Officer, or someone at a senior level, with specific responsibility to initiate new knowledge practices within the organization, and to develop knowledge sharing and innovation infrastructures. This topic will be addressed during the EBP Phase II, primarily under the umbrella of the dedicated Technical Co-operation Regional Project RAS/9/028. This project was initiated in 2003, and a Regional Workshop on KM Techniques will take place in November 2003 in Korea, hosted by KAERI.

2.5.1. ANSN Knowledge Base

The concept and operability of an Asia Nuclear Safety Network to pool, analyze and share safety information was successfully demonstrated in a pilot project in 2003. The challenge for 2004 and beyond is to fully develop the network to sustain national nuclear safety infrastructures and to make use of existing and new nuclear safety knowledge.

During the pilot project, a taxonomy for classification of the material was developed. It will be further expanded to build a larger knowledge base and to facilitate its retrieval and use. As depicted in Fig. 2 the database is structured into facility areas, technical areas, and activity areas.

FIG. 2. Multiple Choices in Searching

An ANSN technical co-ordination group composed of representatives of the Hubs and Technical Centres will be established to elicit and prioritise areas to be addressed in the knowledge base. For each area a group of specialists will be created to analyze relevant information to be used as input data to populate the knowledge base. The guidelines for data quality (ANSN-07) will be used to ensure consistency of data input and proper maintenance of the knowledge base.

Each specialists group will nominate a co-ordinator who will represent the group and report periodically to the ANSN technical co-ordination group.

2.5.2. ANSN Services

The concept of ANSN implementation is that of a decentralized, autonomous network for accumulating existing and new knowledge, sharing and using this knowledge to enhance NS, and contributing to an international safety regime. Therefore, in the frame of Phase II, the ANSN will be the primary mechanism to respond to safety needs from participating countries.

The dynamics for addressing safety needs will be the following:

- *Needs for each country are formulated and justified based on ISEs*. Under Phase I of the EBP, as noted earlier in this report, safety needs were defined for an individual facility or technical area, primarily through the EBP review process. The ISE integrates all technical and institutional aspects related to nuclear safety and evaluates them with respect to the specifics of each installation, and to the country's safety infrastructures. The ISE review is interactive, with each country performing a self-assessment of its achievements and identifying further needs, and a peer review by the IAEA.
- *Assistance is searched for among Hubs and National centres*. Currently, hubs have been set up – in Japan, Korea, and China. Portal sites also were established during the pilot project at the IAEA and at the three hubs . In addition, national centres are being established among all countries involved in the EBP. The resulting network will provide countries virtual access to an extensive knowledge database and the ability to both input as well as retrieve information from the database for self-help.
- *A Hub (including IAEA) or National Centre takes the lead to provide the assistance*. As a starting point for the work plan by 2004, the target is to fulfil 30% of the tasks utilizing ANSN Hubs other than the IAEA. As the system matures, the network will provide the vehicle to member countries in the region to identify common problems related to safety, including safety management and safety culture; to have a forum for development and evaluation of options to solve safety problems; to mutually assist each other, either with specific issues or overall safety concepts; and to provide technical support to each other.
- *A task leader is assigned to co-ordinate the assistance effort, and subsequently, enter the accumulated results and knowledge into the ANSN information/knowledge base*. This is both a housekeeping duty, to make sure that the requested assistance is provided, and a means of expanding regional knowledge and broadening the scope of the ANSN database.

The concept described by this dynamics is to utilize the ANSN as a virtual Technical Support Organization for the EBP, with the IAEA included as one of the Hubs and providing overall coordination and management. During phase II of the EBP, the ANSN should gradually

increase its autonomous and sustainable characteristics over a period of the next three years. At the end of the period, it is hoped that the training and expert services should be mostly provided via the ANSN. International peer reviews will remain part of IAEA deliverables because they are a statutory function related to the application of nuclear safety standards.

2.5.3. Thematic Groups

The ANSN can be used as a tool to address some of the issues mentioned above through the establishment of "thematic groups", addressing topics relevant to research reactor operators, engineering supporting groups and regulatory bodies. To fulfil this objective, the creation of thematic groups composed of specialists from the participating countries is proposed. A thematic group will be a forum for the exchange of experiences and safety related documentation on a particular topic. Generally, a thematic group should contain at least three elements:

- News – general information for the group participants;
- IAEA and national documentation – e.g., safety documentation available for consultation; and,
- Discussion forum – an opportunity to discuss specific subjects and to address questions to specialists in other participating countries.

Each thematic group should be led by a moderator from one of the Hubs. The moderator is responsible to create, and regularly update, the group composition, collect information on events and relevant safety knowledge available, and make a quality check on the material before it is uploaded to the net. Thematic groups should meet periodically to exchange personal experiences.

Safety Analysis

As a starting point for 2004 a thematic group on safety analysis is proposed.

On several occasions the Agency had the opportunity to evaluate the safety analysis of research reactors in Member States. Some of the conclusions from these evaluations are that:

- There is a lack of balance in the accidents discussed in the safety analyses;
- Seismic considerations have not always appeared in the safety analysis;
- Modifications of a facility have not been subjected to safety analysis even though they may constitute an un-reviewed safety question;
- In some reactors, it was found that the safety analyses were frequently based on the opinion of outside experts and institutions. In these cases, analyses would not be available locally to support a stated position;
- In some cases there is a lack of appropriate tools to perform the safety analysis;
- Updates in internationally accepted safety standards were not taken into account.

To address some of these issues several expert missions and training activities were conducted under the EBP programme in the last few years. In particular, it is worth mentioning the two-year project consisting of four consecutive workshops hosted by Korea Institute of Nuclear Safety on "Safety Analysis Methodology and Computer Code Utilization for Research

Reactors". The main objective of these regional training workshops was to enhance the capability of regulatory bodies and operating organizations to perform safety analysis using computer codes. The participants in these workshops form a logical cadre from which the thematic group can be built.

The thematic group on Safety Analysis will provide a forum for the continued exchange of information and documentation among specialists dealing with safety analysis of research reactors. Moreover, it can be used as a means to maintain and improve the knowledge acquired during the project on safety analysis methodology and use of computer codes, as mentioned above. This thematic group is being developed under the leadership of KINS in Korea.

Other thematic groups will be introduced gradually dealing with areas such as:

- Quality Assurance
- Safety Documentation;
- Operational Limits and Conditions;
- Emergency Planning;
- Regulatory Activities; and
- Safety Culture and Management of Safety.

2.5.4. Trainers Forum

One of the main functions of the ANSN is to support training activities in Member States. This function was initiated in 2003 under Phase I and is continuing in Phase II.

A knowledge base of nuclear safety E&T material, prepared by the IAEA and other countries, is being uploaded into the ANSN for search and retrieval for the preparation of national training courses.

During Phase I, trainers have been trained on the organization of national training courses and use of standard training material prepared by the IAEA. It is essential that national trainers continue to exchange their experience as a means of improving their teaching skills and to improve the quality of their training programmes and materials.

In order to promote this communication among trainers a "Trainers Forum" is proposed. Complementary to the communication via ANSN, annual meetings of trainers should be organized in the frame of the EBP to discuss national developments and to elicit new training initiatives, both with respect to subject matter and to teaching methods and skills.

The operational mode of the forum on ANSN will be similar to that of the thematic groups discussed above.

Appendix 1.

EBP ACTIVITIES BY COUNTRY BY YEAR (1997-2003)

1997-2003.pdf

Appendix 2

INTERPRETATION OF THE FOUR LEVELS IN THE GUIDELINES FOR INTEGRATED SAFETY EVALUATION OF NUCLEAR INSTALLATIONS

In the Guidelines for Integrated Safety Evaluation of Nuclear Installations (EBP-ASIA-120), four levels are introduced as measures of progress in the various areas of evaluation. These are:

Level 1 No action taken.

Level 2 Work under development.

Level 3 Work development complete but not implemented.

Level 4 Work implemented, sustainability should be insured.

These four levels were originally developed for use in evaluation of progress in responding to specific recommendations from IAEA Missions. The baseline for the evaluation should be recommendations from completed IAEA Missions, principally those conducted under the EBP-Asia, or from self-assessments performed by the host country. In the ISE the levels are to be used in evaluation of progress in more broadly defined areas. Therefore, a definition of the four levels suitable for judgement of the situation in broad areas is necessary.

Level 1 (Red): Generally, the situation in this area is judged to be unsatisfactory. There has been little or no action taken on recommendations from IAEA Missions or self-assessments in this area. Consequently, there has been little or no improvement in the situation that led to the recommendations. Focused management attention to this area is necessary to address the outstanding recommendations and improve an unsatisfactory situation. Areas judged to be at Level 1 should be given top priority for IAEA assistance.

Level 2 (Orange): Generally, the situation in this area is judged to be marginal. Some action has been taken on recommendations from IAEA Missions or self-assessments in this area, but generally the required action is not complete. The extent to which the various recommendations have been addressed may vary, but work is in progress to improve the situation that led to the recommendations. Continued management attention is required to ensure that the required actions are completed so that a satisfactory situation can be attained. Areas judged to be at Level 2 should be given high priority for IAEA assistance.

Level 3 (Yellow): Generally, the situation in this area is judged to be satisfactory but still in need of improvement in some respects. Action has been taken on the recommendations from IAEA Missions or self-assessments in this area, and the required action on major recommendations is complete or nearly so. Substantial improvement in the situation has been achieved, although there is still work to be done to complete response to the recommendations. However, continued management attention is required to ensure a complete response to the recommendations and ensure that continued progress towards a fully

satisfactory situation is attained. Areas judged to be at Level 3 should be given a medium priority for IAEA assistance. Any requested assistance should be focused on resolution of specific unresolved issues.

Level 4 (Green): Generally, the situation in this area is judged to be good in all major respects. The response to the major recommendations is complete, and work is complete or nearly so on all recommendations. Continued management attention is required to ensure that remaining actions are completed, and that improvements are sustained. Little or no additional IAEA assistance should be needed in areas judged to be at Level 4.

Note that recommendations may include those resulting from an INSARR or similar Agency mission, and those resulting from an internal self-assessment. In cases in which there are no specific recommendations, it will be necessary to judge the level of the overall situation and whether progress is being made.

Appendix 3

INTEGRATED SAFETY EVALUATION (ISE) RATING SCHEME

TABLE 1. LEGAL AND GOVERNMENTAL INFRASTRUCTURE

	Establishment of a National Regulatory Framework				Establishment of the Organizational Structure of the Regulatory Body				Fulfillment of the Activities of the Regulatory Body				Establishment of Specific Infrastructures			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Legislation and Regulations																
Regulatory Body																
General Organization																
Support to the Regulatory Body																
Relations Between the Regulatory Body and the Operator																
International Co-operation																
Authorization																
Review and Assessment																
Inspection and Enforcement																
Development of Regulations and Guides																
Infrastructure for emergency preparedness																
Other specific infrastructure																

1: no action taken, 2: work under development, 3: work development complete but not implemented, 4: work implemented, sustainability should be insured

TABLE 2. SAFETY OF RESEARCH REACTORS

	Organization for Safety				Operational Nuclear Safety				Radiation Protection				Special Issues			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Operating organization and reactor management																
Safety Committees																
Quality Assurance Programmes																
Emergency Planning																
Safety Analysis																
Safety Analysis Report																
Operational Limits and Conditions																
Conduct of Operations																
Maintenance and Periodic Testing																
Utilization and Experiments																
Modifications																
Radiation Protection Programme																
Radioactive Waste Management																
Siting																
Design																
Construction																
Commissioning																
Modifications																
Extended Shutdown																
Decommissioning																

1: no action taken, 2: work under development, 3: work development complete but not implemented, 4: work implemented, sustainability should be insured

TABLE 3. EDUCATION AND TRAINING IN NUCLEAR SAFETY

	Establishment of an Education and Training Policy				Overview of All Capabilities and Competencies Required				Assessment of the Education and Training Available in the Member State				Assessment of the Gaps and the Education and Training Required to Fill These Gaps				Continuous Maintenance and Improvement			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Policy at the national level																				
Policy within the regulatory body and technical support organization (TSO)																				
Policy within the operating organization																				
Capabilities of the regulatory body including its TSO and competencies of the staff																				
Capabilities of the operating organization and competencies of the staff																				
Programmes at the universities and training institutes																				
Effective use of the education and training available																				
Regulatory body and technical support organization																				
Operating organization																				
Scope and depth of programmes																				
Training materials																				
Inventory of trainers																				
Maintenance and improvement of training programmes																				

1: no action taken, 2: work under development, 3: work development complete but not implemented, 4: work implemented, sustainability should be insured