CHALLENGING CURRICULUM
TRAINING THE IAEA INTERNATIONAL SAFEGUARDS INSPECTORATE

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Each year, the IAEA recruits a group of highly qualified specialists to join its experienced international team of safeguards inspectors. Their work will take them to nuclear facilities around the world, to utilize instrumentation and gather information for verifying national pledges that nuclear activities and materials under IAEA safeguards are exclusively used for peaceful purposes. And in those States which have signed a protocol in addition to their safeguards agreement, they will provide assurances that there are no undeclared nuclear activities or materials. Under more than 220 safeguards agreements with 139 States, the IAEA has served as the world's "nuclear safeguards inspectorate" for the past four decades. The Agency carries out verification activities at more than 900 facilities worldwide, conducting about 2200 inspections a year.

Before the new inspectors take to the field, however, they enter the classroom -- participating in an extensive series of IAEA training courses, workshops, and seminars. The courses comprehensively cover the nuclear fuel cycle, the IAEA's safeguards role and responsibilities, and the skills and competence that safeguards inspectors need to do their jobs effectively and efficiently.

Once on the job, training reinforces the evolving safeguards mission. Under the Agency's "enhanced" safeguards training curriculum, experienced inspectors participate in seminars and courses designed to upgrade their skills and keep them fully informed of safeguards developments with respect to, for example, legal responsibilities, technological capabilities, and inspection procedures.

The enhanced curriculum was developed in response to the IAEA's increasing safeguards responsibilities. The system has been strengthened in many ways since 1991, particularly for detecting any undeclared nuclear material and activities that should have been declared by a State under its safeguards agreement.

This article presents an overview of the IAEA's safeguards training activities in the context of measures to strengthen the effectiveness and efficiency of the safeguards system.

Safeguards inspectors are the keystones of the IAEA's inspection system and visibly serve as the principal resource for the implementation of safeguards and the measures designed to strengthen the safeguards system.

The IAEA gives special emphasis to training its safeguard staff as well as personnel from Member States relative to their obligations under international safeguards agreements. For this reason, a dedicated Training Section was established within the Department of Safeguards in 1980. Since that time, a comprehensive training curriculum has been developed with the aim of providing inspectors and other personnel with the skills and knowledge they require for carrying out their responsibilities effectively and efficiently.

The initial course attended by new inspectors is the Introductory Course on Agency Safeguards (ICAS). Since new inspectors come to the Agency with various levels of educational and professional experience, the goal of the ICAS, which is a ten week

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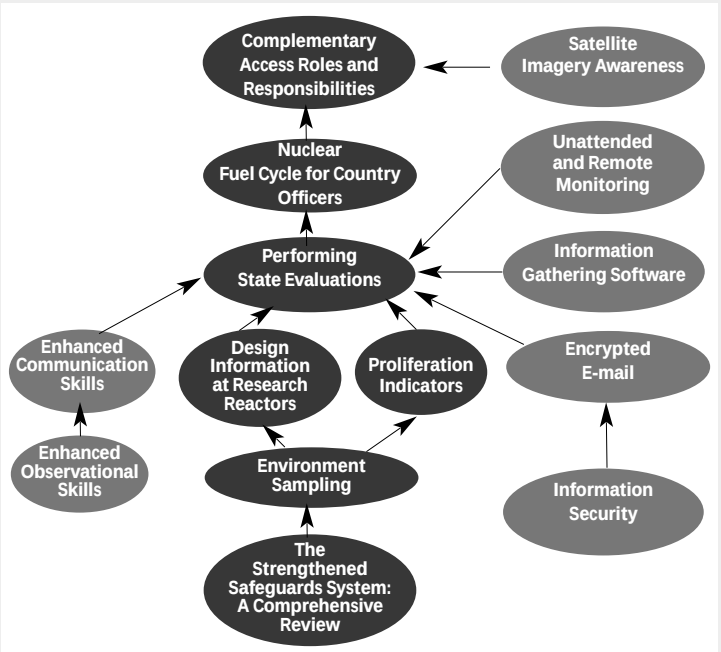
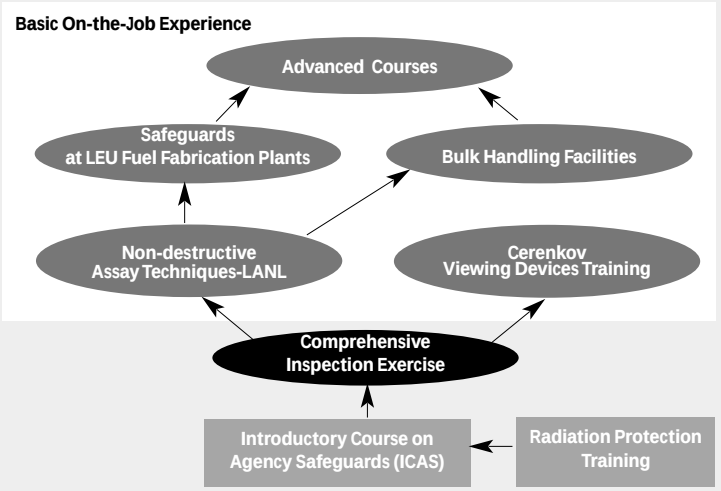
SAFEGUARDS TRAINING EVENTS

Enhanced Training Curriculum



Basic Inspector Training Curriculum



course, is to bring all of the participants to a common level of knowledge with regard to the nuclear fuel cycle and the Agency's commitments and responsibilities. It is also designed to give the participants the necessary skills required by an inspector to carry out an inspection. These skills are in the areas of nuclear material accountancy, containment and surveillance (C/S) techniques, and non-destructive analysis (NDA) equipment and techniques.

The ICAS is followed by the Comprehensive Inspection Exercise. This course supplements the ICAS training by providing the new inspectors with the opportunity to become familiar with safeguards measures and inspection activities as they are applied at light-water reactors and to practice the activities associated with the verification of the nuclear material inventory.

The experience, which consists of a general overview of the facility and the accounting system, augments classroom training. Practical experience is provided on the auditing of facility records, verification of fresh and spent fuel, and containment and surveillance measures at a reactor. All activities are documented as in a normal inspection.

Upon completion of these courses an inspector is sent to the field with more experienced inspectors to further their understanding of the practical problems associated with the inspection process. Within a year or two the inspectors are required to attend additional courses which broaden their understanding of NDA techniques and the inspection activities conducted at more complicated facilities.

ENHANCED TRAINING CURRICULUM

The transition to a Strengthened Safeguards System has created demands for additional inspector skills. In response, the Safeguards Training Section developed an "enhanced curriculum," to ensure that inspectors have the capability to better detect undeclared nuclear activities and the misuse of declared nuclear facilities and

IAEA SAFEGUARDS INSPECTORS: BACKGROUND & QUALIFICATIONS

The IAEA Department of Safeguards has just over 600 staff members, about half of whom are approved as safeguards inspectors. At the end of 2000, there were 213 designated inspectors who performed nearly 2500 inspections at about 900 safeguarded facilities. The inspectors are hired from among the IAEA's 130 Member States and are required to have the following minumu education and professional experience:

- A university degree, or equivalent in nuclear science, chemistry, physics, engineering or electronics/instrumentation. A university degree in accounting may also be relevant.
- At least 6 years for a P-3 level and 10 years for a P-4 level, of relevant experience in the nuclear field, preferably in operation of nuclear facilities.
- National or international safeguards experience.

Background of Inspectors. The background of IAEA safeguards inspectors is primarily in fields of engineering and science. About a quarter (26%) have backgrounds in nuclear physics and related sciences; 20% in nuclear engineering and related fields; 14% in chemical and related sciences; 9% in chemical/metallurgical engineering and related fields; 7% in mechanical engineering and related fields; 6% in electrical/electronic engineering and related fields. About 7% have backgrounds in other fields of engineering and 7% have experience in other disciplines, such as accounting, economics, or business administration.

Nationalities of Inspectors. A credible international inspectorate requires representation from a broad spectrum of countries. The IAEA

strives to recruit inspectors from all possible nationalities to the extent possible. Presently 69 nationalities are represented in the inspectorate. All geographical areas of the world are represented: for example, 22% are from North America; 22% from countries of the European Union; 17% from the Far East and Pacific; 16% from Eastern Europe, including newly indepedent States; 10% from Africa; 6% from the Middle East and South Asia; and 6% from South America.

While the inspectorate is diverse and multicultural, the majority of designated inspectors are from industrialized countries. There are several reasons for this. Developed countries typically have a more advanced fuel cycle and hence can offer seasoned professionals to work as safeguards inspectors. Nevertheless, 38% of the inspectors in the Operations Divisions come from developing countries. The IAEA has been able to recruit competent staff from all over the world providing a truly international inspectorate.

installations, in States with comprehensive safeguards agreements. Work on the enhanced curriculum started at the time of "Programme 93+2", a broad development programme that had the aim of strengthening the effectiveness and improving the efficiency of the safeguards system.

Comprehensive Review Seminar. The enhanced curriculum starts with an overview of the background, development and current status of the Strengthened Safeguards System. This is a weeklong seminar built around a series of lectures and discussions that describe the background and rationale behind the development of the strengthened system, and the framework, developments and requirements for enhanced information evaluation and reporting. The seminar also addresses the requirements and obligations resulting from the implementation of the Additional Protocol. The Seminar includes a round table discussion during which all of the concepts are discussed with those individuals responsible for the development and implementation of Strengthened Safeguards.

Environmental Sampling. The next event is a course on "Environmental Sampling". This course builds on the broad overview provided by the seminar. It provides skills and knowledge on the use of

an effective tool for the detection of undeclared activities. This course has the objective to provide inspectors with an understanding of the principles and practices of environmental sampling as well as the skills for utilizing swipe samples for safeguards purposes. Topics covered by lectures include the principles of environmental sampling, effective sample collection planning, and sample media. Hands-on training focuses on swipe sample collection and handling techniques under real and/or simulated conditions.

Enhanced Training Courses. The enhanced curriculum then branches into two training courses: "Design Information at Research Reactors" and the "Proliferation Indicators" Course. These two courses have a common element. They deal with the skills required to detect undeclared nuclear material and activities in order to provide credible assurance of their absence. The courses have the objective of enabling inspectors to better detect undeclared nuclear activities and the misuse of declared facilities during routine inspections, and to identify and assess the significance of the indicators of undeclared nuclear activities. To a limited degree the course on proliferation indicators enables inspectors to detect possible nuclear weaponization activities. The courses consist of lectures, individual and group exercises that enhance inspectors' knowledge of the safeguards relevant elements of the nuclear fuel cycle, and the observable proliferation indicators.

In essence, these two courses describe "what to look for". However, there is a corresponding need to provide the inspectors with the tools on "how" to look for proliferation indicators. This is addressed by a third course, called "Enhanced Observational Skills". Its objective is to improve the participants' observational capability during safeguard inspections and to assist them in evaluating and interpreting what was observed. Enhanced observational skills training addresses the inspector's ability to look for, recognize, remember and draw inferences from observations of physical structures, equipment, and other conditions that could be indicative of an inconsistency in a State's nuclear declaration. The training techniques include lectures, discussions, individual and group exercises and experimental learning sessions, backed up by extensive audiovisual support.

Workshops. The ability of the Agency to draw a conclusion of the absence of undeclared nuclear material and activities requires the continuous review and evaluation of both a State's declarations and other sources of information. The enhanced curriculum includes several courses to provide the necessary skills and knowledge for this task.

The principal course is the "Performing State Evaluations Workshop". It is intended for staff members expected to participate in the State evaluation process and has the objective of enabling the participants to effectively integrate and evaluate the wide variety of information available to the Agency in order to produce a State Evaluation Report. The workshop takes four working days and focuses on the process to be considered in performing a State Evaluation. It provides the policy base, identifies the available information sources and tools useful in conducting an evaluation, and details the steps taken in preparation of a State Evaluation Report.

The preparation of State Evaluations requires additional knowledge and skills. One of these is the ability to effectively use information gathering software for the retrieval of relevant information from the available sources. To address this need, courses on the latest information collection techniques are offered. These courses typically require one working day and are taught by personnel of the Division of Information Technology of the Department of Safeguards. Additionally there is a need to protect confidential information as outlined in article 15 of the Model Additional Protocol. These needs have resulted in two courses, one on encrypted e-mail practices and procedures and another one on information security, the later one mandatory for all staff members of the Department of Safeguards.

Expanding the Curriculum. The enhanced curriculum continues to develop in line with needs arising from the dynamic process of strengthening IAEA safeguards. Several courses have been developed recently. This includes a course on "Nuclear Fuel Cycle for

Country Officers", which builds upon skills related to knowledge of proliferation indicators and pathways. Another course covers Satellite Imagery Awareness, and a third course focuses on "Complementary Access Roles and Responsibilities". This latter course aims to provide inspectors with necessary knowledge and skills to prepare for, conduct and report on Complementary Access activities within the framework of the Additional Protocol. Complementary Access refers to the Protocol provision that grants the authority for increased IAEA inspector access to relevant locations in a State to confirm the exclusively peaceful intent of that State's nuclear programme.

Enhanced Methodology. Within the framework of the strengthened system, the Safeguards Training Section recognized, at an early stage, the need to utilize a more efficient approach to its training methodology. This was both a challenge and a requirement for ensuring the reliability of the Strengthened Safeguards System that is dependent on the competencies of safeguards inspectors. Based on this, the Section selected as its training methodology the Systematic Approach to Training (SAT). The SAT methodology is recognized as the international best practice for attaining and maintaining the qualification and competence of nuclear power plant operations personnel.

The IAEA report "Nuclear Power Plant Personnel Training and its Evaluation" is the basis for the introduction of SAT methodologies to safeguards training. SAT is defined as an approach that provides a logical progression from the identification of the competencies required to perform a job, to the development and implementation of training to achieve these competencies, and the subsequent evaluation of the results. The methodology applies quality assurance to training and thus assures the safeguards inspectors' competence.

The use of SAT offers significant advantages over the more conventional, curricula-driven training in terms of consistency, efficiency and management control. With a systematic approach to training, the competence requirements for inspector's job can be established and met. Furthermore, with SAT-based training, it can be demonstrated that all required competencies have been attained. One essential item in the SAT methodology is the evaluation phase to determine the effectiveness, efficiency and impact of training programmes and to identify whether and where sessions and/or improvements are needed. This evaluation clearly improves the effectiveness of training through promoting quality.

AN EVOLVING PROCESS

The training of IAEA safeguards inspectors is an evolving process, and the curriculum has expanded considerably since the Training Section was set up 20 years ago. The body of courses, seminars, workshops and field exercises are designed to enable inspectors to carry out tasks arising from the new challenges of a strengthened safeguards system.

Since the strengthening measures were introduced in the early 1990s, safeguards inspectors and staff have been training in areas of environmental sampling; enhanced observation; understanding nuclear fuel cycles and their proliferation pathways; information evaluation; enhanced design information review; and electronic transmission of encrypted data. Additionally since 1996, training courses for safeguards personnel from IAEA Member States have been held in Asia, Europe, the United States, and Latin America.

To a large extent, the continued effectiveness of the IAEA's safeguards system rests upon the recruitment, training, and retainment of highly motivated staff to serve as inspectors. These recruits must meet high standards of educational and professional experience and should come from the broad range of nationalities representing the diversity of the IAEA's Member States.

The training of both new and experienced inspectors will require the use of the latest training techniques and methodologies. As their experience and responsibilities increase, inspectors will benefit from the enhanced safeguards training curriculum, which is being continuously upgraded to keep pace with the latest developments in the evolution of safeguards. ❐