
The Belgian Support Programme to the IAEA: 2014-2018

Authors A. Borella, K. van der Meer

Affiliations SCK•CEN, Belgian Nuclear Research Centre

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Studiecentrum voor Kernenergie
Centre d'Etude de l'énergie Nucléaire
Boeretang 200
BE-2400 Mol
Belgium

Phone +32 14 33 21 11
Fax +32 14 31 50 21

<http://www.sckcen.be>

Contact:
Knowledge Centre
library@sckcen.be

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	Name	Date	Signature
Author: (Function)	Alessandro Borella	01/07/2018	
Reviewed by: (Function)	Klaas van der Meer	01/07/2018	
Approved by: (Function)	Klaas van der Meer	01/07/2018	
Approved for release: (Function)	Klaas van der Meer	01/07/2018	
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Glossary of Abbreviations

IAEA	International Atomic Energy Agency
NPT	Non Proliferation Treaty
MSSP	Member State Support Programme
SCK•CEN	Belgian Nuclear Research Centre
SP	Support Programme

Abstract

This progress report of the Belgian Support Programme to the IAEA for Safeguards Implementation is presented for your information.

It covers the period March 2014– March 2018.

It contains a chapter on the administration of the programme and an overview of the major achievements during the mentioned period.

Following agreed principles, proposals are made by the IAEA through task proposals.

Upon acceptance by the Support Programme the proposal is oriented towards a task outline, and a practical work plan is established in collaboration with the IAEA.

The IAEA task outlines are inserted in the progress report.

1 Introduction

Support programmes constitute a sound basis for sharing e.g. R&D or service work between the IAEA and the Member States. They have the advantage to link a problem definition to its solution and to a field test under realistic circumstances. The existence of support programmes also considerably increases the potential of the Agency in the field of R&D and the associated opportunities in the implementation of these techniques and procedures.

Countries and entities that actually proposed a Support Programme to the IAEA are [STR-386]:

- Argentina (ARG SP)
- Australia (AUL SP)
- Belgium (BEL SP)
- Brazil (BRZ SP)
- Canada (CSSP)
- China (CPR SP)
- Czech Republic (The) (CZ SP)
- European Commission (EC SP)
- Finland (FIN SP)
- France (FRESPAS)
- Germany (GER SP)
- Hungary (HUN SP)
- Japan (JASPAS)
- Netherlands (The) (NET SP)
- Republic of Korea (The) (ROK SP)
- Russian Federation (The) (RUS SP)
- South Africa (RSA SP)
- Spain (ESP SP)
- Sweden (SWE SP)
- United Kingdom of Great Britain and Northern Ireland (The) (UK SP)
- United States of America (The) (US SP)

This report gives an overview of activities performed within the frame of the Belgian Support Programme (BEL SP) to the IAEA, for the period March 2014– March 2018.

The document contains a first chapter on the administration of the programme, with:

- some historical background on the Belgium Support Programme;
- its objective;
- the scope and nature of the tasks;
- an overview of the partners in the Belgian Support Programme;
- its way of financing.

A second chapter gives an overview of the major achievements reached during the mentioned period and contains per task:

- general information on the task administration;
- a task description as defined by the IAEA;
- progress made;
- perspectives for the future of the task.

2 Administration of the Programme

2.1 Background

In 1982, Belgium decided to make a contribution to the development of safeguards measures applied to nuclear facilities under IAEA safeguards. This was done in accordance with preambular paragraph 5 of the NPT, pursuant to safeguards agreements concluded between the Agency and its Member States.

Accordingly, Belgium offers a programme in support of the Agency's safeguards implementation efforts. This work also forms part of the safeguards research programme of the European Community and it was agreed that the results should be examined jointly by the three parties concerned, namely, the Agency, DG-ENER (formerly known as Euratom) and Belgium, in order to evaluate its usefulness for routine safeguards application.

The area of Mol is characterized by the presence of industrial nuclear facilities in the immediate vicinity of the Belgian Nuclear Research Centre, SCK•CEN. The UO₂ fabrication plant (FBFC), the Joint Research Center (JRC-Geel) and the waste processing installations of Belgoprocess have been operated under NPT safeguards since 1978, and constitute a sound basis for safeguards studies. The MOX fabrication plant (Belgonucléaire) finished with its production activities in 2006, is being decommissioned [TECN]. The UO₂ fabrication plant (FBFC) has finished its activities in 2011 and started decommissioning [FBFC].

Due to this fact the safeguards studies were mainly plant oriented in the past.

2.2 Objective of the Belgian Support Programme

The objective of the Belgian Support Programme is to contribute to the optimization of safeguards measures in accordance with INFCIRC/153 type agreements, together with INFCIRC/540 type protocols additional to the forementioned agreements. This optimization has to take into account cost and effectiveness for the Agency, for the State System of Accounting and Control, for the plant operator and for DG-ENER, that is considered an inherent partner.

In other words the programme has to find ways and means to improve or at least maintain the efficiency and effectiveness of international safeguards, while at the same time minimizing the burden of the verification activities in the nuclear industry.

2.3 Scope and nature of the tasks

Taking into account the explained basic principles and strategies, the Belgian R&D programme has undertaken a series of tasks, a detailed overview of which was given at the 1994 IAEA Symposium on International Safeguards, paper IAEA-SM-333/15, at the 2007 ESARDA Symposium and at the 54th INMM Annual Meeting in 2013. A contribution with title *"The Belgian Support Programme to IAEA: past, present and future"* was submitted to the 2018 Symposium on International Safeguards and was accepted. According to the classification used by the IAEA in the Safeguards Member State Support Programme Information & Communication System (SPRICS), the tasks are divided into four categories

- Category A (Measurement Methods and Techniques)
- Category B (Training)
- Category C (System Studies)
- Category D (Information Processing)

The tasks covered the following domains:

- Measurement Technology (Non-destructive Assay) in Category A
- Analytical Measurements, in Category A
- Training, in Category B
- Support for the Safeguards symposia, in Category C
- Safeguards implementation studies, in Category C
- Open source information, in Category D

2.4 Partners in the Belgian Support Programme

In the past, the choice of the tasks was defined essentially by the availability of the nuclear industry, whereas currently, requests from the IAEA are the main driver to select tasks.

As of 2018, the partners in this Support Programme are:

- SCK•CEN (in its role of coordinator);
- the Belgian nuclear industry:
 - Tihange nuclear power plant;
 - Doel nuclear power plant;

-
- the organisations in charge of the fuel and waste management and handling in Belgium:
 - Synatom;
 - NIRAS/ONDRAF;
 - Belgoprocess;
 - the DG-ENER/Euratom inspectorate;
 - the JRC (Joint Research Centre);
 - the Belgian Federal Agency of Nuclear Control (FANC), as it has a comprehensive responsibility for the Belgian nuclear fuel cycle;
 - AVN, a company which has a responsibility for the safety of the major part of the Belgian nuclear industry.

2.5 Financing

Concerning the financial support, the Belgian Support Programme provides for the availability of existing installations, equipment and manpower of the Belgian partners, but no special or additional funding for various kinds of expenses is available.

NIRAS/ONDRAF provided specific funding for follow up of task JNT C 1611 BEL.

3 Major Accomplishments in the period March 2014– March 2018

An overview is given of the major accomplishments during the period covered by this progress report. All tasks are explained in more detail in the following.

The status of the defined tasks is given in Table 1 as of 5 April 2018 and as indicated in the SPRICS platform [SPRI].

Task ID	Task Title	Status
BEL A 01086	Calibration of Underwater Coincidence Counter	Completed
BEL B 01433	Comprehensive Inspection Exercise at LWRs	Terminated
BEL D 01478	Open Source Information Collection	Active
JNT C 01611 BEL	Application of Safeguards to Geological Repositories (ASTOR), Group of Experts	Active
BEL C 2277	Umbrella Task - Technical Assistance on Methodology and Guidance for Implementation of Safeguards at the State-level	Active
BEL A 01615	MSSP Umbrella Task: Support for Instrumentation Technology Foresight	Active
BEL C 01746	Guidance for Designers and Operators on Design Features and Measures to Facilitate the Implementation of Safeguards at Future Nuclear Fuel Cycle Facilities	Completed
JNT B 01757 BEL	Training Course for Safeguards at Research Reactors (BEL, CZ, USA)	Active
BEL A 01758	Qualification of the IAEA's Network of Analytical Laboratories (NWAL) for Analysis of Nuclear Materials	Active
BEL D 01927	Demonstration of Intelligent Decision Analysis Support in Safeguards Evaluation	Active
JNT C 01980 BEL	Support for the 2014 Safeguards Symposium	Completed
BEL C 2342	Support for the 2018 Safeguards Symposium	Active

3.1 Calibration of Underwater Coincidence Counter (BEL A 01086)

General

Project Manager IAEA: Mikhail Mayorov

Task Officer IAEA: Young Gil Lee

Task Officer BEL SP: Klaas van der Meer, Jan Wagemans

Acceptance date by BEL SP: 1997-09-16

Status: Complete

Category A (Measurement Methods and Techniques)

Participating organisations:

- BEL SP: SCK•CEN

Task description

Calibration of LWR-MOX fresh fuel underwater neutron coincidence counter (UWCC) incorporating: 1) the existing modified fork detector and 2) the improved underwater coincidence counter developed under US SP Task A1025.

The UWCC is required to verify fresh MOX for partial defects.

The calibration of the existing modified fork detector is needed to complete actual inspection reports related to fresh MOX measurements performed by non-calibrated modified fork detectors.

The improved UWCC also needs to be calibrated for PWR and BWR fresh fuel as soon as the first prototypes are delivered to the IAEA. The VENUS reactor in Mol, Belgium offers the necessary facilities to carry out the calibration exercises.

Calibration and testing of neutron detectors (He-3 tubes) need to be performed for monitoring of flow of MOX assemblies.

The task has been used by IAEA inspectors in joint inspections with EUR inspectorate at LWR-MOX fresh fuel underwater verification for PWR and BWR types.

If the task is not performed the measurement devices will not qualify for partial defect tests (less than 6% measurement uncertainty).

Results

Following the calibration and characterization measurements in October 2013, the report SG-RP-12754 (*"UWCC calibration with mock-up MOX assemblies at SCK•CEN/Mol in the framework of Belgian support task A1086"*) was announced to be under preparation and distributed by April 2014. However, SCK•CEN never received a copy of this report.

After the experimental activities in October 2013 the Belgian side proposed MCNP calculations in order to expand the UWCC's capability for safeguards implementation. The IAEA initially accepted this proposal, preferring to include the proposed MCNP calculation activity as a continued part of the work in the existing BEL A1086 task but eventually withdrew it.

Further action

Although the task is considered complete, calibration activity at SCK•CEN/Mol will be needed in the future whenever the IAEA purchases a new UWCC system or when re-calibration is necessary.

3.2 Comprehensive Inspection Exercise at LWRs (BEL B 01433)

General

Project Manager IAEA: Jean-Maurice Crété

Task Officer IAEA: Ghislain Emile Berthelot

Task Officer BEL SP: Peter Berben (Electrabel)

Acceptance date by BEL SP: 2003-04-01

Status: Terminated

Category B (Training)

Participating organisations:

- BEL SP: Electrabel
- CZ SP

Task description

The Agency needs to maintain a solid and reliable base for the practical training for newly recruited inspectors at commercial nuclear power plants. The basic training curriculum includes a Comprehensive Inspection Exercise (CIE) which consists of a pre-course session, auditing exercises, fresh fuel measurements, spent fuel measurements and C/S application in a LWR. A Member State's Support Programme is needed to make available a nuclear power plant for the practical exercises as well as personnel to help develop and conduct the course.

The CIE needs to be held immediately after each Introductory Course on Agency Safeguards (ICAS), usually twice per year for a duration of approximately one week each.

Results

Training is provided by the Czech Support Programme. Belgium serves as a backup in case the Czech reactor will not be available for training. No activities took place in the concerned period.

Further action

The task is considered terminated by IAEA.

3.3 Open Source Information Collection (BEL D 01478)

General

Project Manager IAEA: Matthew Ferguson

Task Officer IAEA: Anzhela Baghdasaryan

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2004-02-19

Status: active

Category D (Information Processing)

Participating organisations:

- BEL SP: SCK•CEN
- AUL-, CAN-, EC-, FRA-, GER-, HUN-, RSA-, RUS-, SWE-, UK-, US-SP

Task description

In support of the State evaluation process, the Strengthened Safeguards System (SSS) relies heavily on the timely collection, delivery and analysis of information from many different sources, with the best possible coverage and diversity. In particular, the Additional Protocol requires the Agency to develop greater knowledge on industrial infrastructure capable of supporting nuclear activities and also nuclear research. Also, ongoing contacts are required to keep abreast of developments in the area of open source technologies and related developments as well as nuclear-related technologies. Assistance is also required in improving the technological systems for directly obtaining open source information. It is anticipated that three internships will be required, running in parallel, for assisting in the processing, collection and evaluation of information relating to sub-tasks 1-6.

- Sub-task 1: Profiles of and information on manufacturers of specialized nuclear equipment and non-nuclear materials appearing in Annex II of the Additional Protocol. Collection objectives will apply to selected States.

- Sub-task 2: Profiles of and information on manufacturers of equipment included in the Nuclear Suppliers Group Part II Guidelines (nuclear-related dual use materials and equipment). Collection objectives will apply to selected States.

- Sub-task 3: Profiles of and information on uranium/thorium-bearing mines and ore concentration facilities (location, status, and design capacity). This includes industrial facilities for purifying phosphates/phosphoric acid and generating uranium/thorium bearing waste. Collection objectives will apply to selected States.

- Sub-task 4: Collection of literature on State nuclear-related industries and scientific literature from, for example, conferences, trade shows, symposiums, and workshops. This would include annual Reports from nuclear authorities and nuclear research establishments.

- Sub-task 5: Profiles of and information on other facilities that may be relevant to the evaluation of States nuclear activities.

- Sub-task 6: Information on nuclear projects at the planning stage, including contractors and sub-contractors and the status of negotiations.

- Sub-task 7: Access to information and expertise on science and technology questions.

-
- Sub-task 8: Assist the Agency in its efforts to stay aware of new open sources, tools, and methods to maintain an effective collection and analysis system, including ad hoc open source requests.
 - Sub-task 9: Development of a system for directly feeding data from external sources such as Lexis/Nexis, Reuters, FBIS and DIALOG to an Agency server (rather than through the current web-page access).
 - Sub-task 10: Multi-lingual information monitoring, collecting, processing (including translation/transliteration), and storing for easy retrieval (will also address machine translation/software tools).

Results

Annual reports of most Belgian companies and organisations that play a role in the Belgian nuclear industry have been collected and sent to the IAEA in the previous years. These reports are now available from the internet and are therefore downloaded by the IAEA itself.

Further action

In some cases assistance from BEL SP still may be required. The IAEA will issue a specific request in that case. For this reason the task remains active.

3.4 Application of Safeguards to Geological Repositories (ASTOR), Group of Experts (JNT C 01611 BEL)

General

Project Manager IAEA: Jin Yong Doo

Task Officer IAEA: Marius Davainis

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2006-09-03

Status: active

Category C (System Studies)

Participating organisations:

- BEL SP: SCK•CEN
- CAN SP, CZ SP, EC SP, FIN SP, FRA SP, GER SP, HUN SP, NET SP, ROK SP, RSA SP, SWE SP, US SP

Task description

In December 2004, at a meeting of representatives of the States participating in the Geological Repository Safeguards Expert Group with representatives of the operations and support divisions of the IAEA, the participants decided that this group had facilitated the sharing of information between Member States and the Agency and performed an important advisory function to the IAEA in respect to the development of safeguards approaches and techniques applicable to repositories.

The participants recommended the continuation of the work of the group, under new terms of reference.

The work of the new group will be focused on practical aspects of the generic integrated safeguards approach for geological repositories sites and the safeguards techniques applicable to specific geological repository sites.

Inter alia it will provide the following support to the Agency:

- Review elements of Integrated Safeguards approaches for specific geological repositories;
- Facilitate sharing of safeguards-relevant information on geological repositories between Member States;
- Help promote understanding of safeguards requirements and implications in other technical forums and with operators of geological repositories;
- Supply experts and expertise for safeguards missions and implementation support related to repositories and
- Study and make recommendations on any issues that may arise regarding geological repository safeguards, including those mentioned above.

An invitation to participate in the group will be extended to more Member States than those that participated in the Geological Repository Safeguards Experts Group.

Results

BEL SP participates in this task to provide specific information about a geological repository in clay, to follow the developments in safeguards approaches for geological repositories and to increase the awareness of Belgian designers of the repository for safeguards issues.

BEL SP participated in the 2016 ASTOR meeting in Washington D.C. from 25-28 April. BEL SP chaired a small group to discuss the legal/conceptual framework that is needed for the longterm operation of geological repositories. The discussions led not so much to answers but more to questions that should be posed. These questions related on the one hand to the required legal framework for geological repositories and on the other hand to techniques that will be used for inspecting the geological repositories.

The results of these discussions were laid down in a powerpoint presentation that was presented to the plenary group.

BEL SP participated in the 2017 ASTOR meeting in Mito and Tokai, Japan from 24-28 April. The goal of the meeting was to review the ASTOR final report, which describes several technologies that can be used for safeguarding geological repositories.

In preparation to the meeting BEL SP drafted a section on the Self-Indication Neutron Resonance Densitometry (SINRD) and reviewed the chapter on non-destructive assay verification.

The ASTOR final report was published in August 2017 as STR-384.

Further action

Although the task is active there has been no decision from IAEA about the continuation of ASTOR.

3.5 Umbrella Task - Technical Assistance on Methodology and Guidance for Implementation of Safeguards at the State-level (BEL C 2277)

General

Project Manager IAEA: Jin Yong Doo

Task Officer IAEA: Robert V. Herson

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2017-02-21

Status: active

Category C (System Studies)

Participating organisations:

BEL SP: SCK•CEN

Task description

The content of the task has yet to be defined.

Status

The content of the task has yet to be defined.

3.6 MSSP Umbrella Task: Support for Novel Technologies (BEL A 01615)

General

Project Manager IAEA: Dimitri Finker

Task Officer IAEA: Andrey Sokolov

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2006-03-17

Status: active

Category A (Measurement Methods and Techniques) Participating organisations:

- BEL SP: SCK•CEN
- ARG SP, BRZ SP, CAN SP, EC SP, ESP SP, FIN SP, FRA SP, GER SP, HUN SP, JPN SP, RUS SP, SWE SP, UK SP, US SP

Task description

As an outcome of the 2004 General Conference, Project SGTS-08, Novel Techniques and Instruments for Detection of Undeclared Nuclear Facilities, Material and Activities, was established in the Department of Safeguards Division of Technical Support (SGTS) with the following specific objectives:

- Monitor and address observed deficiencies or vulnerabilities in safeguards approaches, equipment and technology
- Acquire new, or improved, equipment / technology where appropriate
- Develop and/or use new concepts, approaches, techniques and technology for information analysis and verification activities (especially with regard to enhanced capability to detect undeclared nuclear material and activities)

The Conference also called on the Secretariat to examine, subject to the availability of resources, innovative technological solutions to strengthen the effectiveness and to improve the efficiency of safeguards, and for Member States to cooperate amongst themselves to provide appropriate assistance to facilitate exchange of equipment, material and scientific and technological information for the implementation of additional protocols.

Project SGTS-08 was established to identify IAEA needs in the area of detecting undeclared activities and the novel technologies that can be used effectively by the Agency. It is anticipated that many useful novel techniques may originate in States' R&D organizations, not previously utilized by the Agency. Because of the unique nature of some stages of the nuclear fuel cycle, the Project will rely considerably on the assistance of Member State experts who are knowledgeable in such areas to assist in identifying key process signatures and indicators, proposing technical solutions to detection needs, assisting the Agency in the evaluation of other party proposals, where appropriate, and ensuring that the Agency is fully aware of technical developments in particular areas.

The Agency needs an efficient mechanism through its Member State Support Programmes by which staff of Project SGTS-08 may communicate and collaborate with R&D organizations (government and private), States' experts on relatively small tasks, including the provision of technical information on various nuclear activity detection subjects, soliciting technical

proposals, conducting technical proposal reviews, equipment evaluations, field testing and identifying suitable forms of funding for promising technologies.

Results

No activities carried out by BEL SP in the period 2014-2018.

Further action

BEL SP is waiting for other requests for help or information from the IAEA.

3.7 Guidance for Designers and Operators on Design Features and Measures to Facilitate the Implementation of Safeguards at Future Nuclear Fuel Cycle Facilities (BEL C 01746)

General

Project Manager IAEA: Jin Yong Doo

Task Officer IAEA: Caroline Mathews

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2008-04-11

Status: Completed

Category C (System Studies)

Participating organisations:

- BEL SP: SCK•CEN
- ARG SP, BRZ SP, CAN SP, CPR SP, EC SP, FRA SP, GER SP, JPN SP, ROK SP, UK SP, US SP

Task description

At its 65th Series of meetings in June 2007, the Standing Advisory Group on Safeguards Implementation (SAGSI) advised the Secretariat that they should concentrate effort on the further elaboration of the concept of Safeguardability. Furthermore, the Secretariat should develop documentation which can serve as guidance for the inclusion of safeguards considerations at an early stage of nuclear technology designs.

The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) was launched in the year 2000 based on the resolutions of the IAEA General Conference (GC(44)/RES/21). One task in INPRO is improving the methodology for the assessment of the Proliferation Resistance of Innovative Nuclear Energy Systems (PR of INs). It is becoming widely understood that international safeguards are the essential component of proliferation resistance. Furthermore, it is understood that taking into account features at early design stages that are aimed at facilitating the implementation of international safeguards is important for reducing project risk.

Both the Generation IV International Forum (GIF) Proliferation Resistance and Physical Protection (PR&PP) Expert Group and INPRO are working with the concept of "safeguardability" as a measure to be assessed in the consideration of proliferation resistance. Safeguardability has been defined as the degree of ease with which a nuclear facility can be effectively and efficiently put under international safeguards.

One of the key elements of the International Framework for Nuclear Energy Cooperation (IFNEC), previously the Global Nuclear Energy Partnership (GNEP) Initiative launched by the US in 2006, is development of enhanced nuclear safeguards: "Incorporating safeguards into the design phase for new facilities will allow the IAEA to more effectively and efficiently monitor and verify nuclear material."

This task will incorporate the essence of these activities into concise guidance for Member States. The first part of this task, with the support of the participating MSSPs, has been to develop basic guidance to encourage States to consider safeguards early in the conceptual

planning for nuclear facilities. An initial workshop to initiate this task was held in October 2008. A summary of that first workshop, including recommendations, was released as Safeguards Technical Report (STR) 360.

Continuing the first part of this task, a document "Basic Guidance for Safeguards by Design" has been written and is undergoing the Nuclear Energy publication process. The document follows the recommendations in STR 360 and is intended to become part of the IAEA Nuclear Energy Series of documents. Presentation materials on guidance for LWRs have been prepared for workshops and professional meetings. The first workshop using these materials was held in Finland in 2011.

What is needed, and when:

The second part of this task, "Facility Specific Guidance", is needed for designers and operators to elucidate the facility specific design features and measures facilitating the implementation of international safeguards at nuclear fuel cycle facilities. This guidance should be directed at the designer / operator / owner audience not familiar with the details of international safeguards.

Guidance for this audience might usefully address:

- a) terminology and definitions,
- b) the legal basis of safeguards,
- c) international safeguards objectives,
- d) elements of the facility and facility design features that are relevant for safeguards,
- e) potential technical measures to achieve safeguards goals,
- f) overlap with other regulatory and operational constraints,
- g) best practices,
- h) lessons learned, and
- i) opportunities for improving effectiveness and efficiency.

The guidance should not limit the designer, operator, or State to past approaches, nor should it place limits on the negotiation of innovative approaches. While the IAEA will negotiate the safeguards approach with the State for each facility it places under safeguards on an individual basis, this negotiation can be greatly facilitated when the designer and future operator are fully aware of the purpose, the potential safeguards measures that are applicable, and lessons learned from earlier implementations.

Due to the potential for a nuclear renaissance that is likely to result in additional reactors and fuel cycle facilities coming under IAEA safeguards within the coming decades, the second part of the task should be completed within a two-year time-frame.

Results

No activities carried out by BEL SP in the period 2014-2018.

Further action

The task is considered completed.

3.8 Training Course for Safeguards at Research Reactors (JNT B 01757 BEL)

General

Project Manager IAEA: Jean-Maurice Crété

Task Officer IAEA: Daniel Baudinet

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2008-04-11

Status: active

Category B (Training)

Participating organisations:

- BEL SP: SCK•CEN
- US SP

Task description

The Department of Safeguards has need of the development, implementation, and delivery of a training course on Safeguards at Research Reactors. Currently, there is a gap in knowledge between what IAEA-CTR is able to provide regarding the design and proliferation sensitivity of research reactors and associated hot cell operations and what is required by the Department to effectively implement safeguards in this rapidly changing environment.

The course is intended to be conducted in two parts:

1. In Agency Headquarters (HQ), dealing with the theoretical aspects of Research Reactors, including the design and operation, particularly including the knowledge required to determine the operating capacity and the potential for diversion;
2. In the field, allowing inspectors to apply the knowledge acquired received in HQ, based on design information verification and the knowledge of potential proliferation pathways.

A key element is the identification of suitable research reactors for the field portion of the course, including the availability of the the facilities and the personnel required for training purposes.

The task will provide :

For the HQ part:

1. Definition of the required course materials including reference materials and the design information for the identified field reactors;
2. Production of the course materials, preferably in electronic format;
3. Presentation of the HQ part on the operation of various research reactors;
4. Preparation of the field part, including briefings on the relevant research reactors;

For the Field part:

1. Conduct of the field exercise, including an assessment of the trainees;
2. Evaluation of the course and recommendations for follow-on courses;

The course is needed as soon as possible with the exact schedule to be negotiated with the Member States. It is anticipated that the course might be developed and offered within 6 - 9 months.

Results

The first week the course is usually held at IAEA HQ in Vienna, the second week it is held at SCK•CEN laboratories in MOL, Belgium. Whereas the first week is devoted mainly to provide the participants a strong theoretical basis, the second week aims at bringing the acquired knowledge of the first week in practice. This is done by providing information material about the various nuclear installations to the course participants for preparation of a simulated DIV inspection. Consequently simulated DIV inspections took place at the BR1 reactor, the BR2 reactor and the LHMA hot cells laboratories.

Feedback from the participants showed a high appreciation for this course.

In the period 2014-2017 the following courses were held at SCK•CEN

2014: 23-27 June

2015: 22-26 June and 16-20 November

2016: 7-11 November

2017: 3-7 July

2018: 25-29 June

Further action

The Task is active.

3.9 Qualification of the IAEA's Network of Analytical Laboratories (NWAL) for Analysis of Nuclear Materials (BEL A 01758)

General

Project Manager IAEA: Paul Craig Martin

Task Officer IAEA: Marc Andrew Humphrey

Task Officer BEL SP: Andrew Dobney

Acceptance date by BEL SP: 2008-04-11

Status: active

Category A (Measurement Methods and Techniques)

Participating organisations:

- BEL SP: SCK•CEN
- EC SP, FRA SP

Task description

To expand the current IAEA's Network of Analytical Laboratories (NWAL) for analyses of nuclear material samples by qualifying candidate laboratories. At present the IAEA has only two active nuclear material NWALs and these are insufficient to provide the analytical support necessary. Secondly, the current number of NWALs is insufficient to fulfil an external quality control function for SAL. Therefore, it is essential that the IAEA expand its NWAL able to support nuclear material sample analyses on demand. It is anticipated that the qualification process for several laboratories could take up to two years.

Results

SCK•CEN participated in the 2015 interlaboratory comparison exercise (ILC) entitled NMRORO-2015 (see IAEA report SG-RP-13613). During the technical meeting in 2015 it was suggested that the following ILC would be (probably) in 2017. In 2016 SCK-CEN confirmed the participation in the NMRORO-2017 and organized the Belgian import licence required for transporting the samples from SAL to SCK•CEN.

Andrew Dobney also attended the IAEA Technical Meeting on Working Standards held at SAL from 7-10 June, 2016.

In addition, SCK•CEN has participated (samples analysed between 15 March and 15 June 2017, and results reported by 15 June 2017) in the interlaboratory comparison exercise (ILC) entitled NMRORO-2017 (see IAEA report SG-RP-14523). These samples were a gram-sized uranium pellet, and a milligram-sized dried plutonium nitrate sample. Participants were requested to determine and report atom ratios of Pu isotopes in the dried plutonium nitrate sample and atom ratios of U isotopes and mass fraction of uranium in the uranium pellet. Andrew Dobney attended the NMRORO-2017 IAEA Technical Meeting held in Vienna from 5-7 September, 2017.

Further action

Based upon SCK•CEN's performances during the NWAL NMRORO-2013, 2015 & 2017 ILC's, Safeguards Analytical Laboratory (SAL) proposed that a number of SG samples would be sent

in 2018 to SCK•CEN for analysis. The test samples would be derived from actual safeguards inspection samples, and SCK•CEN results would be compared to previous Nuclear Material Laboratory (NML) results and the operator's declaration (using the ITV as the benchmark). The sample set would likely include three U/Pu and Pu samples, and both U and Pu assay and isotopic composition would be requested. Successful analysis of these samples would allow SAL to formally recommend SCK•CEN be qualified under the NWAL (with the final decision being made by the Departmental-wide committee overseeing analytical services). Whilst SAL is ready to proceed with the "final" stage of test samples for SCK•CEN, the 2019 NM RoRo is now also underway and these two things would get in the way of each other. SCK•CEN has informed SAL that we would prefer to first complete the 2019 NM RoRo on time (by end Dec 2018) and afterwards analyse the final test samples.

3.10 Demonstration of Intelligent Decision Analysis Support in Safeguards Evaluation (BEL D 01927)

General

Project Manager IAEA: Claude France Norman

Task Officer IAEA: Claude France Norman

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2012-03-16

Status: active

Category D (Information Processing)

Participating organisations:

- BEL SP: SCK•CEN

Task description

As a part of its efforts to strengthen international safeguards, including enhancing its ability to detect any undeclared nuclear activities, the International Atomic Energy Agency (IAEA) uses an increased amount of information on State's nuclear and nuclear-related activities: information provided by the State, information collected by the IAEA inspectors, and information from open sources (e.g., media, etc.). Such information can be of very different nature, it may be heuristic or incomplete or data that is either of unknown origin or may be out of date or imprecise, or not fully reliable, or conflicting, and even overloaded. To allow an adequate interpretation of the information and to reach a conclusion on undeclared activities and facilities in the State, there is an urgent need to establish an evaluation method that enables inspectorates like IAEA to check that there has been no diversion of nuclear material and that there are no undeclared nuclear activities. Hence, it was considered advantageous to have a sound and reliable mathematical framework available that provides a basis for synthesis across multidimensional information of varying quality, especially to deal with information that is not quantifiable due to its nature, and that is too complex and ill-defined, for which the traditional quantitative approach (e.g. the statistical approach) does not give an adequate answer.

More precisely, a methodology that allows for the transparent and tractable analysis of inspector and analyst decisions from disparate data types (state declarations, inspection/verification activities, open source data, satellite imagery, etc.) could contribute to measuring the level of confidence in ultimate state level decisions. This could be accomplished through a standardized mathematical frame work which elicits, records, analyses, and aggregates inspector and analyst decisions and provide a quasi-quantitative measure of the strength or confidence of the ultimate state level decision.

Results

BEL SP has provided in September 2012 to the IAEA a prototype software tool for the analysis of safeguards data in an undefined format (numbers, discrete numbers, linguistic expressions, etc.). The tool is developed for use by inspectors and IAEA safeguards analysts in order to evaluate information obtained by inspectors during their visits to countries and installations.

During the BEL SP progress meeting in 2016 the IAEA requested a training for the delivered software. BEL SP is prepared to provide this training when we agree on a date for the training.

Further action

So far we have not received a specific date for such a training.

3.11 Support for the 2014 Safeguards Symposium (JNT C 01980 BEL)

General

Project Manager IAEA: Masato Hori

Task Officer IAEA: Katherine Margaret (meg) Furnish

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2013-11-25

Status: Complete

Category C (System Studies)

Participating organisations:

- BEL SP: SCK•CEN
- (AUL, BEL, CAN, EC, FIN, GER, RUS, UK, USA)

Results

BEL SP attended a meeting for the organization of the symposium which allowed to define the distribution of the work in view of the preparation of the Symposium.

3.12 Support for the 2018 Safeguards Symposium (BEL C 2342)

General

Project Manager IAEA: Jin Yong Doo

Task Officer IAEA: Caroline Mathews, Marguerite Leonardi

Task Officer BEL SP: Klaas van der Meer

Acceptance date by BEL SP: 2018-02-22

Status: active

Category C (System Studies)

Participating organisations:

- BEL SP: SCK•CEN

Results

BEL SP is waiting for requests for help from the IAEA.

4 Miscellaneous

In addition to the official aforementioned tasks, SCK•CEN contributed to the Revision of the Physical Model of a Nuclear Fuel Cycle. An expert from SCK•CEN participated in two meetings from 9 - 13 October and from 18 - 23 February 2018.

The meetings were on Reactors Including Neutron Sources and incorporate information related to understanding fuel cycle technology, acquisition pathways, proliferation indicators, emerging safeguards and fuel cycle technology issues.

In the first consultancy meeting a draft of a revised volume was prepared, incorporating information provided by experts on topics assigned for them to research prior to the meeting. The second meeting was dedicated to a final editing session where all comments and questions were addressed.

This work was done in the framework of umbrella task (17/CCA-001) – “Update of the Physical Model” - Subtask 5 on P6, Reactors Including Neutron Sources.

5 References

[STR-386] Development and Implementation Support Programme for Nuclear Verification 2018-2019, STR-386

[FBFC] <https://www.stora.org/nl/content/ontmanteling-fbfc>

[TECN] <http://www.tecnubel.be/en/references/belgonucleaire>

[SPRI] <https://sprics.iaea.org>

6 Distribution List

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