The Treaty verification system monitors the world for evidence of a nuclear explosion. If such an event were to occur, concerns about possible non-compliance with the Treaty would be addressed through a consultation and clarification process. States could also request an on-site inspection (OSI), which is the final verification measure under the Treaty and can be invoked only after the Treaty’s entry into force.

The purpose of an OSI is to clarify whether a nuclear explosion has been carried out in violation of the Treaty and to gather those facts which might assist in identifying any possible violator.

Since an OSI can be invoked by any State Party at any time, the capability to conduct such an inspection requires development of policies and procedures and validation of inspection techniques. In addition, OSIs require adequately trained personnel, appropriate logistics and approved equipment to sustain a team of up to 40 inspectors in the field for a maximum of 130 days while enforcing the highest standards of health and safety and confidentiality.

Highlights in 2012

Further progress in preparation for the 2014 Integrated Field Exercise (IFE), including the conduct of two build-up exercises
Continuation of the second training cycle for surrogate inspectors and conduct of a number of other OSI training events
Conduct of four field operational tests related to OSI techniques and technologies

Setting up the base of operations at Bruckneudorf, Austria, during the second build-up exercise, devoted to the pre-inspection and post-inspection phases, September 2012.
Progress in Implementation of the Action Plan

The aim of the action plan, which was approved by the Commission in November 2009 and adjusted in February 2011, is to provide a framework for developing the OSI regime in a project oriented manner. Resulting from the review and follow-up of the lessons learned from the 2008 IFE, the action plan (as well as its adjustment) outlines a total of 38 sub-projects in five main areas of development. These areas are policy planning and operations, operations support and logistics, techniques and equipment, training, and procedures and documentation.

Twenty-one sub-projects were being implemented during 2012. By the end of the year, 26 of the original 38 sub-projects were completed, 1 less than planned. Financial and human resource constraints, as in previous years, presented a major challenge to the implementation of the action plan.

2014 Integrated Field Exercise

In 2011, the PTS notified the States Signatories that it was seeking a host country for the IFE in 2014. Three countries responded positively: Hungary, Jordan and Ukraine. In 2012, the results of site visits and other discussions were conveyed to the Permanent Missions and to the Thirty-Eighth Session of Working Group B.

The Commission at its Thirty-Eighth Session selected Jordan as the host country on the basis of the Working Group B recommendation.

Accordingly, in-depth planning and preparation activities were initiated jointly with the host country. As part of the process, the respective legal framework documents covering the responsibilities of each party during the exercise preparation and conduct were agreed on and signed in November 2012. Public information and media related preparations for the IFE were started by developing a media concept, a logo and a dedicated web page.

Work on the preparation of a scientifically credible and comprehensive scenario began in March 2012 with the creation of a task force of external experts from States Signatories. Steps taken throughout the year culminated in a visit to Jordan in December to define the inspection area and specific locations of interest and to agree on the overarching background scenario.

Further progress was made in arranging for the long term provision of inspection equipment offered by States Signatories for the IFE. Ten States Signatories, Canada, China, the Czech

Surrogate inspectors practising decontamination procedures during the health and safety training course, May 2012.
Conducting On-Site Inspections

• Republic, Finland, France, Hungary, Italy, Japan, the United Kingdom and the USA, provided offers of equipment and consultations were held with the respective States Signatories on the selection of required equipment.

As part of the IFE preparations, two build-up exercises (BUEs) were successfully conducted. BUE I, covering the launch phase of an OSI, was carried out from 16 to 20 April at the Equipment Storage and Maintenance Facility (ESMF) of the PTS in Guntramsdorf, near Vienna. The exercise involved a total of 70 representatives from States Signatories and various PTS Divisions, who performed core inspection team (IT) related functions. Various aspects were exercised, including activation of the Operations Support Centre (OSC), verification of the validity of the OSI request by senior management, preparation of the initial inspection plan and the inspection mandate, including an equipment list, call-up of prospective IT members, and equipment preparation, packing and certification. Major improvements in a number of areas were noted by the external evaluation team when compared with the 2008 IFE in Kazakhstan. The exercise validated the basic BUE concept as well as confirming the functionality of the ESMF.

The second BUE, covering the pre-inspection and post-inspection phases of an OSI (BUE II/IV), was carried out from 8 to 14 September. The exercise was conducted at the ESMF and at the Austrian Armed Forces training ground in Bruckneudorf, 45 kilometres south-east of Vienna. Forty-one national experts and 63 staff from various PTS Divisions participated in the exercise. Key activities tested during the exercise included procedures and processes related to the point of entry (e.g. negotiations between the IT and the inspected State Party and checking of equipment), setting up a base of operations and establishing operational readiness, as well as conducting crucial elements of the post-inspection procedures. Major improvements in a number of areas since the 2008 IFE were noted. The exercise provided evidence of the availability of an increasingly competent cadre of trained surrogate inspectors, both from the States Signatories and from the PTS.

Planning for BUE III has begun and the exercise specifications have been drafted. The exercise is to focus on the inspection phase and will take place from 26 May to 7 June 2013 at a military training ground near Veszprém, Hungary, that was visited in October 2012.

Policy Planning and Operations

The inspection team functionality (ITF) project was successfully concluded in 2012. An information based search logic and methodology
for IT activities were developed and tested during the first two BUEs as well as during an expert meeting held at the ESMF in March. The ITF concepts were tested during BUE I for the development of the initial inspection plan and yielded satisfactory results. A document covering the IT search logic and the methodology for its application, the structure and agenda of IT internal meetings and reporting, and the IT structure and distribution of roles and responsibilities was drafted for testing during BUE III and for review prior to the IFE.

As a follow-up of the project on IT communications, an expert group meeting took place from 29 May to 1 June at the Austrian Armed Forces training area in the Seetaler Alpen. Thirteen national and six PTS experts participated in the meeting. A new portable VSAT was fully integrated into the GCI network. A successful test was conducted to follow the link to the PTS network via the different satellite hubs. Additionally, in-depth testing of various means of IT communication was performed under the challenging conditions of a mountainous region. Furthermore, the concept of operations for OSI communications, including the relevant draft standard operating procedure (SOP), was tested and validated.

With respect to work on the field information management system (FIMS), an expert group meeting on the geographical information system (GIS), funded by the EU under Joint Action IV, was conducted from 8 to 12 October in Guntramsdorf. A total of 22 experts from States Signatories, United Nations based organizations and the PTS participated in the activity. The meeting focused on evaluating the draft SOP recently developed as well as the new custom designed GIS, which is at the heart of FIMS. A number of valuable
recommendations were made and have been implemented. As a result, an improved SOP as well as an optimized GIS will be available and tested during BUE III and the IFE.

An expert meeting on multispectral including infrared (MSIR) imaging, funded by the EU under Joint Action IV, took place from 3 to 5 October at the Vienna International Centre. Ten invited experts from eight States Signatories along with PTS staff participated. The meeting was held as a follow-up of the 2011 MSIR expert meeting and focused on progress achieved by the PTS with support from States Signatories in the development of technical specifications for the MSIR equipment, results from field tests, drafting of relevant documentation and parts of the draft OSI Operational Manual, and further actions to prepare for the IFE.

Testing and development of the Integrated Information Management System (IIMS) continued in 2012. Suggested changes were made to its functional structure and the specific procedures in order to allow an integration of the IIMS with the ITF and FIMS projects. This should contribute significantly not only to the daily planning and management of IT activities but also to the clear fine-tuning of IT search logic. Integration of the IIMS with the other OSI technologies was also initiated. Work instructions (WINs) for setting up the IIMS were drafted and used during BUE II/IV. Some aspects of the IIMS were tested in field conditions for the first time as an exercise element for BUE II/IV.

Development of the concept for chain of custody for management of OSI samples was carried out using the IIMS as a central information management platform.

In preparation for BUE I, an expert meeting on the OSC was held on 10 and 11 January with the participation of 3 external experts and 13 PTS staff. The meeting focused on the set-up and organization of the OSC and procedures applied there with the aim of identifying best practices. The outcome of the meeting was used to develop, inter alia, OSC related SOPs that were then applied during BUE I.

The PTS continued the implementation of the Integrated Inspection Support System (IISS). The IISS concept covers nine major areas of operations support and logistics for the preparation, launch, conduct and recovery of an OSI. Activities in 2012 focused on completion and testing of the system engineering and synergies of the ESMF, establishment and testing of the infrastructure of the provisional OSC, development of equipment modules to be used with the Intermodal Rapid Deployment System, the health and safety concept, completion of the OSI databank and further improvement of the base of operations.

The ESMF has proven its capability to function as a multipurpose facility for supporting specific training events and exercises as well as for storage, maintenance and calibration of all OSI equipment. Lessons identified during BUE I and BUE II/IV were applied to further refine the ESMF infrastructure and processes. Special emphasis was given to the development of deployment kits and equipment modules. During 2012, all equipment was repacked and sorted into system modules to enable rapid and flexible deployment.

The PTS completed the development of the OSI databank project as an important pillar of operations support. The first version of the databank was being tested and data entry was due to commence at the beginning of 2013.

The layout and infrastructure requirements for the base of operations were further refined in preparation for BUE II/IV using a systematic approach and standardization. The developed infrastructure and procedures proved to be efficient during BUE II/IV, showing significant improvement since the 2008 IFE. Overall, the current equipment and structure enable rapid and effective deployment anywhere in the world. Capability shortfalls revealed during testing, which were related to power generation systems and the handling of material in the field, have been addressed and new equipment is to be delivered. Air conditioning systems and further
modernization of the decontamination module have been planned for 2013.

In 2012, the PTS completed the review and update of the OSI health and safety regime and provided the chapter on health and safety for the draft OSI Operational Manual. Subsequently, it initiated the procurement of items to ensure the safe conduct of OSI activities, including personal protective equipment to be used by inspectors in the field. In addition to updating the health and safety manual, the PTS prepared a draft SOP related to security issues for an OSI.

Techniques and Equipment

During 2012, the PTS focused on the development of techniques and equipment for noble gas detection and radionuclide mapping as well as the further development of MSIR technologies. In addition, more progress was made in implementation of a project funded through EU Joint Action IV for a noble gas system. As part of Joint Action V, an additional project for development of a modular MSIR system was planned.

Another MSIR field test took place in Hungary in May to assess, for OSI purposes, the operational readiness of airborne MSIR sensors. The test addressed the detection of areas where the surface material has been shaken by the detonation of charges and the impact of such detonations on vegetation, as well as changes to hydrological characteristics. The area surveyed was an order of magnitude greater than that in the previous test and key improvements were made in data processing and in the delivery time of data products. These developments, together with the simulation of the integration of MSIR imagery with the IMS, will help effective deployment of MSIR technologies during BUE III as well as the IFE.
A field test of portable gamma radiation scanning equipment was conducted in Belarus in September in order to evaluate its technical performance in operational conditions at the Polesye State Radiation and Ecological Reserve, an exclusion zone created in the aftermath of the Chernobyl accident. The test was combined with O&M training for PTS staff. The tested systems comprised a handheld portable configuration with a standard detector as well as vehicle-borne and airborne configurations with larger detectors. The technical performance of the systems in the field was entirely satisfactory. The software developed and used for data collection and evaluation was very informative and easy to use. This field test activity was extremely productive and generated many lessons learned from the perspectives of in-field operation and inspector efficiency in an elevated radiation field, as well as identifying further developments required for the equipment.

A field test held at the Turecký Vrch military base in Slovakia in October allowed field operation of newly acquired ‘direct push’/augering equipment for environmental sampling of noble gases in soil. Several subsurface sampling stations were created and installed with equipment for subsoil gas sampling. The configurations tested demonstrated no atmospheric gas infiltration during the pumping on each hole, which lasted up to 24 hours. Concurrently, a second team gained experience in collecting environmental samples that would probably entrain dust contaminated with radionuclides in a real OSI situation. Activities involved three types of air sampler and one high volume water sampler. Experience was also gained with the logistics of transporting large and heavy pieces of equipment into an operational setting.

As direct preparation for BUE III, a field test was held in Hungary in November to test the installation and operation of three airborne sensors on board a commercial helicopter. The field test, which involved equipment offered as a contribution in kind by Italy, demonstrated the functionality of these sensors (a caesium vapour magnetometer, a gamma spectrometer and a complex camera system adapted to flight path documentation and visual observation purposes) and established the airworthiness of specific components fabricated as part of the unique sensor installation.

Within the framework of meetings related to noble gas detection, international experts discussed, together with PTS staff, technical details of radionuclide particulate and noble gas sampling for OSI purposes. The meeting identified objectives and needs for development and field testing, and included valuable in-depth technical discussions of equipment and sampling strategy. In a second meeting, the chain of custody was addressed.

An equipment certification SOP was compiled and approved at the beginning of the year. This contributes to the smooth flow of OSI preparation because it covers the whole OSI process, from receiving equipment and performing initial checks, through laboratory and field tests, to readiness for certification. The concept of equipment certification was successfully tested in both BUE I and BUE II/IV and the experience was reported at OSI Workshop-20.

Within the framework of adapting the active seismic survey method for OSI purposes, considerable progress was achieved by one of the contracted geophysical institutions. The breakthrough concept is that the secondary target of any underground nuclear explosion,
the irreversibly fractured zone surrounding an actual cavity, is much more revealing from an OSI standpoint than the primary target, namely the void created by the explosion. This new concept of active seismic detection is based on the petrophysical situation surrounding a detonation point, characterized by a decrease in seismic velocity and high wave attenuation. Although current active seismic methods are very effective, they are also the most labour-intensive inspection activities of an OSI. However, this new approach will reveal traceable changes in rock properties by merely deploying a scaled-down 3D seismic survey. Additionally, the operational benefit of this strategy is that Seismic Aftershock Monitoring System equipment already available and approved can be used for an OSI-relevant active seismic survey.

Training

In parallel with the continuation of training of surrogate inspectors nominated for the second training cycle, the PTS focused on training potential participants in the BUEs.

The year started with an introductory training course for staff from Permanent Missions. This course was attended by 17 participants from 12 States Signatories.

Training for BUE I was provided in seven days dispersed between January and April. It addressed the training needs for various types of expertise required for the functioning of the OSC. Approximately eighty trainees undertook this training by attending one or more of the training segments.

From 14 to 18 May, a health and safety training course took place both in Vienna and at the Austrian Armed Forces NBC Defence School in Korneuburg, near Vienna. This event was ambitious in terms of its scope, the training methods and the large number of participants: in total, 74 experts attended, of whom 64 were from 41 States Signatories and 10 from the PTS. Trainers were drawn from the PTS and external cost-free experts from the USA. Through a combination of lectures, hands-on experience and field activities involving radioactive sources, the participants gained an understanding of the possible hazards of radioactive fields and contamination and the measures which can be taken to mitigate them. This was a very successful event from which several lessons were identified that can contribute to future health and safety courses.
From 18 to 22 June, a tabletop exercise combined with hands-on training in logistics and administration was organized for 22 participants from 14 States Signatories. Most trainees were from both training cycles and had a logistics background. The same training techniques were used as in the health and safety training course, namely lectures, hands-on activities and practical activities using OSI equipment at the ESMF. Following the practical activities, participants took part in the tabletop exercise, which included several simulations and role playing that explored the logistical and administrative procedures of an OSI.

A BUE training course was conducted from 6 to 10 August. It addressed learning needs for three types of participant in BUE II/IV: inspectors, representatives of the inspected State Party and OSC staff. It involved approximately sixty people. The organization of the training was complex as it had to accommodate a challenging scope and the technical and non-technical, procedural and strategic aspects, as well as a variety of training methods (from hands-on training to classroom simulations).

From 5 to 9 November, a tailor-made leadership training course was held for 36 trainees from the first and second OSI training cycles. The course addressed leadership, negotiations and management skills relevant for the ITF and search logic. Most of the training methodology was based on simulations, a tabletop exercise and role playing involving the understanding of other cultures, leadership, public speaking and negotiations.

Steady progress was made with the upgrading and updating of the database for OSI Rapid Inspector Selection (OSIRIS). At the end of the year, data on trainees taken from a comprehensive survey were being prepared for use in the 2013 training and BUE III. An important practical step was taken during BUE I, when a call-up of trainees was performed to assess the degree of completeness of the database.

The e-training simulation system was being upgraded and new equipment for a radioactivity contamination simulation system was being purchased. This will enable trainees to simulate the detection of radioactive sources during field exercises.

The status of inspectors and inspection assistants was discussed at meetings of the Working Groups in 2012. As a result, some progress was made in terms of more detailed definitions of availability criteria as well as improvement of the call-up process.

The year 2012 was one of the most active and productive for OSI training, with about five hundred participants being trained to perform various functions and being prepared for participation in and/or support of activities to test OSI readiness.

### Procedures and Documentation

The PTS continued to provide substantive, technical and administrative assistance to Working Group B in its third round elaboration of the draft OSI Operational Manual. This included a further update of the Model Text for the manual, issued in June 2012. It is expected that in 2013 a consolidated Model Text will be available for use at the IFE in 2014.

OSI Workshop-20 was held at the Vienna International Centre from 29 October to 2 November. A total of 83 experts from all six geographical regions participated, comprising 40 external experts from 19 States Signatories and 43 experts from the PTS. The workshop included two sessions during which participants were debriefed on BUE I and BUE II/IV. The third session focused on the preparations for BUE III and the lead-up to the IFE.

The workshop covered all aspects of the BUEs already conducted, including roles and activities of the different players at the OSC located in the ESMF, activities at the point of entry/exit, set-up of the base of operations, communications, IT reporting and interaction of the inspected State Party with the IT. It also focused on inspection techniques, equipment...
and procedures for BUE III, and identified areas for improvement in preparation for BUE III and the IFE.

A number of OSI documents related to the Quality Management System (QMS) of the PTS were drafted and approved in preparation for the BUEs and training activities. Fourteen SOPs, twelve WINs and three manuals were drafted or revised in 2012. These included two WINs that provided guidance on drafting QMS related OSI documents and the templates to be used by document drafters and process owners.

The first phase of the conversion of the OSI document management system to an ‘e-library’ was completed and a prototype e-library platform was made available for testing and review. The next and final phase of the project has been initiated. This will help the e-library move to a production environment and interface with other systems in the PTS.

With respect to the consolidation of OSI scientific literature, work on the integration of compiled material into the e-library concluded with the first compilation of technical literature for each of the techniques covered by the Treaty. It is expected that this compilation will support the work of PTS staff in obtaining relevant information for the development of training modules, technical specifications of required equipment, concepts of operations for the different techniques and logistical support needed to employ these techniques.