CTBTO
PREPARATORY COMMISSION

preparatory commission for the comprehensive nuclear-test-ban treaty organization

Annual Report 2011

www.ctbto.org

CTBTO
PREPARATORY COMMISSION

preparatory commission for the comprehensive nuclear-test-ban treaty organization

Annual Report 2011

Published by the Provisional Technical Secretariat of the
Preparatory Commission for the
Comprehensive Nuclear-Test-Ban Treaty Organization
Vienna International Centre
P.O. Box 1200
1400 Vienna
Austria

Throughout the document, countries are referred to by the names that were in official use in the period for which the text was compiled.

The boundaries and presentation of material on maps contained in this document do not imply the expression of any opinion on the part of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of names of specific companies or products (whether or not indicated as registered) does not imply any intention to infringe proprietary rights, nor should it be construed as an endorsement or recommendation on the part of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization.

The map on the back cover shows the approximate locations of International Monitoring System facilities based on information in Annex 1 to the Protocol to the Treaty adjusted, as appropriate, in accordance with proposed alternative locations that have been approved by the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization for reporting to the initial session of the Conference of the States Parties following entry into force of the Treaty.

Printed in Austria
June 2012

Based on document CTBT/ES/2011/5, Annual Report 2011

Message
from the Executive Secretary

I have the pleasure to present the 2011 Annual Report of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization, which features the highlights of our achievements throughout the year.

Ghana and Guinea ratified the Treaty and joined the ranks of ratifying States. With these two ratifications, the number of ratifying States increased to 155. Remarkable progress towards entry into force was made with the approval of the ratification of the Treaty by the Parliament of Indonesia in December 2011. As of 31 December 2011, the Treaty had been signed by 182 States. At the same time, a host of developments, including the Fukushima nuclear accident, the "Science and Technology 2011" conference and the seventh Article XIV conference highlighted the security as well as civil and scientific benefits of the Treaty and its verification regime.

The tragic disasters following the devastating earthquake off the coast of Japan on 11 March were also a challenging 'stress test' for the Commission and its verification regime. In responding to the events, the Commission mobilized its resources, drawing on its advanced monitoring technologies and facilities, experience and dedicated staff.

The performance of the organization was impressive. The International Monitoring System (IMS) collected the relevant data. The global communications system transmitted the data and products in accordance with the standard time lines. The International Data Centre (IDC) reviewed the data and produced timely and high quality analysis.

The data and analysis were shared constantly with close to 1200 authorized institutions and other users in around 120 States Signatories. The Commission also held regular briefings for States Signatories. The data and the data products allowed States Signatories and users to monitor the dispersion of the radionuclide particulates and noble gases and prepare for any necessary contingency planning. This contributed to regional and global efforts to assess the radionuclide risks. The organization also became a reliable source of information for the media and the general public.

The Fukushima accident prompted the enhancement and expansion of cooperation among international

organizations in areas such as early warning, disaster management, nuclear safety, human health and the environment.

In brief, the Commission was able to put to the test everything it has worked hard to build and achieve.

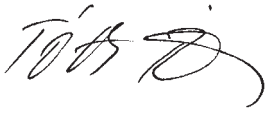
I should pay a special tribute to the dedicated staff of the Commission, who through their teamwork made all of this achievable. Station and system operators, technologists, analysts and support personnel worked day and night to run and maintain our system. Despite the pressure, they did their utmost in generating data and products and ensuring continuous real time access to what was being produced.

We also made considerable progress in the build-up of the verification regime in 2011. The number of certified IMS stations and radionuclide laboratories now stands at 270 (80% of the total network). The number of certified noble gas monitoring systems reached eight (20% of the systems planned).

The volumes of data and data products were increased. The integration of noble gas and infrasound monitoring systems into IDC operations was further consolidated. The Commission also decided on a financing mechanism for the next Integrated Field Exercise in 2014, which would significantly boost the operational readiness of our on-site inspection regime.

The "Science and Technology 2011" conference held in June brought together around seven hundred and fifty participants from over one hundred countries, from every corner of the world. They included scientists, academics, researchers, science administrators, technologists, State officials and representatives of the media and civil society. The conference provided a good opportunity to review the performance of the verification regime and to deepen interaction with the scientific community in our continuous pursuit of a technological vanguard position.

As a final note, I wish to express my appreciation to States Signatories for their resolute support of the work of the Commission in these financially difficult times. This certainly inspires us to continue our hard work and take on the remaining challenges leading to the completion of the verification regime and the entry into force of the Treaty.



Tibor Tóth
Executive Secretary
CTBTO Preparatory Commission
Vienna, February 2012

Treaty

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is an international treaty outlawing nuclear explosions in all environments. In providing for a total ban on nuclear testing, the Treaty seeks to constrain the development and qualitative improvement of nuclear weapons and end the development of new types of nuclear weapon. In doing so, it constitutes an effective measure of nuclear disarmament and non-proliferation in all its aspects.

The Treaty was adopted by the United Nations General Assembly and opened for signature in New York on 24 September 1996. On that day, 71 States signed the Treaty. The first State to ratify the Treaty was Fiji on 10 October 1996.

Under the terms and provisions of the Treaty, the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is to be established in Vienna, Austria. The mandate of this international organization is to achieve the object and purpose of the Treaty, to ensure the implementation of its provisions, including those for international verification of compliance with it, and to provide a forum for cooperation and consultation among States Parties.

Preparatory Commission

In advance of the entry into force of the Treaty and the establishment of the CTBTO proper, a Preparatory Commission for the organization was established by the States Signatories on 19 November 1996. The Commission was given the mandate of preparing for entry into force and is located at the Vienna International Centre.

The Commission has two main activities. The first consists of undertaking all necessary preparations to ensure the operationalization of the CTBT verification regime at entry into force. The second is the promotion of Treaty signature and ratification to achieve entry into force. The Treaty will enter into force 180 days after it has been ratified by all 44 States listed in its Annex 2.

The Preparatory Commission is made up of a plenary body responsible for directing policy and comprising all States Signatories, and a Provisional Technical Secretariat (PTS) to assist the Commission in its duties, both technically and substantively, and carry out such functions as the Commission determines. The PTS started work in Vienna on 17 March 1997 and is multinational in composition, with staff recruited from States Signatories on as wide a geographical basis as possible.

Summary

Despite various challenges, the Preparatory Commission in 2011 managed to build on its efforts in promoting the Treaty and expanding the capabilities of its verification regime.

The Commission continued to enjoy strong political support and registered notable progress in universalization of the Treaty. With ratification of the Treaty by Ghana and Guinea, the number of ratifying States reached 155. The approval of the ratification of the Treaty by the Parliament of Indonesia in December 2011 was another key development that received worldwide media attention.

In 2011, as a result of coordinated efforts of the States hosting facilities of the International Monitoring System (IMS), local operators, States Signatories and the Provisional Technical Secretariat (PTS), further progress was made in expanding the coverage and data availability in all IMS technologies. The number of certified IMS stations and radionuclide laboratories reached 270, representing 80% of the total foreseen by the Treaty. The number of certified IMS noble gas systems increased to 8, which is 20% of the planned network. Moreover, with the certification of an auxiliary seismic station in Bangladesh (AS7), the number of such stations reached 100. This achievement marks an increase in the data available from the verification regime, especially from radionuclide and auxiliary seismic stations.

The major project to repair IMS hydroacoustic station HA3 and infrasound station IS14 (Chile), which were destroyed by a tsunami in 2010, continued to proceed well. The procurement process for HA3 was started. Efforts were being made to return IS14 to full operation in 2012.

The PTS succeeded in further consolidating infrasound and noble gas systems into the operations of the International Data Centre (IDC). At the end of the year, 47 infrasound and 8 noble gas systems were in provisional operation. Efforts were also made to further enhance the atmospheric transport modelling capabilities and to continue delivering high quality products to States Signatories. Atmospheric backtracking calculations are performed daily for each of the IMS radionuclide stations with near real time meteorological data obtained from the European Centre for Medium-Range Weather Forecasts.

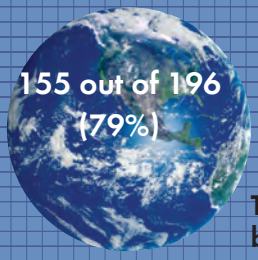
The state of health system deployed in the IDC Operations Centre was developed further. In addition, a wide range of activities were focused on IDC software development.

The Fukushima nuclear accident presented an unexpected major challenge to the Commission. Over and above its regular activities, it took exceptional measures to ensure data collection from its IMS facilities and processing of the data to produce various high quality products, which had to be analysed and provided to States Signatories and international organizations in the shortest possible time. The Commission also served as a reliable source of information for the public and the media.

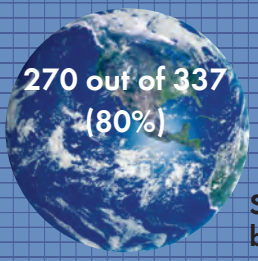
The performance of the verification regime was beyond expectations. It proved its capabilities and demonstrated its vast potential in verification as well as in the support of early warning and disaster management systems. In this regard, important lessons were drawn that are being used for further improvement in equipment development, atmospheric transport modelling, seismic monitoring, radionuclide monitoring, health and safety procedures and the delivery of data and products to users.

Promoting the operational capabilities of the organization in the area of on-site inspection (OSI) was a major priority in 2011. Further progress was made on a range of equipment related issues. These included the definition of the technical specifications and draft list of equipment to be used during the initial period of an OSI.

The second cycle of OSI training continued as planned. Over fifty participants from 43 States Signatories attended an advanced course, which included a four day field exercise in Hungary. As part of the training cycle, two tabletop exercises were conducted for the groups



Treaty Ratifications by the End of 2011



Station Certifications by the End of 2011

in the inspection team responsible for radionuclide monitoring and the application of continuation period techniques.

In addition, several OSI technical expert meetings were organized. The meeting addressed communications, use of a geographical information system and noble gas monitoring technology for OSI purposes. They also covered multispectral and infrared imaging, as well as active seismic survey techniques and drilling.

An OSI Equipment Storage and Maintenance Facility in a warehouse near Vienna was inaugurated in March 2011. The facility was used for a number of training courses, tabletop exercises, expert meetings, equipment demonstrations and technical visits by delegations from States Signatories.

The "Science and Technology 2011" conference, held in Vienna in June, was a major initiative to foster further interaction with the scientific community and to seek cost effective technological improvements. The conference was attended by around seven hundred and fifty scientists, experts and government officials from over one hundred countries, and nearly three hundred oral and poster presentations were given. Discussions were organized around five themes: the earth as a complex system; understanding the nuclear explosion source; advances in sensors, networks and observational technologies; advances in computing, processing and visualization for verification applications; and creating knowledge through partnerships, training and information/communication technology.

The Commission continued to expand its Capacity Development Initiative, whose aim is to build the necessary capacity in States Signatories so that they can more effectively meet their Treaty obligations and contribute to the verification regime. In 2011, two courses were organized which were attended by several hundred participants from over one hundred countries, including IMS station operators, staff of National Data Centres (NDCs), diplomats, academics and members of civil society. The courses addressed various issues, including political, legal, technical and scientific challenges that face the Treaty.

In addition, many workshops, training courses and technical visits were organized to strengthen the technical capacity of States Signatories, in particular NDCs. In this respect, a country profile for all States Signatories has been developed which contains, inter alia, information on the number of authorized users, the use of data and data products and participation in previous events organized by the Commission.

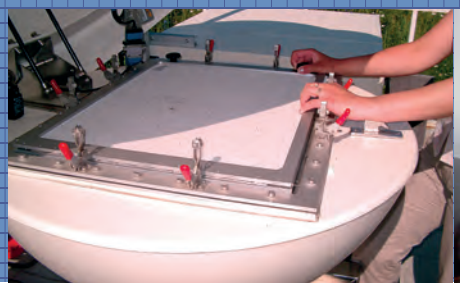
The Commission continued to streamline its activities and to promote synergies and efficiencies by fostering results based management, accountability and oversight. An important decision was made to finance an Integrated Field Exercise in 2014, which will significantly promote OSI operational capabilities.

ABBREVIATIONS

ATM atmospheric transport modelling
CIF Capital Investment Fund
DE10 2010 directed exercise
DOTS Database of the Technical Secretariat
ERP Enterprise Resource Planning
ESMF Equipment Storage and Maintenance Facility
EU European Union
GCI Global Communications Infrastructure
IACRNE Inter-Agency Committee on Radiological and Nuclear Emergencies
IAEA International Atomic Energy Agency
IDC International Data Centre
IFE Integrated Field Exercise
IMS International Monitoring System
IPSAS International Public Sector Accounting Standards
ISHTAR Information System with Hyperlinks on Tasks Assigned by the Resolution Establishing the Preparatory Commission
ISN independent subnetwork
KPI key performance indicator
MSIR multispectral including infrared
NDC National Data Centre
O&M operation and maintenance
OPEC Organization of the Petroleum Exporting Countries
OSI on-site inspection
PCA post-certification activity
PRTool performance reporting tool
PTS Provisional Technical Secretariat
QMS Quality Management System
REB Reviewed Event Bulletin
RRR Reviewed Radionuclide Report
S&T2011 CTBT: Science and Technology 2011 Conference
SOH state of health
SOP standard operating procedure
VPN virtual private network
VSAT very small aperture terminal
WHO World Health Organization
WMO World Meteorological Organization

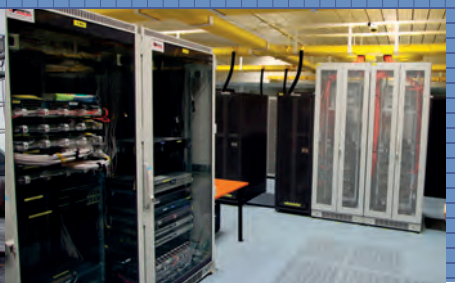
Contents

INTERNATIONAL MONITORING SYSTEM



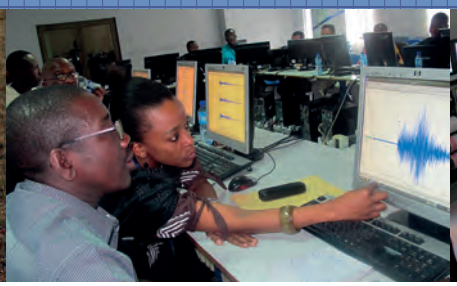
GLOBAL COMMUNICATIONS

INTERNATIONAL DATA CENTRE



CONDUCTING ON-SITE INSPECTIONS

CAPACITY BUILDING



IMPROVING PERFORMANCE AND EFFICIENCY

POLICY MAKING

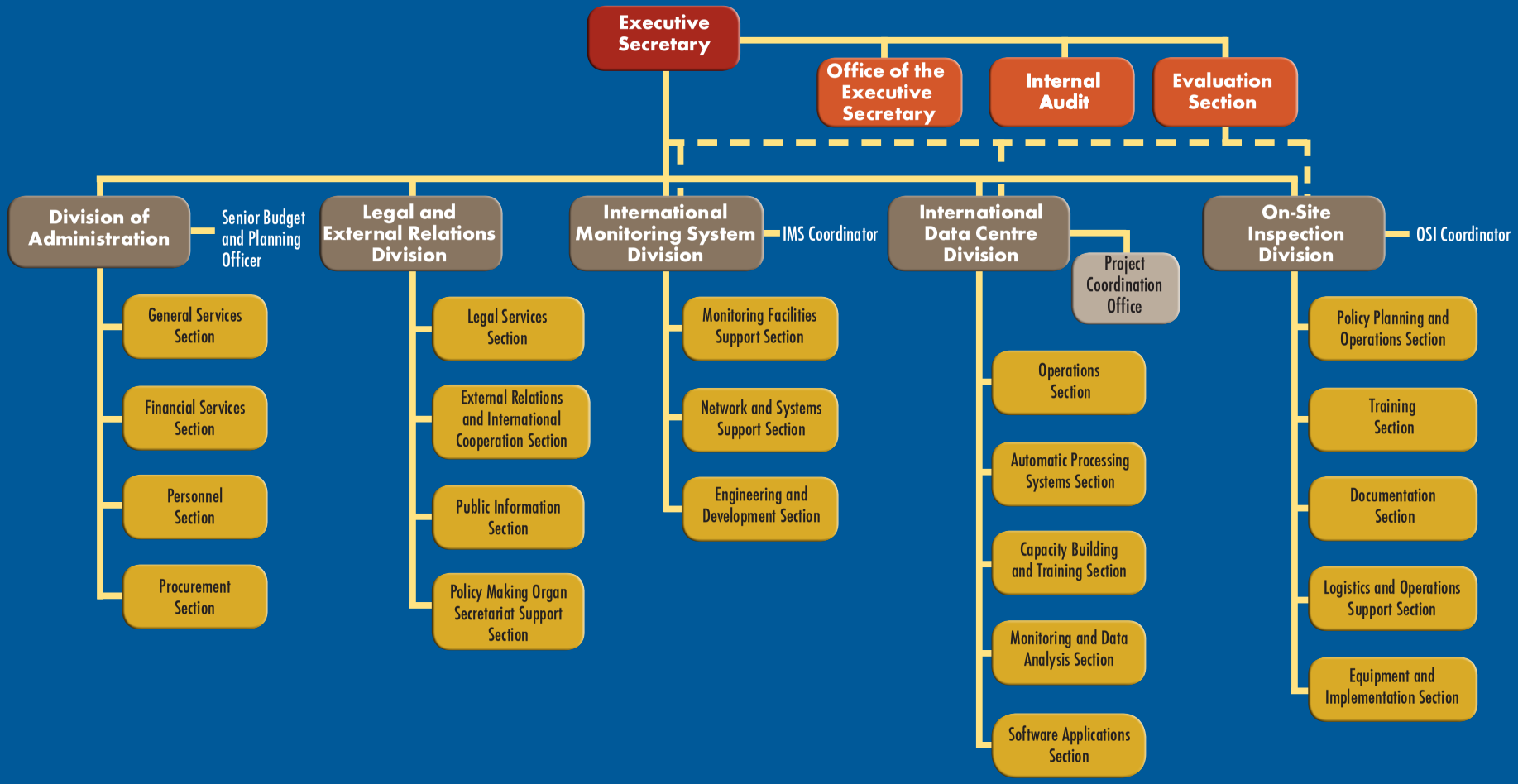
OUTREACH

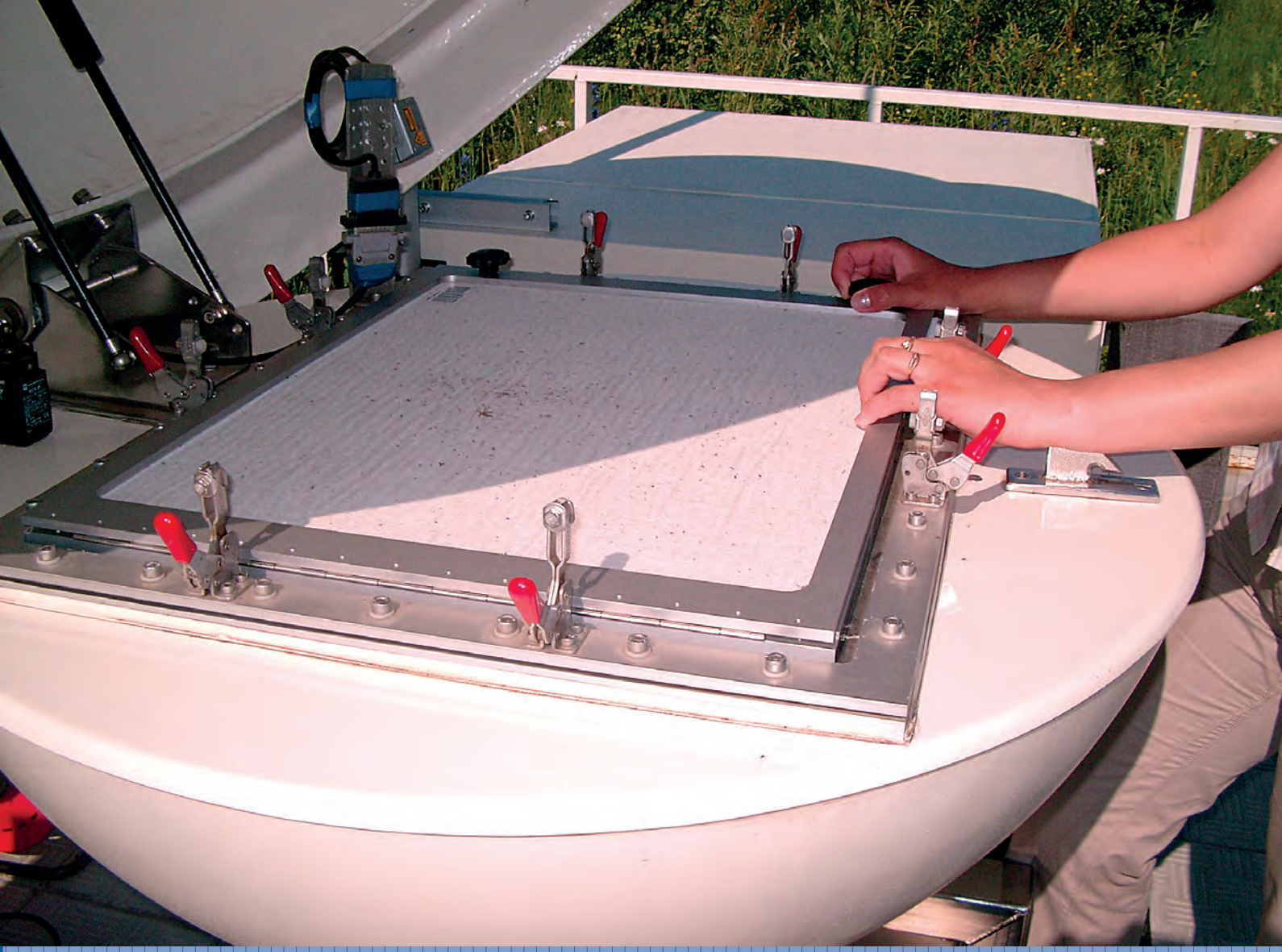
MANAGEMENT

FACILITATING THE TREATY'S ENTRY INTO FORCE

SIGNATURE AND RATIFICATION

Organizational Structure of the Provisional Technical Secretariat (31 December 2011)





International Monitoring System

Highlights in 2011

Increased data availability at certified IMS stations

Enhanced technology development

Progress with the largest ever repair and reconstruction of IMS stations and several major recapitalizations

The International Monitoring System (IMS) is a global network of sensors for detecting and providing evidence of possible nuclear explosions. Upon completion, the IMS will consist of 321 monitoring stations and 16 radionuclide laboratories throughout the world in locations designated by the Treaty. Many of these facilities are located in areas that are remote and difficult to access, posing major engineering and logistical challenges.

The IMS provides data from seismic, hydroacoustic and infrasound ('waveform') monitoring technologies which are used to detect the energy released from an explosion or a naturally occurring event in the underground, underwater and atmospheric environments.

Radionuclide monitoring uses air samplers to collect particulate matter from the atmosphere. Samples are then analysed for evidence of physical products created by a nuclear explosion and carried through the atmosphere. The analysis of the radionuclide content can confirm whether an event recorded by the other monitoring technologies was actually a nuclear explosion. The monitoring capability of some stations is being enhanced by the addition of systems for detecting radioactive forms of noble gases that are produced by nuclear reactions.

ESTABLISHMENT, INSTALLATION AND CERTIFICATION

Establishment of a station is a general term referring to the building of a station from its initial stages until its completion. *Installation* typically refers to all work performed until the station is ready to send data to the International Data Centre (IDC). This includes, for instance, site preparation, construction and equipment installation. A station receives *certification* when it meets all technical specifications, including requirements for data authentication and transmission through the Global Communications Infrastructure (GCI) link to the IDC in Vienna. At this point the station is considered an operational facility of the IMS.

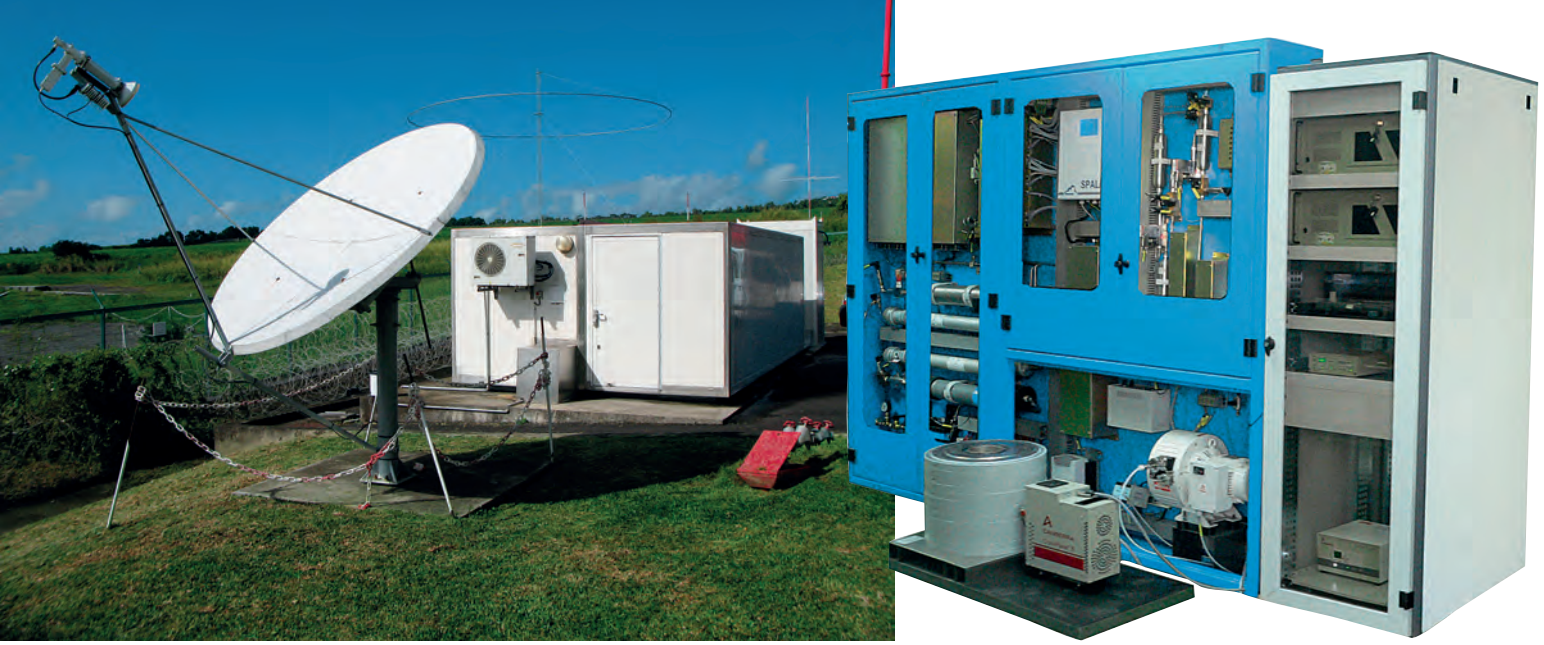
The momentum to complete the IMS network was maintained in 2011.

ESTABLISHING THE INTERNATIONAL MONITORING SYSTEM

The momentum to complete the IMS network was maintained in 2011. Substantial progress was made in all four technologies (seismic, hydroacoustic, infrasound and radionuclide) with the installation, certification and start-up of new facilities.

Six IMS stations were installed in 2011. Thus by the end of 2011, 278 IMS stations had been installed, representing 87% of the entire network. In addition, political support was received from several

Upgrading work at the joint site of primary seismic station PS7 and infrasound station IS9, Brasilia, Brazil.



Radionuclide station RN29 on the island of Réunion (France) in the Indian Ocean, east of Madagascar. RN29 is equipped with a noble gas monitoring system of the SPALAX type (*right*). This is the first SPALAX type system to be certified as part of the IMS.

countries hosting IMS facilities where the Provisional Technical Secretariat (PTS) had not been able to proceed in previous years, bringing the prospect of a complete IMS network closer.

With 6 stations certified in 2011 as meeting all the stringent technical requirements of the Preparatory Commission, the total number of certified IMS stations and laboratories, which had been zero in 2000, reached 270 at the end of the year. An important milestone was reached on 8 December with the certification of the 100th IMS auxiliary seismic station (AS7, Bariadhala, Chittagong, Bangladesh). This increase in the number of certified stations has been a source of improvement for coverage and network resilience. Station design, especially in the infrasound technology, has also evolved, resulting in a higher detection capability.

Table 1. Status of IMS Station Installations and Certifications (31 December 2011)

IMS Station Type	Installation Complete		Under Construction	Contract Under Negotiation	Not Started
	Certified	Not Certified			
Primary seismic	42	4	1	0	3
Auxiliary seismic	102	9	5	0	4
Hydroacoustic	10	1	0	0	0
Infrasound	45	0	4	0	11
Radionuclide	61	4	5	5	5
Total	**260**	**18**	**15**	**5**	**23**

Table 2. Status of Noble Gas System Installations and Certifications (31 December 2011)

Total Number of Noble Gas Systems: 40	Installed: 29	Certified: 8

Table 3. Status of Radionuclide Laboratory Certifications (31 December 2011)

Total Number of Laboratories: 16	Certified: 10

As demonstrated in October 2006 at the time of the first nuclear test announced by the Democratic People's Republic of Korea, monitoring of radionuclide noble gases plays an essential role in the CTBT verification system. Noble gas detection proved to be essential as well during the nuclear accident at Fukushima, Japan. Emphasis therefore continued to be placed on this technology in 2011 with the installation of two additional noble gas systems, bringing the number of such systems installed at IMS stations to 29 (73%). The Commission continued its dynamic certification programme for noble gas systems initiated in 2010. After the certification of the first SAUNA noble gas system in 2010, the first certification of a station using a second type of noble gas system, SPALAX, was achieved in 2011 (RN29, Réunion, France). A total of five noble gas systems were certified in 2011. The addition of these systems strengthens significantly the capacity of the IMS and continues the responsive approach to the establishment of the verification system.

These advances are not just about increases in data flow. They are about the effective application of

Top: **Hydroacoustic station HA2, Queen Charlotte Islands, British Columbia, Canada.** ***Middle:*** **Upgrading work at infrasound station IS18, Qaanaaq, Greenland (Denmark), one of the northernmost towns in the world.** ***Bottom:*** **Auxiliary seismic station AS7 at Bariadhala, Chittagong, Bangladesh, the 100th such station to be certified as part of the IMS.**

monitoring technologies around the globe; they are about higher quality data processing and data products; they are about better and more experienced data analysts and station operators.

AGREEMENTS FOR MONITORING FACILITIES

In order to carry out the functions of efficiently and effectively establishing and sustaining the IMS facilities, the Preparatory Commission for the CTBTO needs to derive full benefit from the immunities to which it is entitled as an international organization under the Resolution establishing it, in similar terms to those stipulated in the Treaty for the CTBTO itself. Consequently, facility agreements or arrangements provide for the application (with changes where appropriate) of the Convention on the Privileges and Immunities of the United Nations to the activities of the Commission and/or explicitly provide for such privileges and immunities, including exemption from taxes or duties. In practice, this may imply that a State hosting one or more IMS facilities would adopt the necessary national measures to that effect.

The Commission has the mandate to establish procedures and a formal basis for provisional operation of the IMS, including concluding agreements or arrangements with States hosting IMS facilities to regulate activities such as site surveys, installation or upgrading work and certification, as well as post-certification activities (PCAs).

Of the 89 States hosting IMS facilities, 42 have signed a facility agreement or arrangement with the Commission, and 34 of these agreements and arrangements are in force. At the end of 2011, the Commission was in

negotiation with 20 of the 47 host States which have not yet concluded a facility agreement or arrangement. States are showing increased interest in the subject and it is hoped that ongoing negotiations may be concluded in the near future and that others may be initiated soon.

In 2011, the importance of establishing such facility agreements and arrangements and of their subsequent national implementation continued to be addressed by the Commission and its subsidiary organs. The lack of such legal mechanisms causes substantial costs and major delays in sustaining certified IMS facilities, adversely affecting data availability of the verification system.

AFTER CERTIFICATION

Following the certification of a station and its incorporation into the IMS, its operation is ultimately focused on delivery of high quality data to the IDC.

PCA contracts are fixed-cost contracts between the Commission and some station operators. These contracts cover station operations and some preventive maintenance activities. The total PCA related expenditure in 2011 was US$16 570 000. This amount covers the 2011 applicable PCA related costs for all 143 facilities and noble gas systems certified up to 31 December 2011, including the 10 certified radionuclide laboratories and 3 noble gas systems. PCA contractual agreements covered one additional non-certified radionuclide laboratory.

As of 1 October 2011, the new draft IMS and IDC Operational Manuals were adopted in the operation and maintenance (O&M) of the IMS

PTS officer performing a spike test during a certification visit to RN29, Réunion (France), in which radio-xenon was injected into the monitoring system to assess its performance.

Infrasound station IS6 on West Island in the Cocos Islands (Australia) in the Indian Ocean, approximately midway between Australia and Sri Lanka.

network. Station operators successfully adapted their monthly reporting to the requirements of the new manuals. The monthly reporting in the new format enables better tracking of services provided under the PCA contracts by the station operators.

The PTS continued to standardize the services provided under PCA contracts and the criteria for evaluating the performance of the station operators. All new stations and stations submitting new budget proposals were requested to develop O&M plans in accordance with a standard template.

SUSTAINING PERFORMANCE

Preparing a global monitoring system of 337 facilities supplemented by 40 noble gas systems involves much more than the building of stations. It requires taking a holistic approach to establishing and sustaining an intricate 'system of systems' that should be completed to meet the verification requirements of the Treaty while protecting the investment already made by the Commission. This can be achieved by testing, evaluating and sustaining what is in place, and then further improving upon this.

The life cycle of the IMS station network proceeds from conceptual design and installation to operation and sustainment. Sustainment covers maintenance through necessary upgrades, replacement and repairs. This process also involves management, coordination and support for the full life cycle of each facility component, performed as efficiently and effectively as possible. In addition, with IMS facilities reaching the end of their life cycle, there is the need to plan and budget for recapitalization of all components of each facility. Review and improvement of operation and support of facilities were continued in 2011.

Logistics

The support required to ensure the highest levels of data availability from such a global network of facilities calls for an all-encompassing logistics approach, which seeks continued optimization. In 2011, the Commission therefore started to invest efforts and resources in further exploiting information technology tools for logistics support analysis by entering information on IMS facility equipment as well as station- and country-specific logistics into a modelling program. Logistics support analysis is used to find the most efficient current and future support structure for the IMS.

Efforts also continued in 2011 to validate, review and improve the configuration management of IMS facilities. Configuration management allows for maintaining an understanding of the status of complex assets, with a view to ensuring the highest level of service at the lowest cost. Knowing and tracking the status and associated life cycle sustainment information of the IMS network of stations and its major components are thus essential for effective planning. At the end of the year, baseline data had been established in the Database of the Technical Secretariat (DOTS) for 99% of the certified IMS stations. DOTS was also enhanced to improve the sharing of station related information with authorized users. Two new modules were introduced in DOTS in 2011, including one to track financial information on facility equipment.

Work intensified in 2011 to optimize the advance location and storage of IMS equipment and consumables at regional, country specific and station based depots and at the Vienna based storage facility. The PTS also continued to develop country specific shipment and customs clearance procedures for equipment transported to and from certified IMS facilities and to appeal for the support of host countries in this matter.

Maintenance

Maintenance support and technical assistance continued to be provided at IMS facilities around the globe. A total of 28 preventive and corrective maintenance visits were

made to 41 certified facilities. In particular, the PTS progressed with the largest IMS station repair and reconstruction so far in terms of financial investment at the joint site of hydroacoustic station HA3 (which uses hydrophones) and infrasound station IS14 in the Juan Fernández Islands (Chile), which were partly destroyed by a tsunami in 2010. This multimillion dollar project, which entails substantial technical challenges and risks, is planned to be completed in the 2013-2014 austral summer. It is funded through an extrabudgetary mechanism. The procurement process for HA3 was started in 2011. Attempts were being made to return IS14 to full operation in 2012.

In order to ensure more timely preventive and corrective maintenance of IMS facilities where data availability is being affected, the PTS also continued to manage equipment support contracts with manufacturers, improving several on the basis of experience. These contracts are instrumental in ensuring timely technical assistance and equipment replacement at IMS stations at optimal cost.

The PTS also continued to optimize its station specific strategy in 2011. Station specific operational manuals and other documentation which support the O&M relevant to each station were further developed in all technologies. Emphasis continued to be placed on developing the technical capabilities of station operators. As the entity closest to an IMS facility, the station operator is in the best position to prevent problems at stations and ensure a timely resolution when they occur. Station visits thus systematically include hands-on training for the local station operator, so that the PTS does not have to travel to a station twice to resolve the same problem.

Recapitalization

The final phase in the life cycle of equipment for IMS facilities involves its replacement (recapitalization) and disposal. The PTS continued to recapitalize IMS facility components as they reached the planned end of their operating lives. Several major recapitalization projects involved substantial planning and investment in 2011, in particular at primary seismic station PS2 and infrasound station IS7 (Australia), PS7 and IS9 (Brazil) and radionuclide station RN27 (France).

Engineering Solutions

The engineering and development programme for IMS facilities continued in 2011 by designing, validating and implementing solutions to improve overall data availability and quality, cost effectiveness and performance. Systems engineering is implemented throughout the station life cycle. It relies on open systems design through standardization of interfaces and modularity. It demands improvement of systems and equipment reliability, maintainability, logistical supportability, operability and testability. It also requires enhancing trustworthiness of the IMS through calibration and data surety measures, and finally applying end-to-end systems engineering and optimizing station design with processing by the IDC.

The continuous analysis of root causes and rates of station failure

Juan Fernández Islands (Chile), the joint location of hydroacoustic station HA3 and infrasound station IS14. The inset shows the shore facility of HA3 and the central recording facility of IS14 before they were destroyed by a tsunami in 2010.

Radionuclide station RN27 at Papeete on the island of Tahiti (France) in the Pacific Ocean.

Upgrading work at the joint site of primary seismic station PS2 and infrasound station IS7, Warramunga, Northern Territory, Australia.

led the PTS to focus on security and alarm systems, power, grounding and lightning protection solutions, cooling techniques for detectors at radionuclide stations, wind noise reduction systems for infrasound stations and replacement of obsolete intra-array communication systems at seismic stations.

Improved security, grounding and lightning protection systems were thus designed and installed at several stations. Progress was made in identifying alternative cooling systems to improve the reliability of radionuclide stations where the detection system, in particular the cooler, is the major cause of downtime. New cooling technologies have been tested and implemented that show significantly lower failure rates than previous coolers. A new standardized data logger suitable for all manually operated radionuclide particulate stations was also developed to improve maintainability. For the beta–gamma detectors of radionuclide noble gas measurement systems, development of a method to automatically correct energy drifts was initiated to reduce the probability of wrong identification of radionuclides. The organization has also begun research into the building of detectors that are free of the 'memory effect' to increase the sensitivity of the measurement method.

There was a continuous review, evaluation and improvement of formalized engineering processes. The PTS progressed with technical drawings as well as a standardized failure analysis system for IMS stations and the establishment of a technical risk register. This register constitutes a major technical basis for the planning of recapitalization and station improvement activities.

Recognizing that the involvement of station operators in technology development is essential for knowledge sharing, capacity development and long term sustainment of the stations, a new web site devoted to engineering and development was launched. It provides access to engineering documentation, projects and products as well as a forum for technical discussions.

The PTS also enhanced its system-wide state of health (SOH) system and made it available to external users. The SOH system is an essential tool to support trend analysis with a view to taking efficient preventive actions.

Auxiliary Seismic Network

The long term operation and sustainment of auxiliary seismic stations continued to attract the attention of the Commission and its subsidiary bodies in 2011. In accordance with the Treaty, regular O&M costs of auxiliary seismic stations, including the cost of physical security, are the responsibility of the States hosting them. However, practice has shown over the years that this constitutes a significant challenge for IMS auxiliary

seismic stations that are located in developing countries and do not belong to 'parent networks' operated by those countries.

Countries hosting auxiliary seismic stations which present design deficiencies or obsolescence problems thus continued to be encouraged by the Commission to review their ability to cover the cost of upgrading and sustaining their stations. However, for several host countries, obtaining the appropriate level of technical and financial support remains challenging.

In this regard, through a Joint Action Project, the European Union (EU) continued to provide useful support for the sustainment of IMS auxiliary seismic stations that do not belong to parent networks and that are hosted by developing countries or countries in transition. This initiative includes actions to return stations to an operational state. Discussions were also initiated with other countries whose parent networks include several IMS auxiliary seismic stations to seek similar arrangements. In this regard, the United States of America in 2011 provided a voluntary contribution for improving several auxiliary seismic stations.

The combined efforts of the host countries, the EU, the USA, the station operators and the PTS have been rewarding. As a result, the data availability of auxiliary seismic stations has steadily risen since 2009.

Quality Assurance

In addition to improving performance at stations, the PTS pays great attention to ensuring a reliable IMS network. It has therefore continued to develop and perform calibration activities. Calibration plays an essential role in the verification system as it determines and monitors, by measurement or comparison against a standard, parameters needed to properly interpret signals recorded by IMS facilities.

The first full-frequency calibration was performed at 38 IMS primary seismic stations in 2011. Procedural documentation, implementation methodology, automatic reporting and analysis were developed and the assessment of results was started. In particular, the new values of calibration parameters were verified and adopted in the IMS data streams and PTS databases.

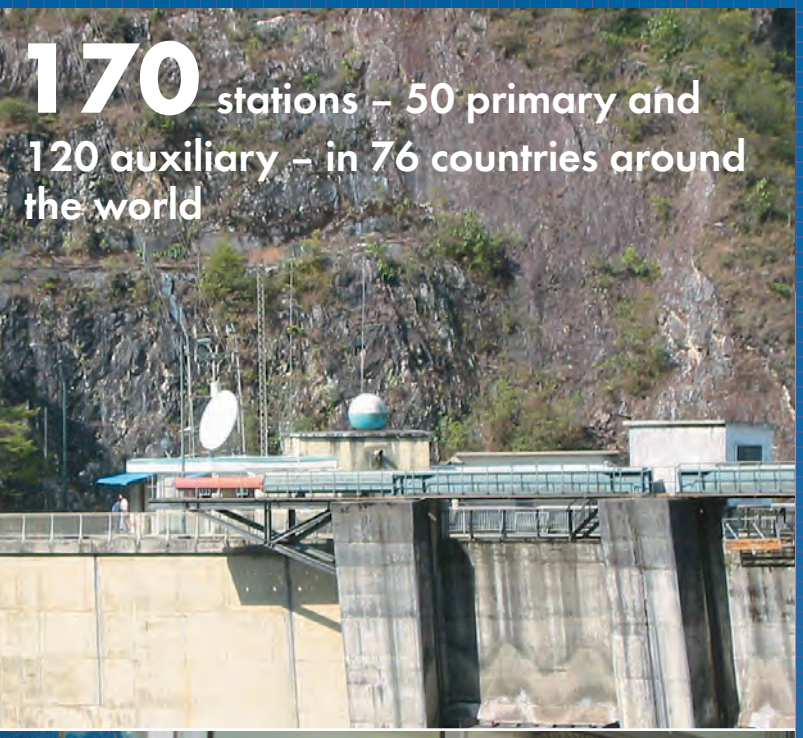
Further progress was made with the inter-comparison of sample analysis between the IMS radionuclide laboratories. The 2010 Proficiency Test Exercise, in which nine out of the ten certified IMS laboratories participated as well as the six non-certified laboratories, was finalized. The aim of the exercise was to check the quality of analytical results for integration in the quality assurance programme for IMS laboratories. All certified IMS laboratories performed successfully in the exercise. In 2011, the unexpected events at the Fukushima nuclear power plant presented an opportunity for an inter-comparison exercise among the radionuclide laboratories involving real IMS station samples. This exercise, based on two IMS station samples, was thus carried out instead of a Proficiency Test Exercise in 2011. Samples containing nuclides released in the Fukushima accident were sent to the laboratories. The samples were split and sent from laboratory to laboratory for analysis. Finally, surveillance assessments were completed at four of the laboratories.

As part of long term quality control and in order to ensure that IMS facilities continue to maintain their certification status, the PTS monitors and records the performance of stations and laboratories on a continuous basis. The certification status is reviewed and revalidated as necessary. Revalidation is necessary if any change occurs at a facility that significantly affects its system response, detection capability or data availability and data quality. In 2011, two facilities were revalidated: RL2 (Australia) and IS59 (USA).

Continued Improvement in Data Availability

The activities mentioned above contributed to increasing the overall data availability of the certified IMS stations in 2011, which has demonstrated a durable positive trend since 2009 towards the level required by the operational manuals. Over the last three years, in collaboration with the States hosting IMS facilities and local operators, a substantial increase in data availability has been achieved. In an ever growing but also ageing IMS network, activities undertaken in recent years have thus not only mitigated the effects of obsolescence in the network but also reversed the decreasing trend in data availability observed in 2008.

Profiles of the Monitoring Technologies



Seismic Station

The objective of seismic monitoring is to detect and locate underground nuclear explosions. Earthquakes and other natural events as well as anthropogenic events generate two main types of seismic wave: body waves and surface waves. The faster body waves travel through the interior of the earth while the slower surface waves travel along its surface. Both types of wave are looked at during analysis to collect specific information on a particular event.

The seismic technology is very efficient at detecting a suspected nuclear explosion as seismic waves travel fast and can be registered within minutes after the event. Data from IMS seismic stations provide information on the location of a suspected underground nuclear explosion and help identify the area for an on-site inspection.

An IMS seismic station has typically three basic parts: a seismometer to measure the ground motion, a recording system which records the data digitally with an accurate time stamp, and a communication system interface.

In the primary and auxiliary seismic networks, there are two types of seismic station: three component (3-C) stations and array stations. The primary seismic network is mostly composed of arrays (30 arrays out of 50 stations), whereas the auxiliary seismic network is mostly composed of 3-C stations (112 out of 120 stations).

A 3-C seismic station records broadband ground motion in three orthogonal directions. An IMS seismic array station generally consists of multiple short period seismometers and 3-C broadband instruments.

Primary seismic stations send continuous data in near real time to the IDC. Auxiliary seismic stations provide data on request from the IDC.

Infrasound Station

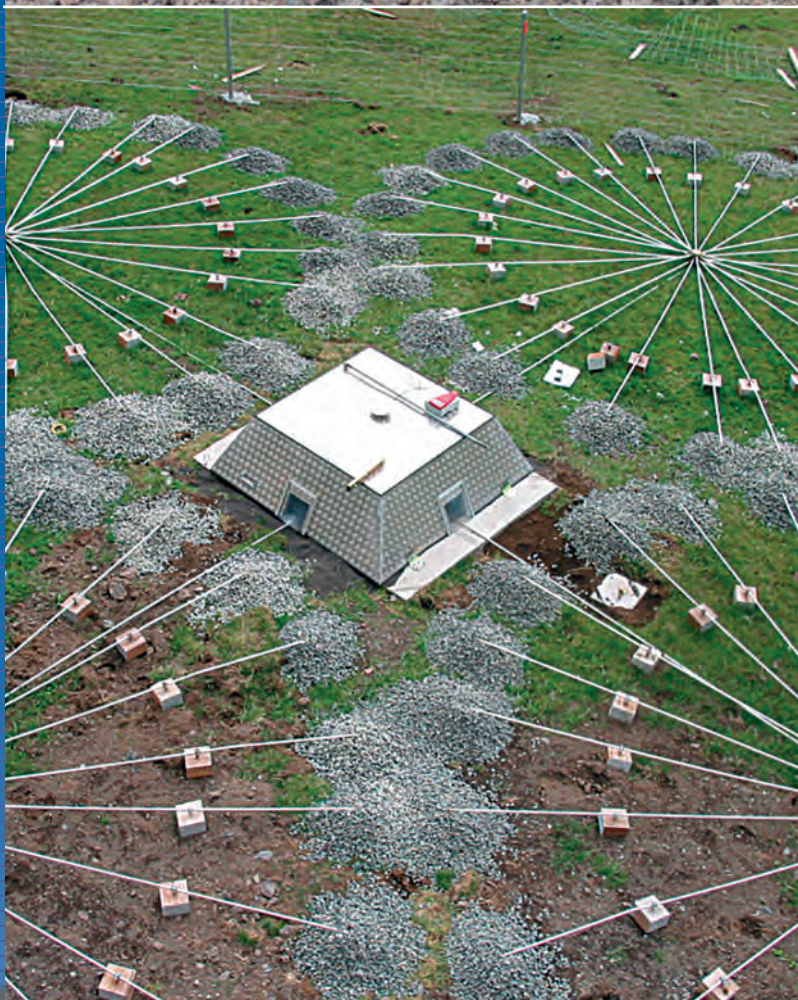
Acoustic waves with very low frequencies below the frequency band audible to the human ear are called infrasound. Infrasound is produced by a variety of natural and anthropogenic sources. Atmospheric and shallow underground nuclear explosions can generate infrasound waves that may be detected by the infrasound monitoring network of the IMS.

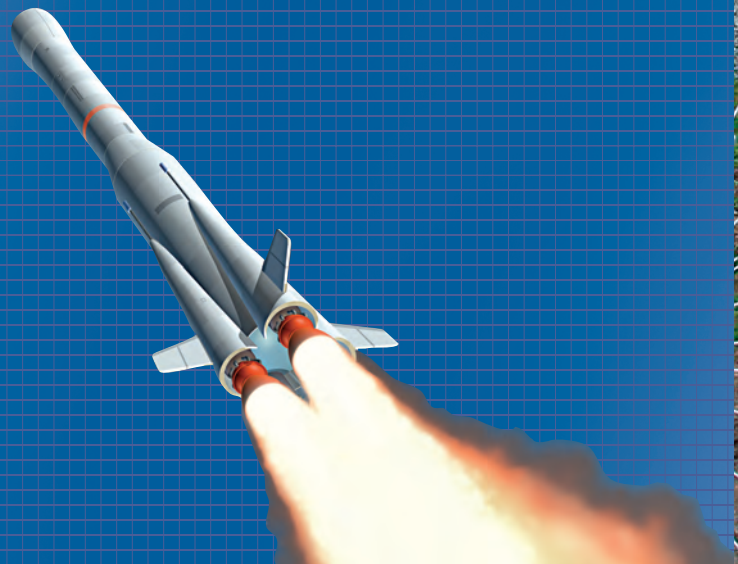
Infrasound waves cause minute changes in the atmospheric pressure which are measured by microbarometers. Infrasound has the ability to cover long distances with little dissipation, which is why infrasound monitoring is a useful technique for detecting and locating atmospheric nuclear explosions. In addition, since underground nuclear explosions also generate infrasound, the combined use of the infrasound and seismic technologies enhances the ability of the IMS to identify possible underground tests.

Although the IMS infrasound stations exist in a wide variety of environments ranging from equatorial rainforests to remote wind-swept islands and polar ice shelves, ideal sites for deploying an infrasound station are within a dense forest, where it is protected from prevailing winds, or at locations with the lowest possible background noise in order to improve signal reception.

An IMS infrasound station (or array) typically employs several infrasound array elements arranged in different geometrical patterns, a meteorological station, a system for reducing wind noise, a central processing facility and a communication system for the transmission of data.

60 stations in 34 countries around the world





Hydroacoustic Station

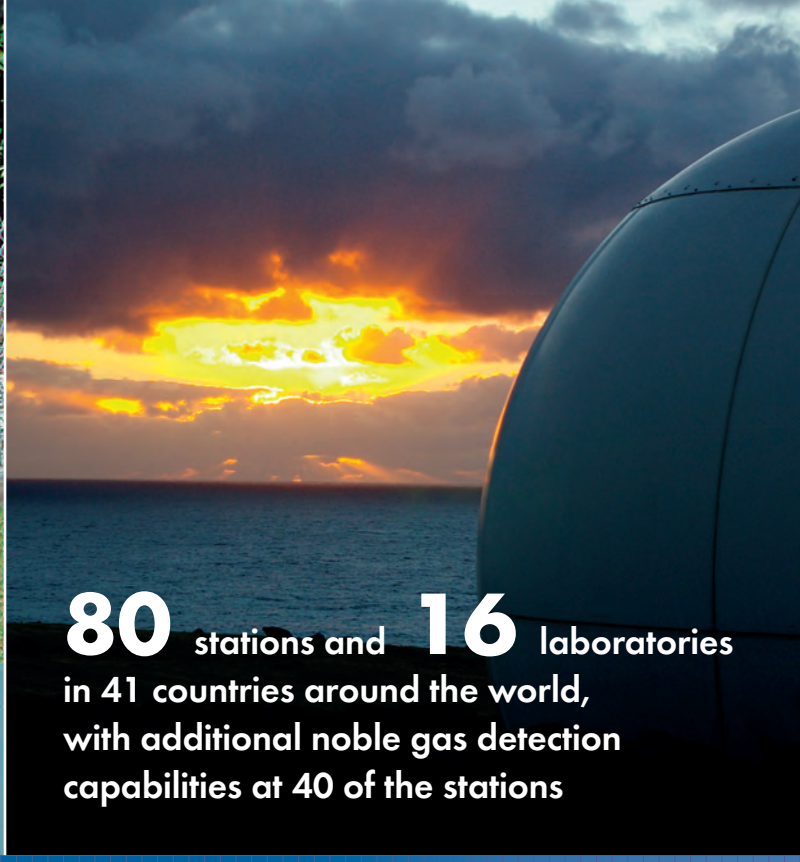
Nuclear explosions under water, in the atmosphere near the ocean surface or underground near oceanic coasts generate sound waves that can be detected by the hydroacoustic monitoring network.

Hydroacoustic monitoring involves recording signals that show changes in water pressure generated by sound waves in the water. Owing to the efficient transmission of sound through water, even comparatively small signals are readily detectable at very long distances. Thus 11 stations are sufficient to monitor most of the oceans.

There are two types of hydroacoustic station: underwater hydrophone stations and T phase stations on islands or on the coast. The hydrophone stations, involving underwater installations, are among the most challenging and most costly monitoring stations to build. The installations must be designed to function in extremely inhospitable environments, exposed to temperatures close to freezing point, huge pressures and saline corrosiveness.

The deployment of the underwater parts of a hydrophone station, i.e. placing the hydrophones and laying the cables, is a complex undertaking. It involves the hiring of ships, extensive underwater work and the use of specially designed materials and equipment.

11 stations – 6 underwater hydrophone stations and 5 T phase stations on land – in 8 countries around the world



80 stations and **16** laboratories in 41 countries around the world, with additional noble gas detection capabilities at 40 of the stations

Radionuclide Particulate Station

Radionuclide monitoring technology is complementary to the three waveform technologies employed in the CTBT verification regime. This is the only technology that is able to confirm whether an explosion detected and located by the waveform methods is indicative of a nuclear test. It provides the means to identify the 'smoking gun' whose existence would be evidence of a possible violation of the Treaty.

Radionuclide stations detect radionuclide particles in the air. Each station contains an air sampler, detection equipment, computers and a communication set-up. At the air sampler, air is forced through a filter, which retains most particles that reach it. The used filters are examined and the gamma radiation spectra resulting from this examination are sent to the IDC in Vienna for analysis.

Noble Gas Detection System

By the time of entry into force of the Treaty, 40 of the 80 IMS radionuclide stations are required by the Treaty to have, additionally, the capability to detect radioactive forms of noble gases such as xenon and argon. Therefore special detection systems have been developed and are being deployed and tested in the radionuclide monitoring network before they are integrated into routine operations. The addition of such systems strengthens the capacity of the IMS and continues the cutting-edge approach to the creation of the verification system.

The name 'noble gases' arises from the fact that these chemical elements are inert and rarely react with others. Like other elements, noble gases have various naturally occurring isotopes, some of which are unstable and emit radiation. There are also radioactive noble gas isotopes which do not occur naturally but can be produced only by

nuclear reactions. By virtue of their nuclear properties, four isotopes of the noble gas xenon are particularly relevant to the detection of nuclear explosions. Radioactive xenon from a well contained underground nuclear explosion can seep through layers of rock, escape into the atmosphere and be detected later thousands of kilometres away. (See also *International Data Centre*: "International Noble Gas Experiment".)

All of the noble gas detection systems in the IMS work in a similar way. Air is pumped into a charcoal-containing purification device where xenon is isolated. Contaminants of different kinds, such as dust, water vapour and other chemical elements, are eliminated. The resulting air contains higher concentrations of xenon, in both its stable and unstable (i.e. radioactive) forms. The radioactivity of the isolated and concentrated xenon is measured and the resulting spectrum is sent to the IDC for further analysis.

Radionuclide Laboratory

Sixteen radionuclide laboratories, each located in a different country, support the IMS network of radionuclide monitoring stations. These laboratories have an important role in corroborating the results from an IMS station, in particular to confirm the presence of fission products and/or activation products which could be indicative of a nuclear test. In addition, they contribute to the quality control of station measurements and assessment of network performance through regular analysis of routine samples from all certified IMS stations. These world class laboratories also analyse other types of PTS sample such as samples collected during a station site survey or certification.

The radionuclide laboratories are certified under rigid requirements for analysis of gamma spectra. The certification process gives an assurance that the results provided by a laboratory are accurate and valid. These laboratories also participate in Proficiency Test Exercises organized by the PTS.

Global Communications

Highlights in 2011

Continuing improvement in GCI availability

Integration into GCI II of 'legacy' virtual private network (VPN) links from the original GCI

Increase in PTS aggregated Internet bandwidth

The Global Communications Infrastructure (GCI) is designed to transport raw data from the 337 facilities of the International Monitoring System (IMS) in near real time to the International Data Centre in Vienna for processing and analysis. The GCI is also designed to distribute to States Signatories analysed data and reports relevant to verification of compliance with the Treaty.

Using a combination of satellite and terrestrial communication links, this global network enables the exchange of data by IMS facilities and States in all areas of the world with the CTBTO Preparatory Commission. The GCI is required to operate with 99.50% availability for satellite communication links and 99.95% availability for terrestrial communication links, and to provide data within seconds from transmitter to receiver. It began provisional operation in mid-1999.

Communications mast at AS26, Vranov, Czech Republic.

GCI TECHNOLOGY

IMS facilities and States Signatories in all but near polar areas of the world can exchange data via their local earth stations fitted with a very small aperture terminal (VSAT) through one of six geostationary satellites. The satellites route the transmissions to hubs on the ground and the data are then sent to the IDC by terrestrial links.

A VPN utilizes existing telecommunications networks to conduct private data transmissions. Most of the VPNs for the GCI use the basic public infrastructure of the Internet together with a variety of specialized protocols to support private and secure communications. In situations where VSATs are still not in use or not operational, VPNs provide an alternative means of communication. VPNs are also used at some sites to provide a backup redundant communication link in case of failure of a VSAT link.

At the end of 2011, the GCI included 215 VSAT stations, 312 stand-alone VPN links, 15 backup VPN links, 5 independent subnetworks (ISNs) on terrestrial links using multiprotocol label switching (MPLS), a terrestrial MPLS link for US stations located in Antarctica, 4 satellite hubs (2 in Norway and 2 in the USA), 6 satellites, a network operations centre (Maryland, USA) and a service management desk (Vienna). All of these are managed by the GCI contractor. The satellites cover the Pacific Ocean, North Pacific (Japan), North and Central America, Atlantic Ocean, Europe and Middle East, and Indian Ocean regions.

EXPANDING GLOBAL COMMUNICATIONS

In 2011, the main GCI O&M activities focused on the improvement of site infrastructure, such as replacing AC powered systems with more reliable DC powered systems. In addition, enhancements were made to the GCI core network infrastructure with the implementation of increased redundancy, to improve the reliability of connection to the GCI satellite teleports.

Following a successful increase in satellite and terrestrial capacity in 2010 of the Pacific Ocean, North and Central America, and Europe and Middle East regions, a contract was concluded in 2011 for capacity upgrades of the Atlantic Ocean and Indian Ocean regions. The upgrades will be completed in 2012. The increase was triggered by higher data volumes from upgraded IMS stations and a larger number of active National Data Centres (NDCs) requesting data and products from the IDC. The additional capacity improves the capability of the GCI to transport IMS data and IDC products in the two regions.

Three new VSATs and four new VPN links were installed in 2011. The volume of data traffic carried by the GCI and by special links to the IDC increased during the year, as did the flow of data in the other direction from the IDC to remote sites.

The PTS aggregated Internet bandwidth was increased to 100 megabits per second. Internet service providers for the PTS are now the companies COLT Telekom and KAPPER Network-Communications GmbH.

Top: **VSAT antenna at the NDC in Yaounde, Cameroon.** ***Middle:*** **VSAT antenna at H07N (part of HA7, Flores) on Corvo Island, the northernmost island of the Azores (Portugal).** ***Bottom:*** **Equipment at the satellite hub for the Indian Ocean Region, located at the Eik earth station on the south-west coast of Norway.**

Santa Paula Teleport in southern California, USA, one of the teleports providing services to the GCI. It connects to three of the six satellite regions: the Pacific Ocean, North and Central America and the North Pacific (Japan).

GCI OPERATIONS

GCI II started its fourth year of operation. Emphasis was placed on enhancing the redundancy infrastructure at teleports. The GCI contractor started a process on quality management systems with the objective of achieving ISO 9000 certification in the future. The legacy VPN links from the original GCI were also integrated into GCI II.

Improvements in incident management involving the GCI contractor and enhancements in network monitoring continued in 2011. As a result of these and other activities, the link availability of the GCI continued to show improvement.

Improvements in the network management systems were introduced in 2011, which further enhanced monitoring of ISN communication links of the core infrastructure of the GCI managed by the PTS and of PTS Internet traffic. These enhancements were integrated into the SOH system used in the IDC Operations Centre.

The PTS examined sites to find those where ageing equipment has deteriorated, necessitating investment and recapitalization of assets. These efforts will be continued in 2012.

The PTS also initiated amendments to ISN agreements and arrangements to reflect the new scale of ISN allowances that was approved by the Commission.

International Data Centre

Highlights in 2011

Response to the Fukushima nuclear power plant accident, including the daily issuance of related IDC products

Introduction of the review of noble gas data into provisional operations

Installation of a completely new radionuclide processing system for both automatic and interactive operations

The International Data Centre (IDC) is designed to collect, process, analyse and report on data received from facilities of the International Monitoring System, including the results of analyses conducted at certified radionuclide laboratories. The data and products are then made available to States Signatories for their final assessment. Data and products are received and distributed through the Global Communications Infrastructure.

The IDC is situated at the Headquarters of the CTBTO Preparatory Commission in the Vienna International Centre. A relational database management system forms the core of all information management. Full network redundancy has been created at the IDC to ensure high availability. A mass storage system provides archiving capacity for all verification data, currently covering more than 10 years. The software utilized in operating the IDC is mostly developed specifically for the CTBT verification regime.

SUPPORT AND BUILD-UP

In 2011, support and build-up of the IMS continued with the testing and evaluation of data from new stations. Seven newly installed or upgraded stations were introduced into IDC operations as part of the certification process. Other stations awaiting certification were installed in the IDC test bed.

With the installation of new radionuclide software, the routine review of noble gas data commenced in IDC operations. In early June, the first Reviewed Radionuclide Report (RRR) containing noble gas data was released. The noble gas data from certified stations continued to be reviewed by an analyst on a daily basis.

Infrasound monitoring can be used to detect and locate an atmospheric nuclear explosion. The IDC introduced routine infrasound signal analysis into operations in February 2010. The initial level of automatically detected false events and probability of detection were sufficient to allow interactive review of the infrasound results. Work continues to refine the analysis of infrasound events. On the basis of the results of technical meetings with experts, new processing methods are being tested.

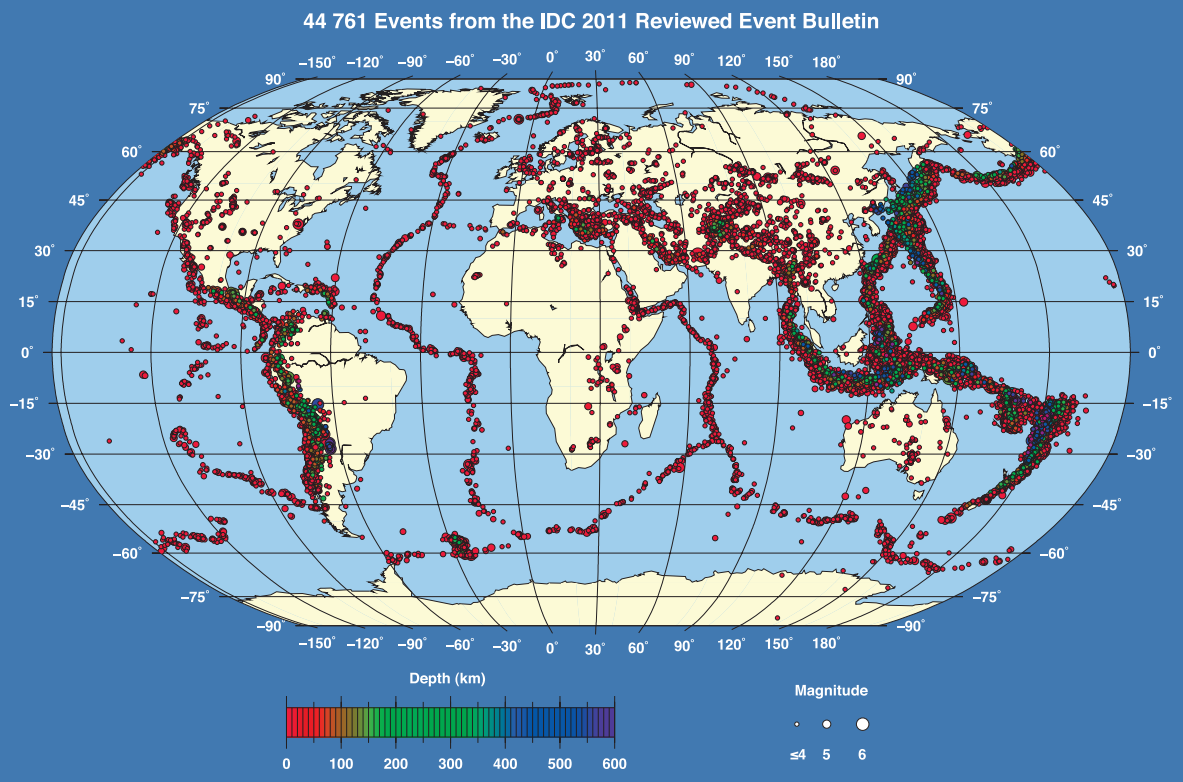
FROM RAW DATA TO FINAL PRODUCTS

The data collected by the IMS under provisional operations are processed immediately when they reach the IDC. The first automated data product, known as Standard Event List 1 (SEL1), is completed within one hour after the data have been recorded at the station. This data product lists preliminary events recorded by the primary seismic and hydroacoustic stations.

Requests are then made for data from the auxiliary seismic stations. These data, together with the data from the infrasound stations and any data arriving late, are used to produce a more complete event list, SEL2, four hours after the recording of the data. SEL2 is improved again after six hours have elapsed to incorporate any additional late-arriving data, to produce the final automated event list, SEL3.

Analysts subsequently review events recorded in SEL3 and add missed events to prepare the Reviewed Event Bulletin (REB). The REB for a given day contains all those events detected at IMS seismic, hydroacoustic and infrasound stations which meet specific criteria. During the current provisional operating mode of the IDC, the REB is targeted to be issued within 10 days. After the Treaty enters into force, it is planned to release the REB within approximately two days.

Observations from events recorded by IMS radionuclide particulate and noble gas monitoring stations typically arrive several days later than the signals from the same events recorded by the seismic, hydroacoustic and infrasound stations. Radionuclide particulate

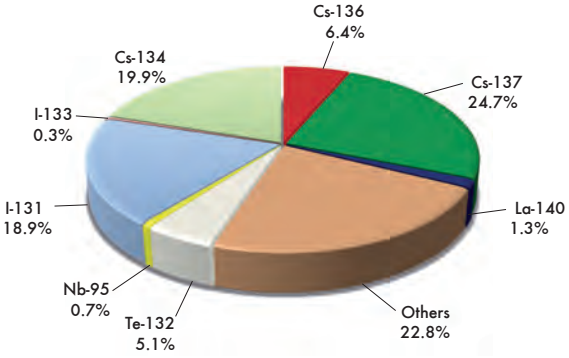


Data analysts at work in the IDC.

data undergo both automatic and reviewed processing to produce an Automatic Radionuclide Report (ARR) and then an RRR for each full gamma ray spectrum received. The information in the REB and RRR will eventually be fused, associating seismoacoustic events with radionuclide detections.

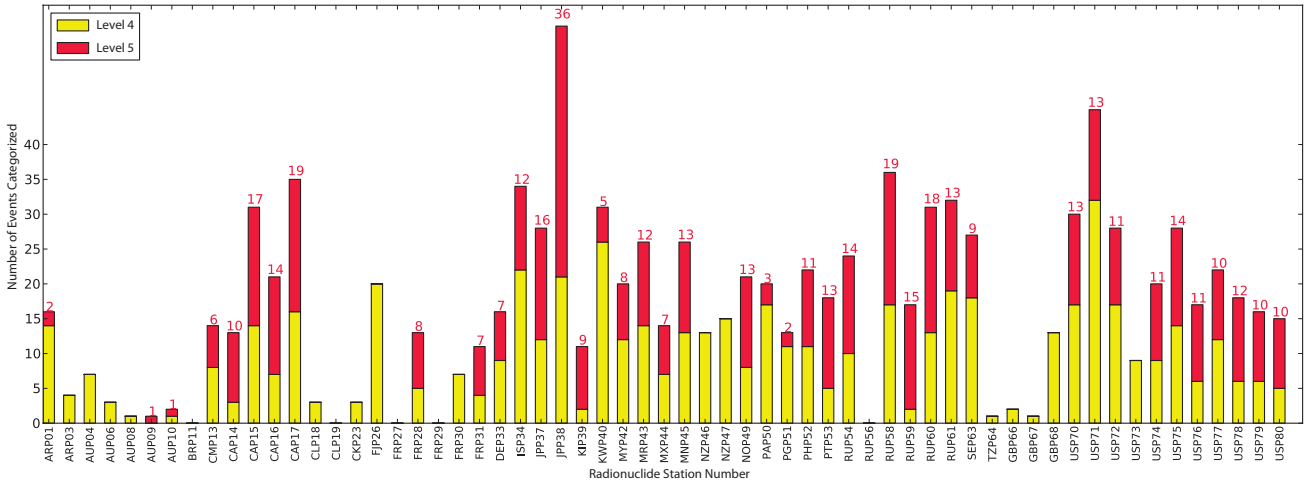
To apply new tools for the analysis of noble gas data and to optimize the overall performance of the existing gamma analysis tools, new software for the automatic and interactive processing of radionuclide data has been developed at the IDC in the past years.

The goal of this work has been to implement a new set of data processing and analysis tools for the automatic handling of data obtained from IMS stations, the automatic analysis of spectra as well as subsequent interactive procedures and, finally, the generation of ARRs and RRRs for noble gas and particulate samples, including their characterization. The complete data processing sequence for particulates and noble gas samples consists of an automatic data 'pipeline' to process data from the IMS stations and to store the data in a database, the automatic analysis of samples and the generation of ARRs, and the interactive analysis of samples and



Overall Distribution of Treaty-Relevant Radionuclide Occurrences in 2011
Most detections refer to the release from the Fukushima nuclear power plant in Japan in March 2011. The release caused more than 1600 samples to contain mostly caesium- and iodine-based radioactive fission and activation products. The nearest stations, in particular, had detections of additional fission products such as niobium-95, tellurium-132 and lanthanum-140. Other relevant radionuclide detections were typically due to cosmic radiation, resuspension of fallout from the Chernobyl accident in 1986 and historical atmospheric nuclear tests.

Level 4 and Level 5 Radionuclide Events Recorded During 2011 by IMS Stations in IDC Operations
A level 4 radionuclide particulate spectrum indicates that the sample contains an anomalously high concentration of a single anthropogenic radionuclide (fission product or activation product) which is on the standard list of relevant radionuclides. A Level 5 radionuclide particulate spectrum indicates that the sample contains multiple anthropogenic radionuclides at anomalously high concentrations, out of which at least one is a fission product.



the generation of RRRs, including sample characterization.

In June 2011, the software was moved into operations, replacing the legacy applications that were used in routine radionuclide data processing operations at the IDC. This provided the IDC with the capability to process and review noble gas data for the first time in operations.

After the data products are generated, they must be distributed in a timely way to the States Signatories. The IDC provides subscription- and Web-based access to a variety of products ranging from near real time data streams to event bulletins and from gamma ray spectra to atmospheric dispersion models.

To facilitate measurement of the global radio-xenon background, portable equipment can be deployed temporarily at various sites. *Top:* Transportable xenon laboratory developed at the Pacific Northwest National Laboratory (USA) using a SAUNA system (Sweden) (host institution: National Nuclear Energy Agency (BATAN), Jakarta, Indonesia). *Bottom:* Mobile SPALAX system (France) (host institution: Kuwait Institute for Scientific Research, Kuwait City).

OPERATIONS CENTRE

At the Operations Centre, the workflow was enhanced to include radionuclide stations. Monitoring and reporting on outages for these stations were integrated in the daily tasks of the Operations Centre. The procedure for reporting on auxiliary seismic stations was improved in order to reduce the time to report.

A test version of a Web based SOH system was released to station operators and NDCs. The system presents every 10 minutes the actual status of each IMS station, including the SOH parameters for components at the station and in the GCI link.

Over 3500 problem reports were registered and resolved. Over 1000 requests for support from NDCs and authorized users were received and addressed. The reporting system was upgraded and external users can now observe and track the status of their support requests using the performance reporting tool (PRTool) developed by the PTS.
.

NATIONAL DATA CENTRES

A National Data Centre is an organization with technical expertise in the CTBT verification technologies. Its functions may include sending IMS data to the IDC and receiving data and products from the IDC.

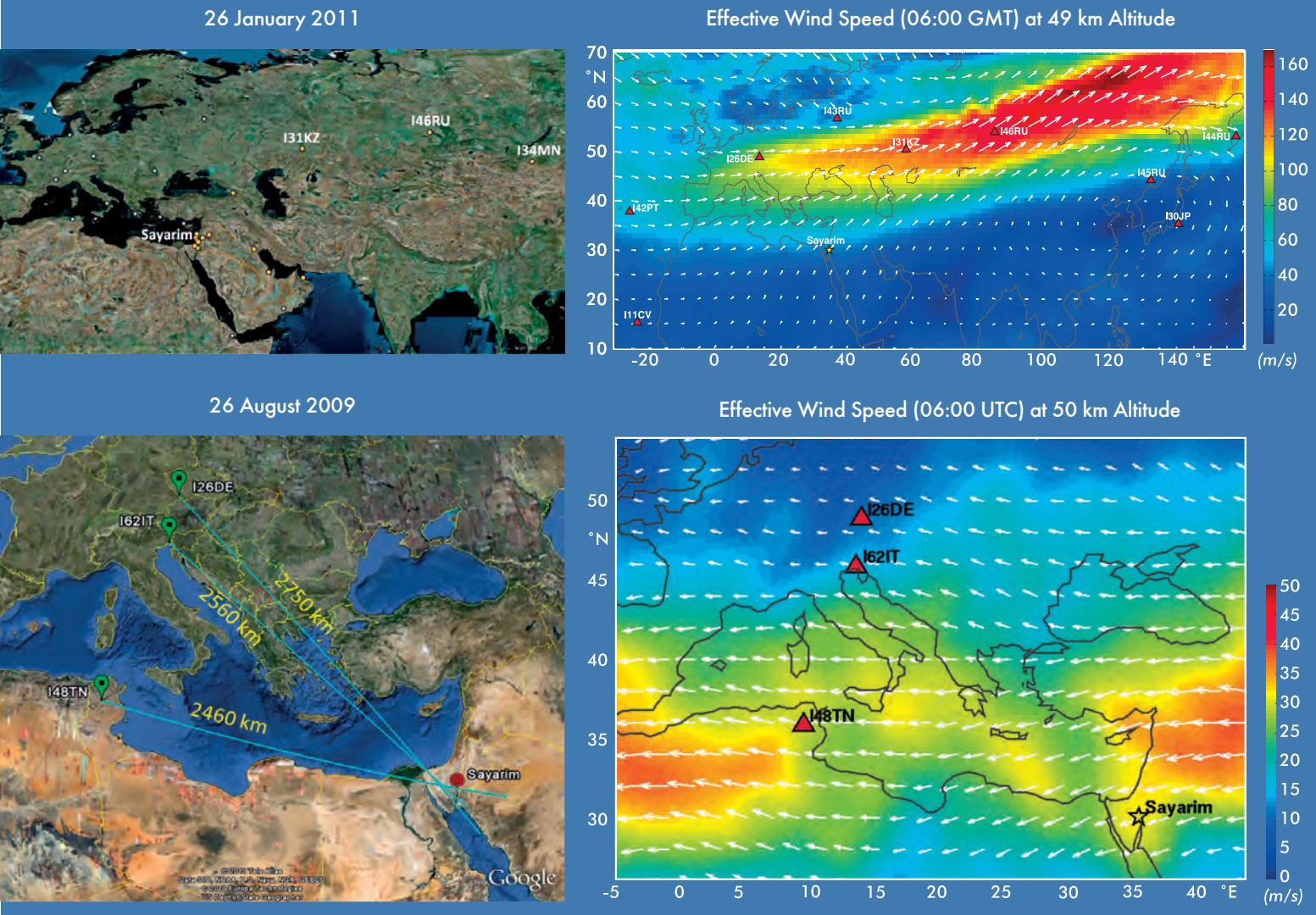
The PTS continued to provide the 'NDC in a box', a software package for use at NDCs, enabling them to receive, process and analyse IMS data. Efforts were also made to further improve the software.

A total of 114 secure signatory accounts, one for each requesting State Signatory, have been established, and 1191 users from these States Signatories have been authorized to access IMS data and IDC products and receive technical support.

INTERNATIONAL NOBLE GAS EXPERIMENT

Additional noble gas systems were transferred into IDC operations during 2011. At the end of the year, a total of 29 noble gas systems were in provisional operation at IMS radionuclide stations. Data from these stations are sent to the IDC and processed in the testing environment. Specific software to enable the monitoring of SOH parameters of these stations has been further developed.

Today the xenon background is measured by the IMS radionuclide network at 29 locations, but is still not understood in all cases. The background is variable because of medical isotope production. Medical isotope production facilities are the biggest contributor to the radioxenon background. The global network coverage for xenon-135 is poor (compared with that for other isotopes), Xenon-135 data are required in order to be able to distinguish medical isotope production from possible nuclear explosions. As more medical isotope production plants are expected to start operating, this will lead to an increased number of non-CTBT-relevant detections. Therefore the EU has funded an initiative to improve knowledge of the global xenon background.



Top left and right: Results from an infrasound calibration experiment conducted at the Sayarim Military Range in the Negev Desert, Israel, on 26 January 2011 (from a PTS presentation at S&T2011). On that date, a 100 tonne chemical explosion was detonated at the earth's surface to investigate the propagation of sound waves. *Top left:* Map showing IMS and temporary infrasound stations that detected the explosion (in yellow) and those which did not (in white). *Top right:* The predominance of detections towards the east was influenced strongly by the direction of the stratospheric winds. The results can be contrasted with those of a similar experiment on 26 August 2009 (*bottom left and right*), when the summer weather patterns favoured observations towards the west and the stratospheric winds were from the east.

The first such EU project (Joint Action Project II) had the purpose of performing noble gas background measurements for brief periods at five sites and was completed on 17 July 2009. Measurement campaigns were performed in Belgium, Germany, Kuwait, South Africa and Thailand. The outcome of this project was a substantial improvement of the radioxenon background map, a better understanding of radiopharmaceutical plants and the discovery of xenon-131m at remote places.

A new initiative funded by the EU (Joint Action Project III) was started in December 2008 to further improve knowledge of the global xenon background. The objectives of this project were to supplement knowledge on the global radioxenon background over longer and thus more representative periods at selected sites by performing measurements for at least six months, to detect local sources, if present, and to provide empirical data for validating network performance, for testing xenon equipment and logistics, for data analysis and for training of local experts.

For this purpose two mobile container based systems were purchased. The new systems were designed to be deployable anywhere in the world within a few days.

TRACKING RADIONUCLIDES THROUGH THE ATMOSPHERE

The CTBTO–WMO response system continued into its fourth year of provisional operation. This system enables the Commission to send requests for assistance in the case of suspicious radionuclide detections to nine Regional

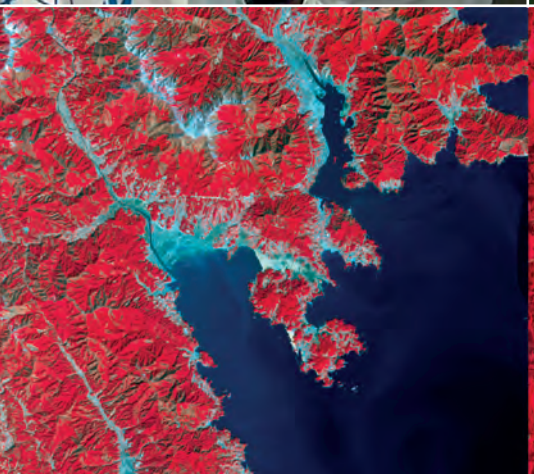
Specialized Meteorological Centres or National Meteorological Centres of the World Meteorological Organization located around the world. The centres respond to these requests by submitting their computations to the Commission with a target response time of 24 hours.

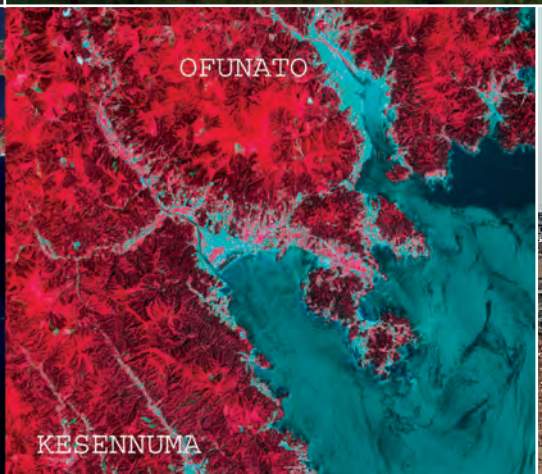
This system is intended to corroborate the backtracking calculations of the Commission, and all centres benefit from the feedback and evaluation of the backtracking systems and methods in use. To maintain the response system at a high level of preparedness, it was agreed that regular announced and/or unannounced system tests would be made.

The PTS continued to enhance its capabilities to perform atmospheric transport modelling (ATM) and to reliably deliver high quality products to States Signatories. Atmospheric backtracking calculations are performed daily for each of the IMS radionuclide stations with near real time meteorological data obtained from the European Centre for Medium-Range Weather Forecasts. Using software developed by the PTS, States Signatories can combine these calculations with radionuclide detection scenarios and nuclide specific parameters to define regions in which sources of radionuclides are possibly located.

EASTERN MEDITERRANEAN INFRASOUND EXPERIMENT

An infrasound calibration experiment was conducted in January in the eastern Mediterranean region. The PTS coordinated two surface explosions of 10 and 100 t along with temporary infrasound sensor deployments throughout the region to observe the signals over a wide range of distances. Collaborators from 20 States Signatories deployed





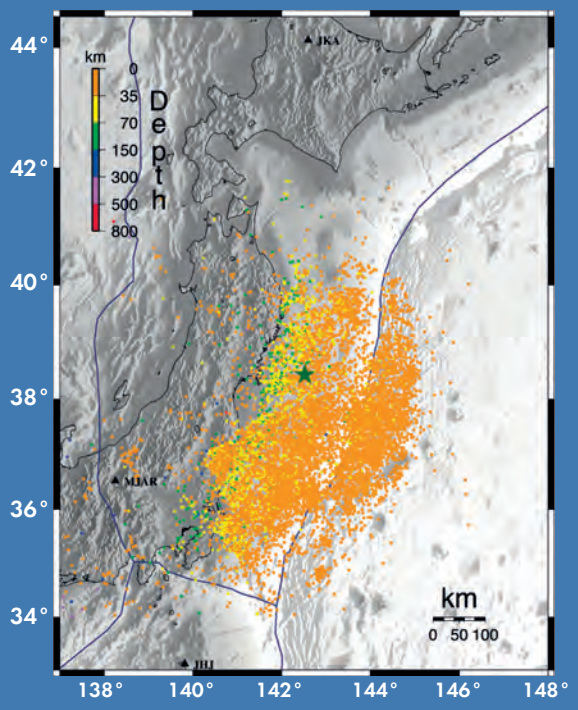
temporary sensors at sites in 13 countries. The meteorological conditions for the larger explosion favoured enhanced propagation to the north-east and signals were detected at three IMS infrasound stations as far as 6400 km from the explosion source.

FUKUSHIMA NUCLEAR ACCIDENT AND ITS IMPLICATIONS

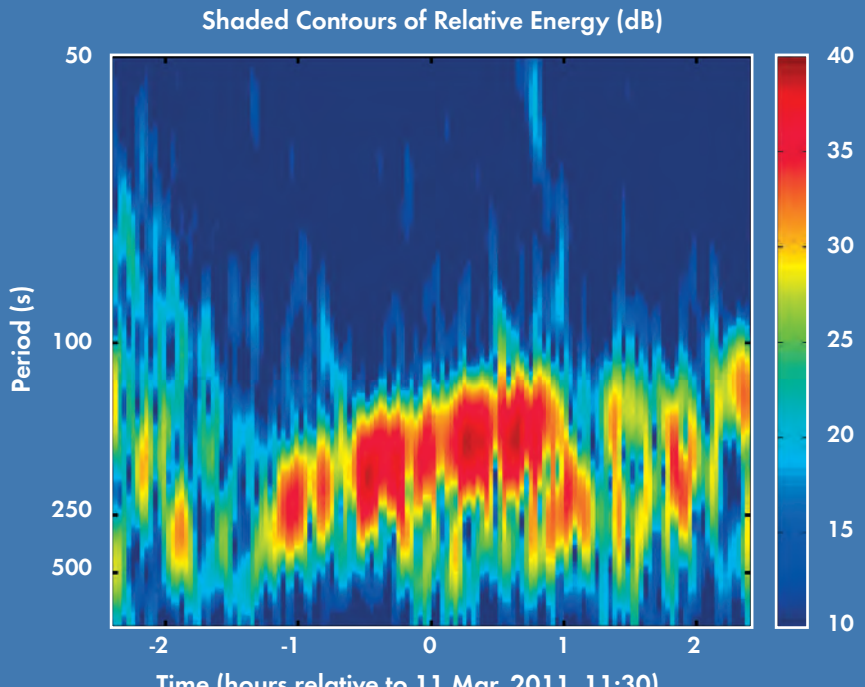
The Tohoku earthquake, the associated tsunami and the subsequent nuclear accident in Fukushima resulted in a demanding 'stress test' for the entire CTBT verification system: data gathering, data processing, data distribution and provision of assistance to States Signatories. Interest in the CTBTO data and products was extensive and the PTS made strong efforts to respond to the international community. The IMS radionuclide system provided global coverage of the release of both radioactive noble gases and radionuclide particulates. Exceptional measures were taken to ensure the collection, analysis and assessment by PTS radionuclide experts of the samples gathered globally, to report findings in a timely manner to States Signatories and to enhance cooperation with other international organizations.

The Commission does not operate 24 hours a day, 7 days a week under its current 'provisional operations', yet staff made a major effort to manage the workload. The event had a long duration and it required especially extensive review of data by IDC staff. Daily data analysis and information review were performed for several weeks to monitor the situation.

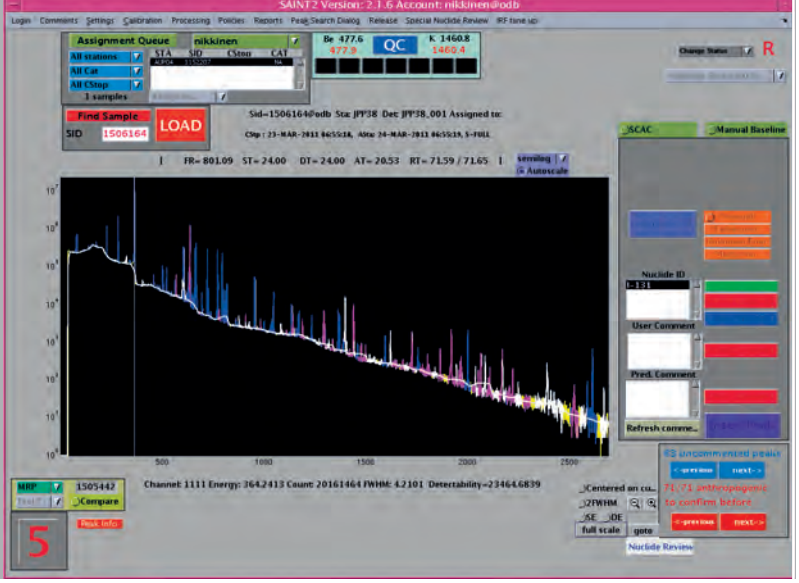
The raw data were analysed as soon as they arrived. Seismic aftershocks and radionuclide detections continued for three months after the accident. Approximately ten thousand aftershocks were detected from the



Map showing the location of the Tohoku earthquake near the east coast of Honshu (Japan) on 11 March 2011 (star) and the REB events located in the region for the three month period following the earthquake, with symbols colour coded according to calculated depth. Also plotted are the locations of the closest IMS stations, primary seismic station PS22 (Treaty code MJAR) at Matsushiro, auxiliary seismic station AS53 (JHJ) at Hachijojima, Izu Islands, and AS54 (JKA) at Kamikawa-asahi, Hokkaido. The major tectonic plate boundaries in this region are shown in blue.



Spectrogram of signal energy as a function of time at the H11N1 hydrophone of hydroacoustic station HA11, Wake Island (USA), in the Pacific Ocean during the passage of the tsunami generated by the Tohoku earthquake. The spectrogram shows a clear tsunami signal with the dispersion of the water wave visible as a diagonal stripe of high energy, demonstrating that the long period waves arrive first, followed by the slower, shorter period waves.



Typical spectrum of a sample taken at radionuclide station RN38, Takasaki, Gunma, Japan, several days after the Fukushima accident. The complexity of such spectra imposed a considerable demand on the IDC analysts.

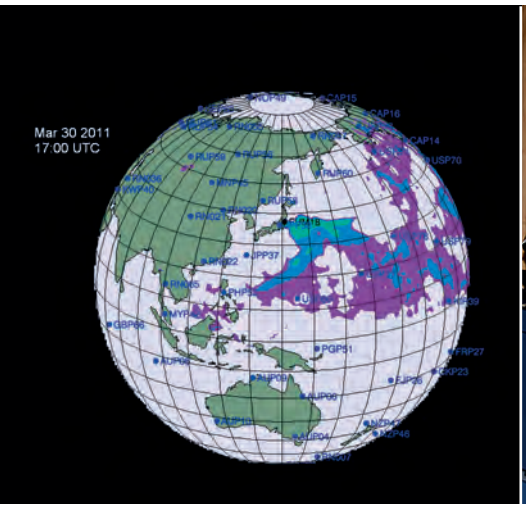
Operators verifying the installation of the detector system at RN38.

earthquake and 1600 particulate samples were affected by the radiation originating from the accident. In addition, the rupture of the main earthquake was observed in the T phase signals recorded by the IMS hydroacoustic detection systems. The infrasound detection system also registered the explosions in the Fukushima nuclear power plant. ATM played an important part in predicting when successive radionuclide stations were likely to detect released radionuclides. Overall, the detection system and analysis performed reliably during the whole observation period.

Much diagnostic information was made available through the radionuclide detections, in particular reactor temperature, fuel burnup, containment of heavier elements relative to gases and the change in the mixture of released materials owing to radioactive decay.

The event generated more than four hundred Level 5 samples (samples with multiple anthropogenic nuclides, at least one of them being a fission product) at IMS radionuclide stations. Only a subset of them was sent for analysis to prevent bottlenecks at IMS laboratories and WMO regional centres. A few samples from IMS station RN38 at Takasaki, Gunma, Japan, needed special handling at the station owing to their high activity concentration.

Throughout the Fukushima accident and its aftermath, the Commission kept States Signatories abreast of the developing situation with six technical briefings, the first of which



Atmospheric transport model of dispersion of radionuclides from the Fukushima nuclear power plant. The coloured areas show the evolution of the dispersion as of 30 March 2011 at 17:00 UTC.

The Executive Secretary of the CTBTO Preparatory Commission, Tibor Tóth (*fourth from the left*), with officers of the PTS at a briefing given in March 2011 to States Signatories following the Fukushima accident.

was on 15 March 2011. Besides the formal briefings, special arrangements to keep States Signatories continuously informed included a dedicated web page with secure access, where radionuclide detections and ATM results were displayed.

At the same time, the Commission proactively informed the media and the public about its role and contribution, thus quickly becoming a reliable source of information. Hundreds of questions were responded to, either directly or by referring to information published by States Signatories and their institutions. Media coverage of the contribution of the Commission included six hundred broadcast, print and online media news items; the number of visits to the web site increased temporarily by six hundred per cent.

As recommended by the States Signatories in such briefings, in-depth cooperation also started with the International Atomic Energy Agency (IAEA) on 21 March 2011. Special assistance was given for the IAEA, the World Health Organization (WHO) and WMO with access to CTBTO data. As coordinated after the Fukushima accident, data and products of the Commission were made available to the IAEA as an authorized user.

The Commission was invited by the IAEA on 11 April to attend meetings of the Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE) as an observer. The IACRNE, which is coordinated by the IAEA, gathers representatives of the European Commission, the European Police Office, the Food and Agriculture Organization of the United Nations, the IAEA, the International Civil Aviation Organization, the International Maritime Organization, the United Nations Scientific Committee on the Effects of Atomic Radiation, the International Criminal Police Organization, the Nuclear Energy Agency of the Organisation for Economic Co operation and Development, the Pan American Health Organization, the United Nations Environment Programme, the United Nations Office for the Co-ordination of Humanitarian Affairs, the United Nations Office for Outer Space Affairs, WHO and WMO. Joint work through the IACRNE was found beneficial for all parties, and the Commission is now seeking to join as a participating member.

LESSONS LEARNED FROM THE FUKUSHIMA NUCLEAR ACCIDENT

Useful lessons could be drawn from the event for the CTBT verification system. Overall, the IMS network and the IDC analysis performed well under an enhanced workload. Taking into account that the Commission does not currently have '24/7' operation, the event highlighted the need for special arrangements to enable staff to work under temporarily enhanced levels of operation in exceptional cases.

The need for increased cooperation with other United Nations agencies and international organizations was also made clear, as well as the necessity to develop rapidly dedicated information sharing platforms and forums with States Signatories.

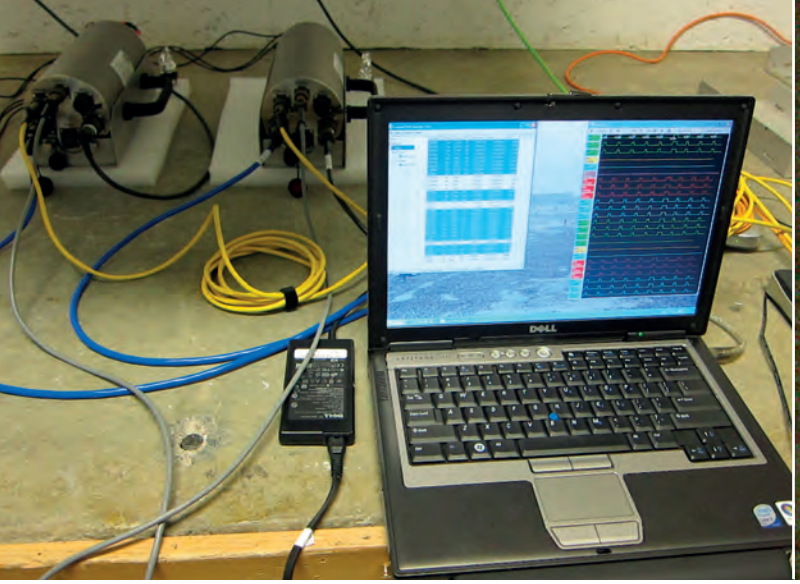
A need was identified to develop additional tools to refine calculation of the source term based on IMS detections with ATM. The high number of aftershocks also demonstrated the need to develop further seismic tools. Radionuclide concentrations measured at the Takasaki station were at levels close to or above the dynamic range of the equipment.

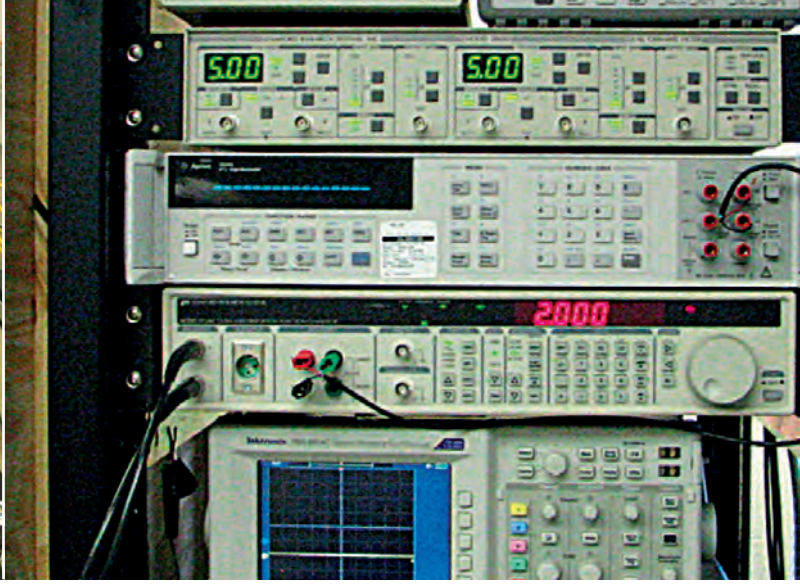
Additional measurements of dose rate and gamma radiation levels were carried out at several IMS radionuclide stations to provide essential information to support decision making, especially concerning health and safety aspects of station operation. Prevention of cross-contamination also proved to be important at the radionuclide stations. Only two systems had traces of contamination after the incident was over. IMS stations that can be accessed remotely proved to be necessary to deliver high quality data.

ENSURING TECHNOLOGICAL RELEVANCE OF THE VERIFICATION SYSTEM

Technology Foresight

The Commission is engaged in a technology foresight exercise in support of its commitment to uphold the relevance of its technology-intensive system, as well as to ensure awareness of developments in science and technology that could enhance performance and efficiency of systems and operations. It is a continuous process whereby scientists and technologists meet, interact, debate and jointly define future courses for Treaty related research and development. This involves an iterative cycle of workshops on various themes,





All equipment installed at IMS facilities must be tested to ensure that it conforms to technical specifications set by the Commission. The photographs, taken from a PTS contribution at S&T2011, show a new waveform digitizer under test at the Sandia National Laboratories in the USA.

definition of pilot projects and funding of these projects from various sources.

In 2011, the technology foresight exercise focused on identifying the scientific and technological developments that may affect future PTS operations. The aim of this phase is to deliver a medium- to long-term integrated technology forecast for the Commission. The technology foresight initiative was presented at a number of meetings, a paper describing the approach and initial results was distributed and a new web site was launched to engage the organization and the wider science and technology community in this activity. Finally, a first assessment to identify major topics and trends relevant to the CTBT technologies was released.

Engaging with the Scientific Community

Verification of compliance with the Treaty poses challenges whose resolution depends crucially on the promotion and exploitation of scientific research and technological developments. The credibility of the verification system being established by the Commission, and its ability to detect, locate and identify nuclear explosions both rely on a continuing

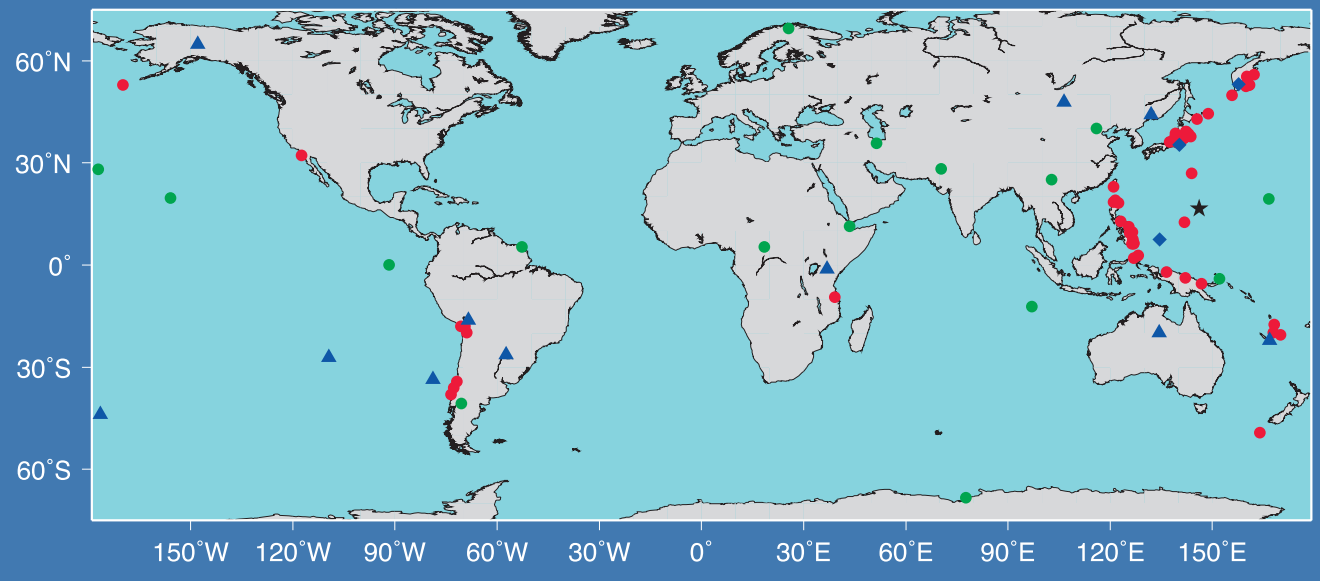
engagement with the specialist communities that drive advances in relevant instrumentation, processing and analysis methods. Recognizing the strategic importance of this, initiatives taken by the Commission such as "Synergies with Science" in 2006, "International Scientific Studies" (ISS09) in 2009 and "Science and Technology 2011" (S&T2011) have provided good opportunities for the global scientific community and the Commission to interact constructively.

The outcomes of the initiatives and scientific work presented at the ISS09 conference were compiled into two reports. The first, giving the perspective of the topic coordinators external to the PTS, is entitled "Science for Security: Verifying the Comprehensive Nuclear-Test-Ban Treaty". The second, entitled "Possible Projects for the CTBTO Arising from the International Scientific Studies Conference, 10-12 June 2009", focuses on projects which are potentially of particular relevance to the work of the PTS. Both publications are available in hard copy from the PTS and on the public web site.

The S&T2011 conference (Vienna, 8-10 June 2011) brought together around seven hundred and fifty scientists and diplomats from over one hundred countries. The conference provided scientists and scientific institutions with a good opportunity to discuss advances in science and technology relevant to nuclear test ban verification, and to explore civil and scientific applications of the CTBT verification infrastructure. It also fostered partnerships and knowledge exchange between the Commission and the broader scientific community. A publication on the scientific outcomes of the conference is in preparation.

The conference welcomed approximately three hundred oral and poster presentations by scientists worldwide, including some from non-signatory States. The presentations were organized around five themes: the earth as a complex system; understanding the nuclear explosion source; advances in sensors, networks and observational technologies; advances in computing, processing and visualization for verification applications; and creating knowledge through partnerships, training and information/communication technology. A special session, including a panel discussion, on the Tohoku earthquake, the resulting tsunami and the Fukushima accident was organized. Two additional panel discussions centred on practical means to achieve cooperation with the scientific community.

A comprehensive public information strategy was put in place for S&T2011. A dedicated web site area was created for all materials related to the conference, including the programme, abstracts, posters, presentations, video files, articles and video interviews with key scientists. Conference brochures, posters and a DVD were also produced and distributed. A capacity



The introduction of routine infrasound processing and analysis into IDC provisional operations in early 2010 has resulted in a significant number of events in the REB which include IMS observations at stations of all three waveform technologies: seismic, hydroacoustic and infrasound. The map, taken from a PTS contribution at S&T2011, shows the 62 such events during the 14 month period from February 2010 to March 2011. Red circles denote the 61 events that include T phases at hydroacoustic stations, while the black star denotes the one event with H phases. The blue triangles and diamonds show the contributing infrasound stations, with the diamonds indicating the three largest contributors: IS30 (Isumi, Japan), IS39 (Palau) and IS44 (Petropavlovsk-Kamchatskiy, Russian Federation). IMS infrasound stations not yet installed or not transmitting data to the IDC are denoted by green circles.

building seminar for journalists was held on the margins of the conference with distinguished scientists.

A project to establish a virtual Data Exploitation Centre (vDEC), initiated at the end of 2009, progressed throughout 2010 and 2011 and the platform is now well established with a growing number of scientific teams having access to hardware, archive data and a collaborative wiki. The legal framework has been put in place for scientists to access data at vDEC free of charge, and will be instrumental in allowing innovative ideas to be tested on IMS data, as well as providing scientists with access to a large continuous data set from which valuable information and insight can be gathered.

PROVISION OF DATA FOR TSUNAMI EARLY WARNING

In November 2006, the Commission endorsed a recommendation to provide continuous IMS data in real time to recognized tsunami warning organizations. The Commission subsequently entered into agreements or arrangements with a number of tsunami warning centres approved by the United Nations Educational, Scientific and Cultural Organization to provide data for tsunami warning purposes. In 2011, agreements were finalized with the tsunami warning organizations in Malaysia and Turkey. This brought to 10 the number of such agreements or arrangements that the Commission has entered into: with Australia, France, Indonesia, Japan, Malaysia, the Philippines, Thailand, Turkey and the USA (Alaska and Hawaii). Additional agreements or arrangements were being developed with Chile and Sri Lanka.

Conducting On-Site Inspections

Highlights in 2011

Project oriented approach to accomplishing the OSI action plan

Start of the preparation for the next Integrated Field Exercise (IFE) in 2014 and the preceding build-up exercises

Continuation of the second training cycle for surrogate inspectors

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.

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 (and its adjustment from 2011) 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 finally procedures and documentation.

During 2011, a total of 30 sub-projects were being implemented. By the end of 2011, 17 sub-projects were completed, 2 more than planned. Financial and human resource constraints in 2011 presented a major challenge to the implementation of the action plan.

2014 INTEGRATED FIELD EXERCISE

In 2011, the concept for the preparation and conduct of the next IFE, including its budgetary requirement, was approved. This detailed concept foresees the conduct of three build-up exercises during 2012-2013 and the conduct of the IFE in 2014. The build-up exercises will be closely coordinated with the pace of implementation of the OSI action plan projects and will systematically cover important aspects related to the different phases of an OSI (launch, pre-inspection, inspection and post-inspection).

In-depth planning and preparation started for the first build-up exercise, which is to take place in April 2012. As part of these efforts, the exercise planning team has defined the scope of the exercise and aspects to be tested. It has also prepared the scenario, identified personnel for the exercise and made the necessary infrastructure arrangements at the Equipment Storage and Maintenance Facility (ESMF), where the exercise will take place.

A project initiation document was prepared for the whole IFE project. It will serve also as the basis for the process of selecting the host country. This process was initiated with a request to States Signatories for nominations. By the deadline for receipt of nominations, three countries had made offers to host the IFE. In parallel with this process, a request for the long term provision of inspection equipment as contributions in kind was sent to States Signatories. Six States Signatories, China, the Czech Republic, France, Hungary, the United Kingdom and the USA, have responded with offers.

POLICY PLANNING AND OPERATIONS

In 2011, the PTS incorporated the lessons of the 2010 OSI directed exercise (DE10) in relevant operating procedures for ground based visual observation and communications. A Technical Report and educational video material on DE10 were also produced and distributed.

The inspection team functionality (ITF) project progressed considerably in 2011. An information based search logic and methodology for inspection team activities were fully developed and tested. Among the key aspects covered were reporting and communication structures within the inspection team and the concept of reconnaissance and hypothesis testing missions. The methodology was tested during the field exercise in the advanced course of the second training cycle for OSI inspectors, and presented at the S&T2011 conference. The entire product was presented and practised at an expert meeting held between 17 and 20 October at the ESMF. The information based search logic was tested in a tabletop exercise during three different moments in the inspection time line. Many lessons were collected for refinement of the methodology. The lessons learned have been reviewed and a plan has been developed to address them through modifications to the methodology and/or through carefully designed training.

In the framework of the ITF project, three expert meetings funded by the EU under Joint Action Project IV and focusing on techniques not yet developed for OSI purposes were conducted. The first meeting was devoted to multispectral including infrared (MSIR) imaging and was held in Rome from 30 March to 1 April with the support of the Italian National Institute for Geophysics and Volcanology. Fourteen invited experts from eight States Signatories along with PTS staff participated. The meeting had as its major objective the development of MSIR imagery techniques in the framework of an OSI, including operational (search logic and methodology), technical (equipment and data analysis and interpretation) and human resource aspects, as well as development of relevant text for the draft OSI Operational Manual. Many points of consensus in all these areas were identified. Some of them will have a

strong impact on the way in which MSIR techniques will be developed in the OSI framework.

The second EU funded expert meeting dealt with active seismic techniques for OSI. The meeting was conducted in Vienna from 30 May to 1 June. Eleven experts from eight States Signatories along with PTS staff participated. The participants identified several key points related to, inter alia, equipment, methodology and training, and a proposal was made on development of active seismic monitoring before the next IFE.

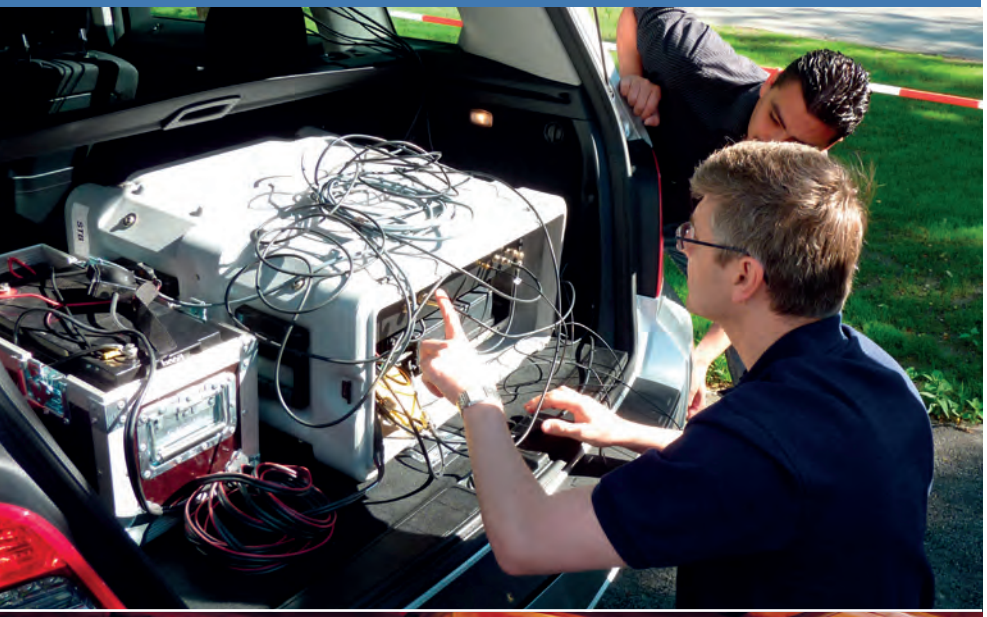
The third EU funded expert meeting, focusing on drilling, was held in Edinburgh, United Kingdom, between 9 and 11 November, and hosted by the Arms Control and Disarmament Research Unit of the Foreign and Commonwealth Office. Fifteen participants from five States Signatories along with PTS staff participated. The sessions were devoted to drilling objectives, how to implement drilling for an OSI, tailoring of commercial drilling equipment for OSI purposes, radiation protection during drilling and the role of the inspection team during the conduct of drilling.

A one day expert meeting on the OSI radionuclide laboratory was held at the ESMF on 28 October. The sessions covered the overall concept and function of the radionuclide laboratory and discussed the kinds and quantities of samples, how to process them, the laboratory equipment, the number of inspectors required to operate the equipment and the approach to quality assurance/ quality control.

With respect to work on the field information management system (FIMS), an expert group meeting on the geographical information system (GIS) took place from 26 to 30 September at the ESMF. A total of 19 experts (both external and PTS staff) participated. The purpose of the meeting was, inter alia, to evaluate the technical performance of the new custom designed FIMS workstation and the process for FIMS operation during an OSI in accordance with the draft standard operating procedures (SOPs), as well as to learn about the experiences of other organizations or entities that use a GIS or FIMS in the field.

Comprehensive testing and further development of the Integrated Information Management System (IIMS) were conducted in the ESMF following an IIMS tabletop exercise that took place in 2010. In light of the needs of the inspection team during its routine activities, suggested changes have been planned for the data receiving and working areas. The IIMS set-up in the ESMF was used during tabletop exercises in initial tests of data throughput.

Participants in the expert meeting on drilling, Edinburgh, United Kingdom, November 2011.



Top: PTS staff at an expert group meeting on OSI communications, Baden, Austria, May–June 2011. *Middle:* Participants at OSI Workshop-19, Baden, Austria, May 2011. *Bottom:* Specially designed containers of the Intermodal Rapid Deployment System at the Equipment Storage and Maintenance Facility.

The main focus of the work on OSI communication in 2011 was to implement the recommendation of DE10 and to continue the development of communication technologies. As part of this development and assessment of the current customized system, an expert group meeting on communications was conducted from 30 May to 3 June in Baden, Austria. A total of 16 experts participated to evaluate the performance of the modified and improved communications equipment that was tested during DE10. The experts provided input to the development of a concept of operations for OSI communications, discussed communications related aspects relevant to the training of inspectors and exchanged views on possible risk mitigation options in the event of interference affecting the system. Furthermore, and as a result of the expert group meeting, PTS staff were invited to observe Combined Endeavor 2011, the world's largest communications exercise, which took place in September in Grafenwöhr, Germany, to gain first-hand knowledge of recent developments in communications equipment and to identify operational aspects relevant for OSI communications.

With reference to the development of operational procedures for the launch phase of an OSI, a number of coordination meetings were held in the PTS. As a result, a framework for PTS-wide cooperation was developed. The framework includes technical issues related to the exchange of data and products and data requirements before, during and after an OSI. Furthermore, a list of possible inputs from national technical means in the pre-inspection phase and an initial list of information and data required by

the inspection team for preparing the initial inspection plan were drafted. Flow charts and checklists describing tasks, processes and roles in the Operations Support Centre (OSC) were also developed.

OPERATIONS SUPPORT AND LOGISTICS

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. Developments in 2011 focused on completion of the system engineering and synergies of the ESMF, the infrastructure of the provisional OSC, the Intermodal Rapid Deployment System (IMRDS), the health and safety concept, the OSI databank and the base of operations.

The ESMF, functioning as a multipurpose facility for supporting training, testing and exercises as well as for the original purpose of storage, maintenance and calibration, was opened on 30 March 2011 in Guntramsdorf, south of Vienna. All the OSI related equipment has been moved to the facility and the installation of specific features and fine tuning are continuing. The facility has been regularly hosting and supporting training courses, tabletop exercises, expert meetings, equipment demonstrations and technical visits by delegations from States Signatories. It is also being equipped to house the 'test version' of the OSC prior to the first build-up exercise in 2012.

Special emphasis was given to the development of the OSI databank project as an important pillar of operations support. The databank is aimed to be a highly adaptable OSI support solution capable of facilitating the initial planning and preparation for an inspection as well as of supporting the inspection team once in the field. The design of the expected system was finished in 2011 and the practical development was begun.

All 30 IMRDS containers tailored specifically to OSI requirements have been delivered and placed in the ESMF. A packing and unloading test took place for different scenarios. The first field test for the system was performed during the advanced course of the second training cycle. The test included packing, loading, unloading, transportation and field use.

The layout and infrastructure requirements for the base of operations were further refined. The undertaking benefited from lessons learned from the 2008 IFE, field training and equipment test activities, as well as from in-house testing to factor in climatic, topographical, cultural and geopolitical issues.

In 2011, the PTS completed the review and update of the OSI health and safety regime. It concluded the revision of standards on radiation protection, aviation safety and physical and mental fitness, as well as a guide on health and safety for the inspection team leadership and SOPs for radiation protection.

TECHNIQUES AND EQUIPMENT

During 2011, the development of techniques and equipment focused on noble gas detection techniques, MSIR imaging technologies and the refinement of techniques for subsoil gas sampling. As a contribution to the concerted ramp-up activities for the 2014 IFE, the process of revising existing SOPs was initiated.

Within EU Joint Action Project IV, the implementation of the development plan for an OSI specific model of a noble gas detection system gained momentum. The development plan entails prototype testing, training and finally the roll-out of the equipment after a contract duration of 30 months.

One high resolution germanium spectrometer was delivered to the PTS and passed the acceptance test for inclusion in the set of OSI radionuclide equipment.

With respect to MSIR imaging, a field test was conducted on a military site in Hungary. The test was devoted to high resolution sampling of airborne hyperspectral, light detection and ranging (lidar) and infrared data. During the test, data from helicopter-borne imaging equipment on several OSI-relevant ground signatures (tracks, covered pits and infrared anomalies) had been collected. The test revealed clearly that data from airborne surveys will contribute significantly to the fulfilment of an OSI mandate.

While a potential strategy for subsoil noble gas sampling during an OSI was being shaped by international experts, the PTS took a lead by testing commercially available shallow augering and 'direct push' units. The field trial identified an appropriate tool to collect subsoil gases at a depth between 5 and 10 m below the surface while maintaining the necessary sampling productivity to meet the tight schedule of a

Top: Trainees in the OSI advanced course operating ground penetrating radar equipment. *Middle:* Field trial of augering equipment. *Bottom:* Preparation of imaging equipment for installation in a helicopter prior to field testing in Hungary.

potential OSI. In addition, valuable experience was gained concerning the technical means and methods required to keep the subsoil sampling spots productive over a longer sampling period and to secure the necessary subsoil gas yields.

A basic mechanical workshop and maintenance laboratory were put into operation at the ESMF. As a consequence, core equipment provided for field exercises and training courses has a higher operational readiness. In addition, responses to requests for small services and repairs are now possible.

TRAINING

In 2011, the PTS continued its second OSI training cycle with an advanced course in which over fifty trainees participated. A major effort was invested in the development, planning, preparation and conduct of this activity, which was held from 20 June to 8 July in four different locations.

The advanced course included sessions on particular OSI techniques and training covered sub-team activities as well as synergy between the technologies of the various sub-teams. The activity finished with a training exercise replicating the conduct of a field inspection in which all trainees participated as members of an inspection team.

As part of the second training cycle, two tabletop exercises were conducted, covering technology issues and search logic for specific sub-teams. One tabletop exercise on radionuclide technology was held from 14 to 18 November, with 17 trainees from 16 States

Signatories. A second tabletop exercise together with hands-on training in geophysical techniques was held from 28 November to 2 December, involving 16 trainees from 15 States Signatories. These events not only provided further training in specific techniques, but also served well as a platform for trying out and improving newly developed concepts and procedures before field testing.

The annual OSI Introductory Course for Permanent Missions was held in Vienna from 1 to 4 February with the participation of 31 diplomats.

A new e-learning module on the use of a magnetometer was tested during the advanced course. This module is available in the PTS learning management system. Additional new modules on this platform cover overflight planning and radiation safety principles.

Towards the end of the year, a special simulation game was held during the advanced science course of the Capacity Development Initiative (see also *Outreach*) to give participants an idea of the environment in which CTBT inspectors will be working. The game was based on scenarios previously developed for training surrogate inspectors.

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.

OSI Workshop-19, entitled "Development of OSI Equipment List: Initial Period Techniques", was conducted from 16 to 20 May 2011 in Baden, Austria. A total of 53 OSI experts from 26 States Signatories as well as PTS staff attended. The participants were divided into six groups organized by technology. The primary focus was on the development of the equipment lists (including equipment specifications) for the following technologies: video and still photography, the Seismic Aftershock Monitoring System, radionuclide noble gas sampling and measurements, position finding and visual observation, MSIR monitoring, and rapid gamma radiation survey, radionuclide sampling and high resolution gamma radiation measurements. A new draft OSI equipment list for initial period techniques was produced as a result of this workshop.

Given the advanced level of the definition of the list of equipment for video and still photography developed at the workshop, the list was transmitted to the Commission, which adopted a decision on its inclusion in the draft list of equipment for use during OSIs.

The OSI document management system was updated to include revised documentation. Preparations started for the conversion of the system to an 'e-library'.

Capacity Building

Highlights in 2011

Development of country profiles and analyses for use in capacity building and training efforts for all geographical regions

Further development and use of e-learning modules as prerequisites for NDC training events

Installation of capacity building systems at six NDCs

The CTBTO Preparatory Commission offers States Signatories training courses and workshops in technologies associated with the International Monitoring System (IMS), the International Data Centre (IDC) and on-site inspection, thereby assisting in the strengthening of national scientific capabilities in related areas. In some cases, equipment is provided to National Data Centres to increase their capacity to participate actively in the verification regime by accessing and analysing IMS data and IDC products. Such capacity building serves to enhance the technical capabilities of States Signatories throughout the globe, as well as those of the Commission. As technologies expand and improve, so too do the knowledge and experience of designated personnel. Training courses are held at the Headquarters of the Commission, as well as in numerous external locations, often with the assistance of hosting States. The European Union also continues to contribute to the capacity building programme of the Commission.

CAPACITY BUILDING PHASES

The capacity building programme of the Commission for States Signatories includes training courses and workshops, equipment donations and technical follow-up visits. The programme, which continues to be supported by contributions from the EU, consists of various phases:

- Development of country profiles for all States Signatories
- Provision of a regional NDC development workshop
- Provision of a two week training course for NDC technical staff
- Provision of one or more experts
- Provision of basic NDC computer equipment.

The programme has been considerably enhanced with e-learning, which is being used on a routine basis and as a prerequisite for all training events for NDC technical staff, station operators and OSI inspectors.

COUNTRY PROFILES

A standard country profile for all States Signatories has been developed. This profile contains the information available at the PTS regarding the number of authorized users that the State has, the use of IMS data and IDC products, and participation in previous training events. The profiles serve as a reference before and during events and meetings with States.

NDC DEVELOPMENT WORKSHOPS

Two NDC development workshops for African countries were conducted in 2011: in Ouagadougou, Burkina Faso (36 participants), and in Vienna (12 participants). Their purpose was to promote understanding of the Treaty and the work of the Commission and to enhance national capabilities of States Signatories in the implementation of the Treaty. They also provided a forum to promote the exchange of experience and expertise in the establishment, operation and management of an NDC, and to promote the application of verification data for civil and scientific purposes.

The workshops included presentations from the Commission emphasizing the information needed to build and sustain NDCs, and from representatives of NDCs in all stages of development. They also provided opportunities to collect additional information for the country profiles.

TRAINING NDC TECHNICAL STAFF

Following the NDC development workshops, a Regional Training Course on NDC Capacity Building: Access and Analysis of IMS Waveform Data and IDC Products was held in Accra, Ghana, from 17 November to 2 December for 27 NDC technical staff members from African countries. During the course, participants were trained in accessing IMS data and IDC products, downloading and installing the 'NDC in a box' software and analysing data.

NDC TECHNICAL VISITS

Following an advanced training course, a consultant is provided to the recipient country to assess how the participants are making use of what was learned at the course. The objective is to ensure that the trainees can routinely use data and products of the Commission. Specific needs and interests are also addressed during this visit.

NDC CAPACITY BUILDING EQUIPMENT

As part of the capacity building strategy of the Commission, several sets of equipment necessary for establishing an adequate technical infrastructure at NDCs were purchased by means of the Regular Budget and Joint Action Projects III and IV of the EU. The equipment has been delivered and installed at six NDCs and several more deliveries are planned for early 2012. The equipment, provided as part of the technical assistance given to States Signatories to establish or strengthen their NDCs, enhances the capacity of an NDC to participate in the verification regime and to develop civil and scientific applications in accordance with national needs.

TRAINING STATION OPERATORS

A diverse range of training events for station operators and NDC technical staff was provided in 2011. A total of 94 station operators benefited from nine courses, largely on the use and maintenance of equipment, but also covering procedures related to reporting and communication with the PTS.

WORKSHOPS ON MONITORING TECHNOLOGIES

Infrasound Technical Workshop 2011 was organized by the Commission jointly with the Jordanian Seismological Observatory of the Natural Resources Authority and held in Jordan at a location near the Dead Sea from 30 October to 4 November. This international forum discussed recent advances in infrasound research and operational capabilities of global and regional networks. The topics covered during the workshop included infrasound instrumentation, modelling, data processing, network detection capabilities, analysis of infrasound sources, the 2011 eastern Mediterranean experiment and infrasound station performance. The workshop also hosted an expert group meeting, funded by the EU, to facilitate a discussion among infrasound experts on three issues critical for the CTBT verification regime: wind noise reduction systems, on-site calibration techniques and performance assessment of infrasound stations.

The Nuclear Regulatory Authority of Indonesia hosted the 2011 International Noble Gas Experiment Workshop in Yogyakarta from 6 to 10 December with the support of the Commission and the EU. A total of 78 experts from around the globe in the field of noble gas monitoring attended the workshop. Research results, operational experience and information on procedures were exchanged and recommendations formulated on the following topics: science and technology, data analysis, the background xenon level, categorization, lessons learned from the Fukushima accident, operation and failure analysis, OSI, and laboratory quality assurance/ quality control with respect to noble gas monitoring.

Top: **Installation of capacity building equipment during a mission to Port-au-Prince, Haiti, September 2011.** ***Middle:*** **Participants in a training course at the NDC in Algiers, Algeria, November 2011.** ***Bottom:*** **Participants in a training course at the NDC in Accra, Ghana, November-December 2011.**

Top: **Participants of Infrasound Technical Workshop 2011, held in Jordan, October–November 2011.** ***Bottom:*** **On the occasion of the 10th anniversary of the establishment of IMS radionuclide laboratory RL3 in Seibersdorf, Austria, Informal Radionuclide Laboratory Workshop 2011 was held in Vienna. The opening ceremony on 24 October 2011, which included celebration of the anniversary, was hosted by the Austrian Federal Ministry for European and International Affairs. Pictured at the opening ceremony are (*from left to right*) Michael Spindelegger, Austrian Vice-Chancellor and Federal Minister for European and International Affairs, Martina Schwaiger, Managing Director of Seibersdorf Laboratories, and Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission.** (Courtesy of Seibersdorf Laboratories)

Informal Radionuclide Laboratory Workshop 2011, which was held from 24 to 27 October in Vienna, was organized jointly with Seibersdorf Laboratories, Austria. A total of 36 participants from 16 countries presented and discussed advances in the set-up, operation and further improvement of IMS radionuclide laboratories. The main topics of the workshop were laboratory operations, Proficiency Test Exercises, laboratory techniques, surveillance assessment and certification, and noble gas measurements by laboratories.

E-LEARNING

The e-learning system, which was put into preliminary operation at the end of 2009, increased in use throughout 2011. The development of e-learning modules with support from the EU continued and with the available funds it was possible to expand the number of courses from that originally planned.

This e-learning system is being used for the training of NDC technical staff, station operators and OSI inspectors. The modules are made available for authorized users, station operators, OSI inspectors and PTS staff.

Improving Performance and Efficiency

Highlights in 2011

Enhancement of the PTS performance reporting tool and creation of a radionuclide concentrations tool

Further development and consolidation of procedures related to the QMS

Feedback from users of data, products and services during the NDC Evaluation Workshop in Bucharest

Throughout the process of establishing the verification system, the Provisional Technical Secretariat of the CTBTO Preparatory Commission aims for effectiveness, efficiency and continual improvement through the implementation of its Quality Management System (QMS). This system is focused on customers, such as States Signatories and National Data Centres, and aims at fulfilling the responsibilities of the Commission in establishing the CTBT verification regime in compliance with the requirements set forth in the Treaty, its Protocol and relevant documents of the Commission.

DEVELOPING THE QUALITY MANAGEMENT SYSTEM

The main purpose of the QMS is to ensure the continuous provision of high quality products and services. The QMS is a 'living system' that can be adjusted, in keeping with the emphasis placed by the organization on customers and continual improvement.

As part of the ongoing work to consolidate QMS procedures, efforts focused on developing and testing the procedure for coding and controlling QMS related documents as well as the workflow of the QMS document management system. Manuals, policies, quality plans, records, reports, specifications, SOPs and work instructions prepared by the PTS will all be organized within this system.

In line with a recommendation made by the 2010 Quality Management Workshop, the glossary of verification related terms was updated.

Process Metrics Manual and Performance Reporting Tool

One of the functions of the QMS is to identify and put into effect key performance indicators (KPIs) for evaluating PTS processes and products, thus facilitating management review and continual improvement. KPIs are parameters used to quantify the performance of the processes of an organization. They are primarily employed to assess the progress in reaching objectives and to supply quantitative information for prescribing a course of action. The aim of the QMS is to support the objective of consistently meeting verification system requirements.

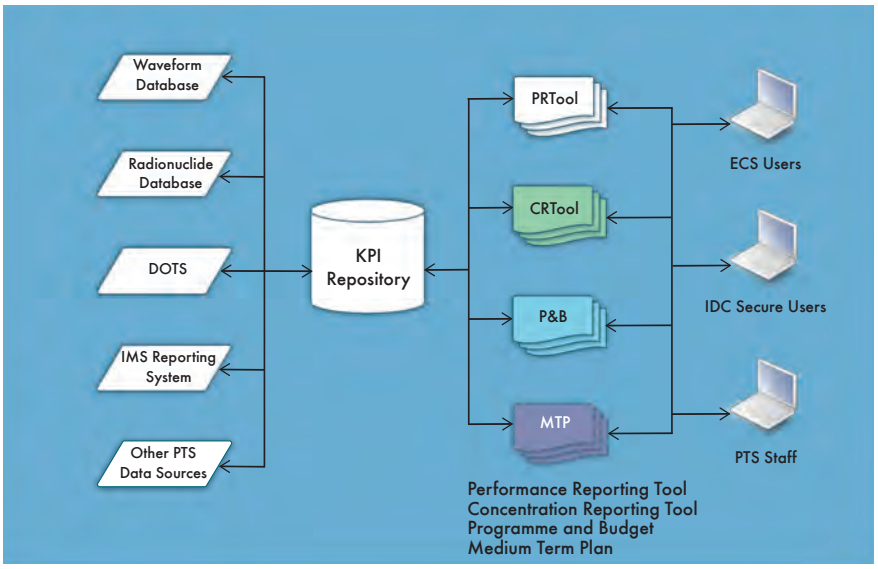


Diagram of the architecture of the performance reporting tool (PRTool).

It encompasses all contributing PTS processes and work products.

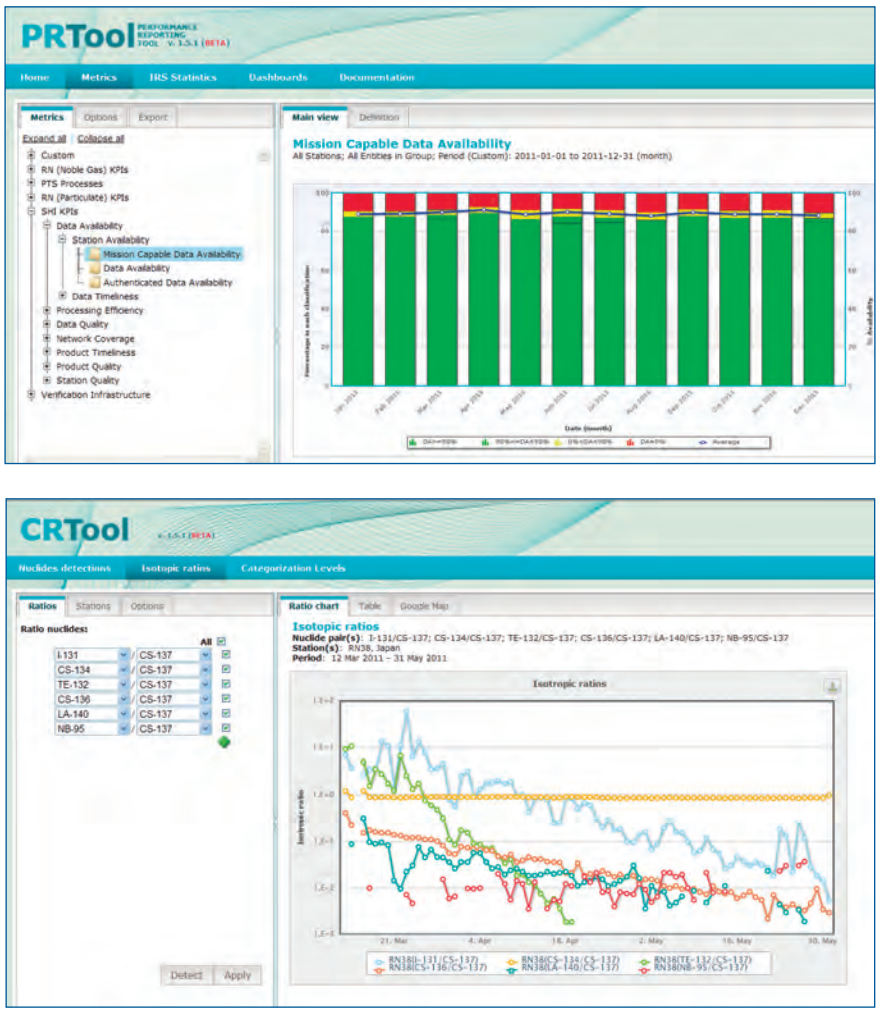
The PTS Process Metrics Manual was compiled on the basis of the definitions of the KPIs contained in the draft IMS and IDC Operational Manuals and was issued. In addition, a test version of PRTool, comprising a Web platform to display information on performance for most of the KPIs and their trends, was made available for authorized users.

The capabilities of PRTool were expanded to strengthen its potential for helping to assess improvement of processes and products on the basis of the values of the related KPIs, and to permit browsing and filtering of information by date or by geographical region or for an individual country or IMS station. In other words, this approach enables the assessment of performance at many different levels. PRTool is therefore setting ambitious standards of transparency and accountability. It allows States Signatories to monitor the PTS programme implementation with the possibility of going back to any given year and making a judgement on the value gained for the resources invested. This interactive tool can be used to generate more than one thousand standard graphical presentations.

The PRTool design proved its potential and flexibility after the Fukushima accident when a new information technology application called CRTool, based on this design and dealing with radionuclide concentrations and radioisotope ratios, was launched expeditiously. The graphical displays provided by CRTool were used during the briefings for States Signatories on developments related to the Fukushima event. States Signatories also have online access to performance information expressed in terms of the KPIs related to the strategic goals of the Commission.

EVALUATING ON-SITE INSPECTION ACTIVITIES

The main focus of the evaluation of OSI activities centred on the preparations for the evaluation of the next IFE and a related series



Top: **Screenshot of the display produced by PRTool of the monthly average mission capable data availability for all waveform stations in operation.** ***Bottom:*** **Screenshot of the display produced by the concentration reporting tool (CRTool) of the evolution of the activity concentrations of several nuclides recorded at radionuclide station RN38 (Takasaki, Gunma, Japan) after the Fukushima accident.**

of three core build-up exercises preceding it. These exercises are designed to ensure the maturity of OSI components when finally tested in the IFE. The general approach to the whole evaluation was presented at the first meeting held under the expert advisory mechanism in May. Feedback was received after the meeting regarding the further development of the evaluation approach.

The evaluation concept is being developed and set out in the draft blueprint for the evaluation document, which will evolve as and when information on the build-up exercises is released. Moreover, the development process will involve the implementation of lessons learned from the evaluation and the experience gained along the way. Thus feedback on the approach to the first build-up exercise will be incorporated into the design of the second and so on.

The evaluation concept takes two different approaches in order to reflect the two distinct purposes of the build-up exercises and the IFE. Since the former are viewed as 'dress rehearsals' for the IFE, in which progress can be assessed, the evaluation of the three exercises will take a formative approach in order to help shape the operational capability being exercised. It will do so by providing feedback which can be incorporated into the next exercises or be used to make adjustments prior to the IFE.

The IFE, on the other hand, is regarded as a test vehicle for benchmarking operational capability and determining the level of OSI preparedness. Therefore the approach to its evaluation will be summative.

The evaluation of the advanced training course of the second training cycle for surrogate inspectors took place in June-July.

FEEDBACK FROM NATIONAL DATA CENTRES

The 2011 NDC Evaluation Workshop was jointly organized by the Government of Romania and hosted by the National Institute for Earth Physics. Seventy-four participants representing 32 States Signatories, NDCs and the PTS attended the workshop in Bucharest from 3 to 7 October.

The objective of the workshop was to provide a forum for NDC experts to share their experiences in fulfilling their verification responsibilities and to provide feedback on all aspects of the data, products, services and support provided by the PTS. The workshop focused on the results of the 2010 NDC Evaluation Workshop, the results of the 2010 NDC Preparedness Exercise (NPE10) and plans for subsequent exercises, as well as data fusion concepts and their importance to the NDC mission.

Participants of the NDC Evaluation Workshop, Bucharest, October 2011.

In its Quality Policy, the PTS underlines its focus on customers. The 2011 NDC Evaluation Workshop reviewed the status of implementation of the recommendations offered by previous such workshops.

NDC experts shared their experiences in fulfilling their verification responsibilities and provided feedback to the PTS on all aspects of PTS data, products, services and support. Discussions included a wide variety of topics related to data acquisition and analysis. The importance of communicating clearly to the NDCs any changes in parameters was emphasized. The discussions also covered aspects of gaining a better understanding of the degree to which PTS data and products are used by the NDCs and the importance of providing feedback and addressing questions to the PTS through the established channels.

The NDCs expressed their views on issues such as differences between the IDC and NDC bulletins, shifts and mismatches in event locations, missing events and sources of discrepancies in bulletin comparisons. They also reported on the civil use of scientific data and pointed out the importance of training and software.

NDC feedback to the PTS on services covered a broad range of aspects, including use of IDC products, performance reporting, documentation and access.

The presentations on establishing and running newer NDCs addressed the organization and activities of the respective NDCs in developing countries. The presentations described examples of data analysis carried out using the hardware and software available to the NDCs, putting in perspective evidence of some difficulties still to be resolved in the installation and application of the software.

Policy Making

Highlights in 2011

Continuation of the project to promote the participation of developing countries in official technical meetings of the Commission

Appointment of Ambassador Jargalsaikhan Enkhsaikhan (Mongolia) as Chairperson of Working Group A and reappointment of Mr Hein Haak (Netherlands) as Chairperson of Working Group B

Further advances in establishing the Information System with Hyperlinks on Tasks Assigned by the Resolution Establishing the Preparatory Commission (ISHTAR)

The plenary body of the CTBTO Preparatory Commission, which is composed of all States Signatories, provides political guidance and oversight to the Provisional Technical Secretariat. The plenary, as the Policy Making Organ, is assisted by two Working Groups.

Working Group A deals with budgetary and administrative matters facing the organization, while Working Group B considers scientific and technical issues related to the Treaty. Both Working Groups submit proposals and recommendations for consideration and adoption by the Commission.

In addition, an Advisory Group of qualified experts serves in a supporting role, advising the Commission through its Working Groups on financial, budgetary and associated administrative matters.

MEETINGS IN 2011

In 2011, the Thirty-Sixth and Thirty-Seventh Sessions of the Preparatory Commission were held on 14-15 June and 24 October respectively. The sessions were chaired by Ambassador Igor Davidovič, Permanent Representative of Bosnia and Herzegovina.

Working Group A was chaired by Ambassador Antonio Guerreiro (Brazil) and held its Thirty-Ninth Session from 23 to 24 May and its Fortieth Session on 3 October. Working Group B was chaired by Mr Hein Haak (Netherlands) and held its Thirty-Sixth Session from 14 February to 4 March and its Thirty-Seventh Session from 22 August to 9 September. Joint meetings of Working Groups A and B were held on 28 February and 5 September. In addition, informal open-ended consultations on various Working Group B issues were held from 15 to 19 August. The Advisory Group, chaired by Mr Michael Weston (United Kingdom), held the first and second parts of its Thirty-Sixth Session from 18 to 20 April and from 9 to 12 May and its Thirty-Seventh Session from 12 to 15 September.

EXPANDING THE PARTICIPATION OF EXPERTS FROM DEVELOPING COUNTRIES

The PTS continued the implementation of a project, initiated in 2007, to facilitate the participation of experts from developing countries in official technical meetings of the Commission. The stated aim of this project is to strengthen the universal character of the

Commission and capacity building in developing countries.

In 2011, four experts supported in 2009 and 2010 left the project and four new experts were selected, so that the total number of experts supported continued to be 10 (one each from Algeria, Bolivia (Plurinational State of), Brazil, Burkina Faso, the Dominican Republic, Indonesia, Kenya, Madagascar, Papua New Guinea and South Africa). Experts from two least developed countries were therefore supported under the project.

The experts took part in sessions of Working Group B and other technical meetings, including S&T2011 in June and the 2011 NDC Evaluation Workshop in October. In addition, the experts benefited from technical discussions with the PTS on key verification related issues. The expert from Kenya continued to lead discussions as the Task Leader for Issues Related to NDCs at both of the regular sessions of Working Group B. Moreover, the experts from Brazil and Madagascar were appointed by the Chairperson of Working Group B at its Thirty-Seventh Session as new Task Leaders.

The project was financed in 2011 by voluntary contributions from Austria, China, Finland, Hungary, Indonesia, Luxembourg, Malaysia, Morocco, New Zealand, Norway, Oman, Qatar, the Republic of Korea, Slovenia, South Africa, Spain, Turkey and the United Kingdom, as well as from the OPEC Fund for International Development. New voluntary contributions were received in 2011 from Austria, Norway, South Africa and the OPEC Fund for International Development.

On the basis of an implementation report prepared by the PTS, at its October session the Commission expressed its appreciation to the donor countries for their contributions and to the PTS for its reports on, and management of, the project.

SUPPORTING THE PREPARATORY COMMISSION AND ITS SUBSIDIARY BODIES

The PTS is the body that executes the decisions adopted by the Commission. It is multinational in composition: staff are recruited from States Signatories on as wide a geographical basis as possible. As far as the meetings of the Commission and its subsidiary bodies are concerned, the role of the PTS is to provide substantive and organizational support, thus facilitating the decision making process. From organizing conference facilities and arranging interpretation for the meetings and translation of papers to drafting official documents of the various sessions and advising the Chairpersons, the PTS is a vital element in the work of the Commission and its subsidiary bodies.

The PTS provided substantive and organizational support to the coordinators of the Article XIV process in connection with the holding of informal consultations of States ratifiers, as well as the seventh Conference on Facilitating the Entry into Force of the CTBT ('Article XIV conference'), which was held in New York on 23 September 2011.

Information System on Progress in Fulfilling the Mandate of the Treaty

Further advances were made in establishing ISHTAR. Using hyperlinks to the official documentation of the Commission as its basis, the aim of the ISHTAR project is to monitor progress achieved in accordance with the mandate of the Treaty, the Resolution establishing the Commission and the guidance of the Commission and its subsidiary bodies. Its overall purpose is to enable the Commission to determine which tasks remain to be completed in terms of preparations for the establishment of the CTBTO at entry into force and the first session of the Conference of the States Parties.

Virtual Working Environment

The PTS provides a virtual working environment for those unable to attend regular meetings of the Commission and its subsidiary bodies. State of the art technologies are employed to transmit the proceedings of each official plenary meeting around the globe in real time. Meetings are recorded and transmitted live via the Experts Communication System (ECS) before being archived for reference purposes. In addition, supporting documents related to each particular session are distributed to States Signatories through the ECS, and participants are notified of new documents by email alerts. In 2011, the PTS continued to distribute on DVDs all documents of and presentations to the Commission and its subsidiary bodies at their sessions.

Outreach

Highlights in 2011

Sustained commitment to and interest in the Treaty and its entry into force, including deposit of instruments of ratification of the Treaty by Ghana and Guinea

Expansion of the Capacity Development Initiative

Increase in worldwide media coverage of the Treaty and the work of the Commission

A key mandate of the Provisional Technical Secretariat of the CTBTO Preparatory Commission is to promote understanding of the objectives and principles of the Treaty, the functioning of the Commission, the global CTBT verification regime, and the civil and scientific applications of the International Monitoring System. This is done through interaction with the international community, including States, international organizations, academic institutions, non-governmental organizations, the media and the general public. The outreach activities involve promoting signature and ratification of the Treaty by States, educating the general public about the work of the Commission and fostering international cooperation in the exchange of verification related technologies.

A WATERSHED YEAR FOR THE TREATY

Over the years, the Commission has energetically pursued its objectives of raising awareness and enhancing understanding of the CTBT, establishing the verification regime and installing IMS facilities, and promoting CTBT signature and ratification. Events in 2009 and 2010 heightened the salience of the CTBT and its entry into force as never before. This renewed momentum for its entry into force and universality was sustained in 2011 as a result of several developments that have consolidated the political determination of the international community in favour of the Treaty. On 6 December, the Indonesian Parliament ratified the CTBT. With this strong showing of determination, Indonesia sent a powerful signal to the remaining States listed in Annex 2 to the Treaty that have not yet signed or ratified the Treaty, as well as to other States that have not done so, about the importance of the CTBT for global and regional security. Overall, the CTBT promises to remain, as it has always been, a uniting force in the multilateral security system. The ratification by Indonesia will increase momentum and broaden support for entry into force while demonstrating that the Treaty continues to be a rallying point for nuclear non-proliferation and disarmament.

One important precursor to the ratification by the Indonesian Parliament was the 2011 Article XIV conference, held on 23 September at the United Nations Headquarters in New York. The ratifying States, together with other States Signatories, issued a powerful call for the remaining Annex 2 States to ratify the Treaty, calling entry into force "more urgent than ever before". During the conference, the Indonesian Minister for Foreign Affairs reiterated the commitment of his Government to ratify the Treaty at an early date, signalling its intent to move quickly towards this goal. In November 2011, a delegation from the Indonesian Parliament visited Vienna for consultations with the Executive Secretary and PTS staff, the second such visit in 2011. Immediately following the November visit, the Defense and Foreign Policy Commission of the Indonesian Parliament adopted draft legislation to ratify the CTBT, sending the legislation to the plenary body for final approval on 6 December.

As of 31 December 2011, the Treaty had been signed by 182 States and ratified by 155 States, including 35 of the 44 States listed in Annex 2 to the Treaty, whose ratification is required for the Treaty to enter into force.

The political support for the Treaty and the work of the Commission has reached an unprecedented level, as evinced by the near universal recognition in the international community that the Treaty is an effective instrument of collective security and an important pillar of the nuclear non-proliferation and disarmament regime. A growing number of States, politicians and representatives of civil society are spearheading the campaign for ratification of the Treaty by the remaining States, including the last of the 44 Annex 2 States. Through their efforts, the international community is sending a resounding message that the Treaty has a critical role to play in today's security environment.

Maintaining and building on the momentum created in support of the Treaty requires the Commission to seize every suitable opportunity to further its objectives and explore modalities of engagement with States, as well as with civil society and the international scientific community. Future prospects for the CTBT depend on sustained political, technical and financial investment in the Treaty and its verification regime. This investment will pay dividends not only through enhancing international peace and security by verifiably ending nuclear testing, but also by building on the multilateral security architecture designed to create the conditions for a world free of nuclear weapons.

TOWARDS ENTRY INTO FORCE AND UNIVERSALITY OF THE TREATY

The Treaty moved closer to universalization in 2011 with ratification by Ghana and Guinea.

As of 31 December 2011, the Treaty had been signed by 182 States and ratified by 155 States, including 35 of the 44 States listed in Annex 2 to the Treaty, whose ratification is required for the Treaty to enter into force.

INTERACTING WITH THE INTERNATIONAL COMMUNITY

In 2011, the PTS continued efforts to facilitate implementation of decisions of the Commission on establishing the verification regime and promoting participation in its work. The PTS also maintained a dialogue with States through bilateral visits in capitals and

interactions with Permanent Missions in Vienna, Berlin, Geneva and New York. The major focus of such interactions was on States hosting IMS facilities and States that have not yet signed or ratified the Treaty (particularly those listed in Annex 2). All in all, the PTS took advantage of various international, regional and subregional conferences and other gatherings to enhance understanding of the Treaty and to advance its entry into force and the building of the IMS.

The Executive Secretary of the Preparatory Commission visited Belgium, Canada, the Czech Republic, Indonesia, Kazakhstan, the Republic of Korea, Romania, the Russian Federation, Sweden, Switzerland, Turkey, the United Arab Emirates, the United Kingdom and the United States of America with a view to strengthening their interaction with the Commission and highlighting the significance of entry into force of the Treaty.

PARTICIPATING IN THE INTERNATIONAL RESPONSE TO THE FUKUSHIMA NUCLEAR ACCIDENT

During the devastating earthquake and tsunami and subsequent nuclear accident in Japan, data from the IMS were disseminated in near real time to States Signatories and relevant international organizations, in particular the IAEA. The CTBT monitoring technologies were widely regarded as an important source of reliable information during these disastrous events. Throughout the course of the events, the Commission delivered a series of technical briefings to the IAEA with a view to efficient and effective cooperation. The Executive Secretary held meetings with the Director General of the IAEA on 16 and 21 March to discuss cooperation between the two organizations in sharing relevant data related to the Fukushima nuclear accident. Following consultations, the organizations immediately established a joint team of experts to make effective and strategic use of the data and data products shared. Among the data shared were data from radionuclide stations as well as relevant source data, which were used to enhance ATM.

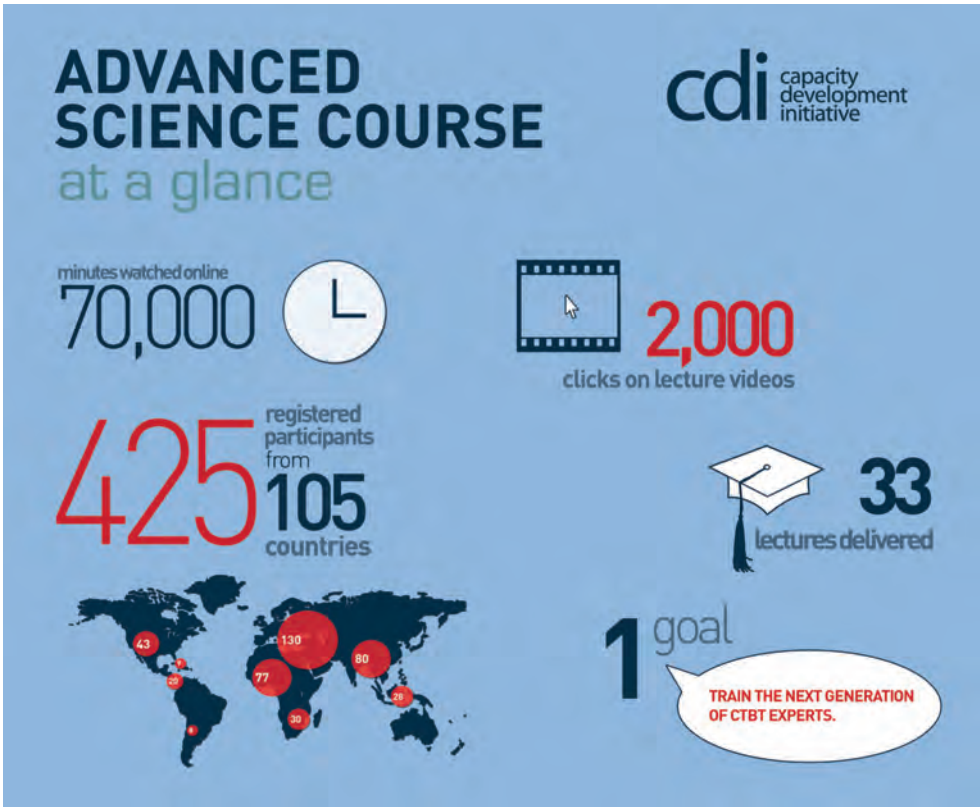
On 25 March and 8 April, the Executive Secretary participated in two videoconferences organized by the Secretary-General of the United Nations with the heads of all international organizations involved in the response to the nuclear accident. The conferences focused on lessons learned by international organizations in relation to this event and ways to further strengthen cooperation and coordination. Among the participating organizations were the IAEA, WMO, the United Nations Development Programme, WHO and the United Nations Office for Disarmament Affairs.

The PTS also initiated and strengthened its cooperation with international organizations, including the IAEA, WHO and WMO, in the aftermath of the events in Japan. For example, the PTS started to attend meetings of the IAEA-organized IACRNE.

On 21 June, the Executive Secretary addressed the IAEA Ministerial Conference on Nuclear Safety. He explained how the IMS demonstrated that it was "tragically relevant" during the Fukushima nuclear accident.

CAPACITY DEVELOPMENT INITIATIVE

The Commission expanded its Capacity Development Initiative



in 2011. The initiative aims to build the necessary capacity in States Signatories to effectively confront political, legal, technical and scientific challenges that face the Treaty and its verification regime. As part of this initiative, the Commission has developed introductory and advanced courses dealing with various aspects of the Treaty and the verification regime.

From 5 to 9 September 2011, the Commission held a week-long introductory course entitled "Strengthening Verification, Enhancing Security: The Science and Political Significance of the CTBT". The course addressed political, legal and security related aspects of the CTBT, as well as the science and technology that underpin the verification regime. The course targeted the diplomatic community, university students and faculty members, United Nations Disarmament Fellows and other interested individuals. Over one hundred participants attended the course in Vienna while 150 followed it on the public web site.

Following on from the introductory course, the Commission held an Advanced Science Course from 28 November to 9 December. The course was designed to enhance understanding of the CTBT verification technologies for individuals with a background or interest in the nuclear, geophysical or computer sciences, electronics, telecommunications or engineering. Topics included in-depth analysis of IMS verification technologies, OSI techniques and procedures, civil and scientific applications of the IMS, and IDC data products and their

Scenes from the introductory course of the Capacity Development Initiative in Vienna. (*Top right:* Tibor Tóth, Executive Secretary of the CTBTO Preparatory Commission, at the opening of the course. *Bottom left:* Siegfried Hecker, Co-Director of the Center for International Security and Cooperation at Stanford University, California, USA, addressing the course participants.)

role in the verification regime. More than four hundred participants from nearly one hundred countries either attended the course in Vienna or followed it via the public web site. Participants included IMS station operators, NDC analysts, academics and students, ambassadors and representatives from Permanent Missions, and members of international organizations and government institutions.
The Commission continued to engage with dozens of academic institutions, think tanks, non-governmental organizations and international organizations in an effort to promote the Capacity Development Initiative and attract participation in future courses.

UNITED NATIONS

In addition to the seventh Article XIV conference on 23 September, the Executive Secretary took part in the sixty-sixth session of the United Nations General Assembly in New York from 18 to 24 September 2011. He met with a number of senior officials and government representatives and addressed a High-level Meeting on Nuclear Safety and Security, convened by the Secretary-General on 22 September. Throughout 2011, the Executive Secretary had meetings with the Secretary-General. PTS representatives also participated in several conferences sponsored by the United Nations with the aim of strengthening cooperation with academics and practitioners in the field of disarmament and non-proliferation.

REGIONAL ORGANIZATIONS

The Executive Secretary met with the Secretary General of the Organization of American States in Washington, D.C., on 31 March 2011. He also met with the Chairman of the African Commission on Nuclear Energy and the Secretary General of the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean. During these meetings, the Executive Secretary discussed joint efforts to promote the CTBT in a regional context and ways to enhance cooperation between the Commission and these regional institutions.

OTHER CONFERENCES AND SEMINARS

On 28 February, the Executive Secretary delivered remarks at a conference organized by the Academic Council on the United Nations System, entitled "Connecting Academics and UN Practitioners – A Unique Encounter at the United Nations in Vienna".

On 10 May, the Executive Secretary participated in a discussion on "Strengthening Preparedness for Nuclear Incidents and Emergencies at the Third Session of the Global Platform for Disaster Risk Reduction", which was held in Geneva. The session brought together disaster risk reduction, recovery and reconstruction experts. The United Nations Secretary-General as well as representatives from the IAEA, WHO, WMO and the Food and Agriculture Organization of the United Nations and a number of interested member States attended along with over five hundred other participants. The discussion highlighted the importance of integrating the knowledge and competence of national, regional and international disaster management organizations to respond to and manage these types of events.

The Executive Secretary attended the Fourth United Nations Conference on the Least Developed Countries in Istanbul on 13 May and delivered a statement during the general debate. Bilateral meetings were held with the Foreign Ministers of the Gambia and the Solomon Islands.

At the 16th Ministerial Conference and Commemorative Meeting of the Non-Aligned Movement (NAM), which was held in Bali, Indonesia, from 25 to 27 May, the Executive Secretary had bilateral consultations with 13 ministers and other officials from ratifying and non-ratifying States, including Algeria, Angola, Chile, Cuba, Egypt, Guatemala (whose Parliament subsequently ratified the Treaty), Indonesia (whose Parliament subsequently ratified the Treaty), Iraq, Luxembourg, Morocco, the Philippines, Yemen and Zimbabwe. In the Final Document issued by the conference participants, the NAM ministers emphasized universal adherence to the CTBT, including by the nuclear weapon States, which should contribute to the process of nuclear disarmament.

At the invitation of the Government of Kazakhstan, the Executive Secretary delivered a statement to the 38th Session of the Council of Foreign Ministers of the Organization of the Islamic Conference, which was held in Astana from 28 to 30 June.

From 6 to 7 July, the Executive Secretary participated in an EU seminar in Brussels to promote confidence building and in support of a process aimed at establishing a zone free of weapons of mass destruction and means of delivery in the Middle East.

The Executive Secretary attended the annual Summit on the Global Agenda. The event was hosted by the World Economic Forum in partnership with the United Arab Emirates and held in Abu Dhabi from 10 to 11 October.

From 12 to 13 October, the Executive Secretary attended the International Forum for a Nuclear-Weapon-Free World in Astana, Kazakhstan, marking the 20th anniversary of the closure of the former nuclear test site in Semipalatinsk, and delivered the keynote speech. During the forum, he also held bilateral consultations with the President and the Minister of Foreign Affairs of Kazakhstan and with other senior Kazakh officials.

The Executive Secretary delivered a keynote speech to the Tenth United Nations–Republic of Korea Joint Conference on Disarmament and Non-proliferation Issues, which was held from 7 to 8 November on Jeju Island, Republic of Korea.

BILATERAL VISITS

From 25 March to 9 April, a PTS delegation headed by the Executive Secretary undertook a bilateral mission to the USA. The Executive Secretary met with several high level officials in the US Administration and at several national laboratories. Among the matters discussed were the current and future prospects for CTBT ratification in the USA, as well as enhanced cooperation on technical and strategic levels between the Commission and the USA.

On 2 and 3 May, the Executive Secretary had meetings in Stockholm with the Minister for Foreign Affairs of Sweden as well as other high level officials from the Ministry of Foreign Affairs, the Swedish Defense Research Agency and the Stockholm International Peace Research Institute (SIPRI). The Executive Secretary also participated in and delivered a keynote address at a workshop, entitled "The Nuclear Renaissance and the Risks of Nuclear Proliferation in Asia", which was organized by Stockholm University, SIPRI and the Swedish Pugwash Group.

From 27 to 30 September, the Executive Secretary undertook a bilateral mission to Moscow and met with a number of high level officials, including the Deputy Minister of Defence. He also met with the Deputy Director General of the State Atomic Energy Corporation, Rosatom. On 30 September, the Executive Secretary participated in a seminar at the Center for Policy Studies in Russia, entitled "15 Years of the CTBT: Achievements and Prospects".

The Executive Secretary undertook a bilateral mission to the Republic of Korea from 9 to 10 November. He used the visit to hold consultations with the Minister of Foreign Affairs and Trade and the newly appointed Chairman of the Nuclear Safety and Security Commission (NSSC). The Executive Secretary also delivered a lecture at the Seoul National University and visited the NSSC, where he held discussions with the Chairman and other senior NSSC officials.

On 6 December, the Executive Secretary attended the session of the Indonesian Parliament in Jakarta. During the session, the Parliament ratified the CTBT. The Executive Secretary held consultations with the Minister for Foreign Affairs and senior members of Parliament in addition to other senior Government officials. On 6 December, the PTS held a high level event commemorating the ratification by Indonesia. The event included statements from the Indonesian Ambassador to Austria and the Executive Secretary that were broadcast live from Jakarta via videoconference. In Vienna, representatives from Indonesia, Poland and the USA and the joint coordinators of the Article XIV process (Mexico and Sweden) welcomed the decision taken by Indonesia.

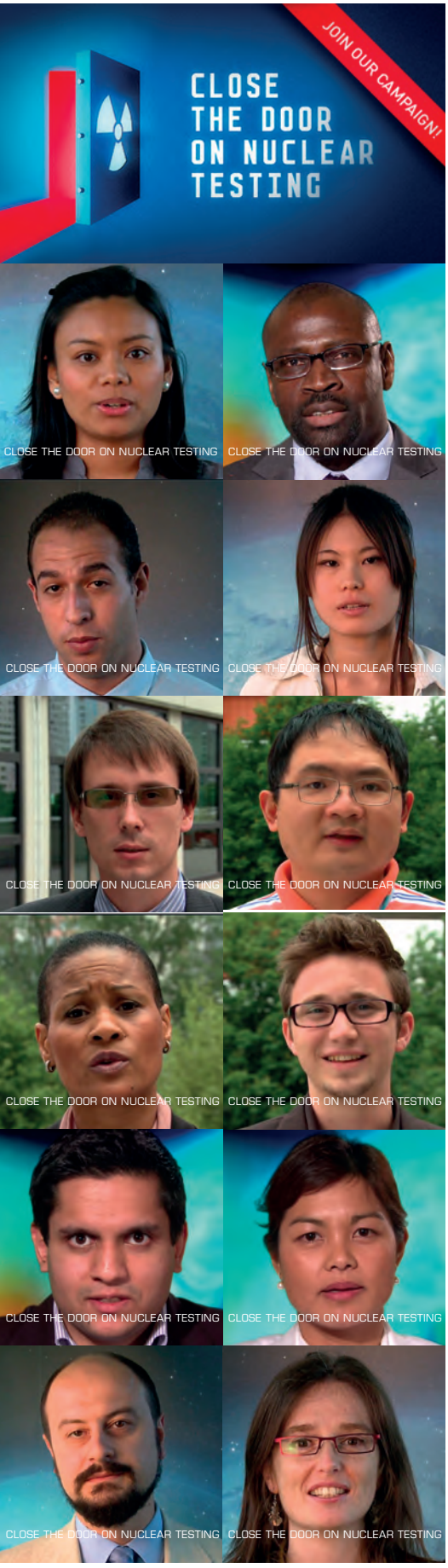
OUTREACH

The PTS holds regional and subregional workshops with the overall aim of encouraging political and technical cooperation in areas related to the Treaty, reviewing Treaty related achievements in support of the nuclear non-proliferation regime and promoting the entry into force and universality of the Treaty. Other objectives include enhancing the understanding of the Treaty as a regional security and confidence building measure, and developing national capabilities in the region for implementing the Treaty and participating in the verification regime. Participants also explore means of promoting the application of PTS data and products for civil and scientific purposes, and ways in which experience and expertise can be exchanged between the PTS and the relevant national agencies, as well as between the participating States.

Participants of the Cross-Regional Workshop on the Role of the CTBT in Regional and Global Security, Istanbul, November 2011.

From 24 to 25 March, over forty participants from nine countries, including four Annex 2 States, attended a Scientist-to-Scientist Workshop entitled "Technical Aspects of a Ban on Nuclear Testing" in Beijing. The workshop brought together scientists to discuss the technical underpinnings of the CTBT, as well as the potential civil and scientific applications of monitoring technology and data. The workshop included a brief session on the devastating earthquake and tsunami that struck Japan on 11 March. The workshop was organized by the Chinese Arms Control and Disarmament Association in Beijing and the Center on International Cooperation at New York University, with financial support from the Norwegian Ministry of Foreign Affairs.

In cooperation with the Government of Turkey, a Cross-Regional Workshop on the Role of the CTBT in Regional and Global Security was held from 15 to 17 November in Istanbul. The workshop was designed to bring together national representatives from different regional groups, as well as members of a number of academic, research and security institutions, including the Organization for Security and Co-operation in Europe, the Conference on Interaction and Confidence Building Measures in Asia, and the Association of Southeast Asian Nations. The Executive Secretary delivered a statement at the opening session. The event gathered more than seventy political officials and technical experts from thirty countries spanning six geographical regions to exchange views and share information on the CTBT, its verification regime and the civil and scientific applications of CTBT technology. Participants consistently emphasized the considerable benefits of the CTBT for regional and global security and confidence building. They also conveyed the importance of sustaining the political momentum surrounding the Treaty as well as of signature and ratification by Annex 2 States and non-Annex-2 States that had yet to join the Treaty.



PROMOTING THE TREATY AND THE COMMISSION

Proactive and strategically planned public information activities continue to be an integral part of the outreach efforts of the Commission in the political arena as well as in verification related fields. Particular events such as S&T2011 and the Article XIV conference received high publicity through tailor-made media campaigns. Intensified use was made of social media channels. Peak levels of media coverage were reached as a result of the Fukushima accident and the ratification of the Treaty by the Indonesian Parliament. Each event led to around six hundred articles and references by online and print media. The role of the Commission in the response to the Fukushima accident also featured prominently in broadcast media. The number of visits to the public web site averaged 1200 daily, peaking at over 7000 during the Fukushima accident.

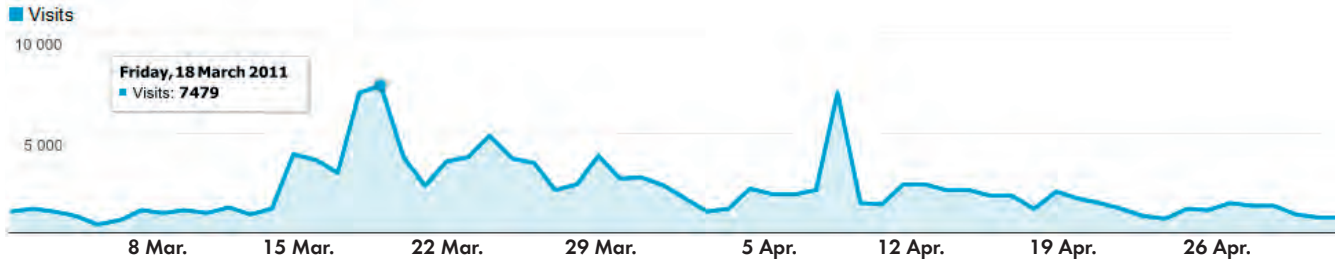
Public information outreach efforts included briefing journalists and interacting with States and civil society. Capacity building seminars for journalists were held in Beijing and on the margins of S&T2011. Public information activities flanked several bilateral visits by the Executive Secretary and his involvement in international conferences as well as regional workshops.

The video–audio project gained further momentum with 15 new video clips being produced. A public service announcement by Michael Douglas (United Nations Messenger of Peace) and a video for the new "Close the Door on Nuclear Testing" campaign were disseminated further by broadcast media worldwide. Videos were distributed via UNifeed, reaching over three hundred broadcasters around the globe. CNN broadcast the report on the OSI exercise in Jordan and Euronews reported on the former Semipalatinsk test site using the PTS animated graphics that explain the IMS technologies. A new series of articles was launched via social media to increase awareness of the risks of nuclear testing and the role of the CTBT in addressing them.

The publication *Spectrum* included contributions from the Swiss President and Minister of Foreign Affairs, Micheline Calmy-Rey, the Prime Minister of Trinidad and Tobago, Kamla Persad-Bissessar, the former President of the Soviet Union, Mikhail Gorbachev, and several other foreign ministers.

The intensified use of social media led to more than double the number of Internet users registering their support and interest via Facebook and Twitter compared with 2010. In addition, around fifty thousand visitors to the Vienna International Centre toured the permanent CTBTO exhibition. Temporary exhibitions were set up at the Carnegie International Nuclear

"Has your country joined the Treaty?" Michael Douglas, United Nations Messenger of Peace, in a promotional video that can be viewed on the public web site.



The public web site received over 7000 visits daily during the Fukushima accident.

Policy Conference (28-29 March, Washington, D.C.) and at the celebration in Vienna for International Women's Day.

NATIONAL IMPLEMENTATION MEASURES

In 2011, the PTS continued to promote the exchange of information between States Signatories on the subject of national implementation measures. For the first time, the PTS organized a pilot workshop on CTBT implementing legislation for requesting States of the Latin American and Caribbean region, which took place in Vienna on 1-4 November. The objective was to provide a venue to analyse and discuss the main elements of CTBT implementing legislation and other implementation measures, including during the preparatory phase. As a result of the meeting, participants elaborated proposals for national measures in their respective countries and provided valuable input for the further development of the PTS programme of legal assistance. It is expected that this workshop will serve as a reference for similar events in the future.

Management

Highlights in 2011

Approval by the Commission of financing for the 2014 Integrated Field Exercise (US$10.3 million)

Further increase in numbers of female staff in the Professional category and in senior management positions

Progress in implementation of an Enterprise Resource Planning (ERP) system compliant with International Public Sector Accounting Standards (IPSAS)

Effective and efficient management of the activities of the Provisional Technical Secretariat of the CTBTO Preparatory Commission, including support of the Commission and its subsidiary bodies, is ensured mainly through the provision of administrative, financial and legal services.

A wide variety of general services are also provided, from arrangements concerning shipments, customs formalities, visas, identity cards, laissez-passer and low value purchases to insurance, tax, travel and telecommunication services, as well as standard office and information technology support and asset management. Services provided by external entities are continuously monitored to ensure that these are being provided in the most efficient, effective and economical way.

Management also involves coordinating with the other international organizations located in the Vienna International Centre over planning of office and storage space, maintenance of the premises and common services, and enhancement of security efforts.

OVERSIGHT

Internal Audit is an independent and objective internal oversight mechanism. It helps the organization accomplish its objectives through a systematic approach to assessing and improving the effectiveness of risk management, control and governance processes.

In order to promote the independence and objectivity of the function, Internal Audit reports directly to the Executive Secretary and has direct access to the Chairpersons of the Advisory Group and Working Group A. The Chief of Internal Audit independently also submits an annual activity report for consideration by the Commission and its subsidiary bodies. In addition to the approved work plan, the Chief of Internal Audit may institute special audits or investigations warranted by particular circumstances.

In 2011, six audits were undertaken. These resulted in identification of areas for improving efficiency, effectiveness and internal controls, and of compliance with rules and procedures. The audit work also secured the recovery of unpaid credit, which was reimbursed by a service provider to the Commission and to another organization based at the Vienna International Centre.

In line with the International Standards for the Professional Practice of Internal Auditing, Internal Audit also performs management support activities, such as risk management and maximizing synergies.

Networking with internal audit services of United Nations organizations is conducted regularly to exchange good practices and lessons learned. Internal Audit is also the focal point of the Commission for activities related to the Joint Inspection Unit of the United Nations.

FINANCE

Extrabudgetary Resources

In 2011, the Commission, while approving the 2012 Programme and Budget proposals, adopted a supplementary appropriation of $7.8 million for the 2014 IFE. This will help to advance considerably the operational readiness of the OSI capabilities of the Commission during the coming years.

2011 Programme and Budget

The 2011 Programme and Budget was prepared at a level corresponding to slightly less than zero real growth and maintained the split currency system (US dollar and euro) for assessing the contributions due from States Signatories. This system was introduced in 2005 to lessen the exposure of the Commission to the effects of fluctuations in the value of the US dollar against the euro.

The Budget for 2011 amounted to $46 555 600 and €56 453 600. At the budget exchange rate of 0.796 euro to 1 US dollar, the total US dollar equivalent of the 2011 Budget was $117 481 800, representing a nominal growth of 1.8% but almost constant in real terms (a decrease of $119 000 or 0.1%).

On the basis of the actual average exchange rate in 2011 of 0.7189 euro to 1 US dollar, the final total US dollar equivalent of the 2011 Budget was $125 083 351 (Table 4). Of the total Budget, 78.8% originally was allocated to verification related activities, including an allocation of $18 907 848 to the Capital Investment Fund (CIF), established for the build-up of the IMS.

Assessed Contributions

As of 31 December 2011, the collection rates of the assessed contributions for 2011 amounted to 97.0% of the US dollar portion and 82.2% of the euro portion. In comparison, the 2010 collection rates as of 31 December 2010 were 97.9% and 76.4% respectively. The combined collection rate for the US dollar and euro portions in 2011

Table 4. Distribution of 2011 Budget

Area of Activity	U$$ (millions)[a]
International Monitoring System	40.1
International Data Centre	46.7
On-Site Inspection	9.7
Evaluation and Audit	2.1
Policy Making Organ Support	5.2
Administration, Coordination and Support	16.9
Legal and External Relations	4.4
Total	**125.1**

[a] An average exchange rate of 0.7189 euro to 1 US dollar was used to convert the euro component of the 2011 Budget.

Staff Members in the Professional Category by Geographical Region as of 31 December 2011 (Percentages as of 31 December 2010 are shown in brackets.)

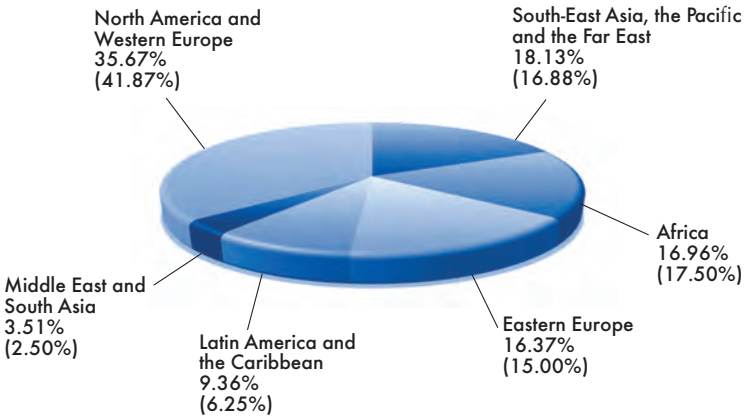


Table 5. Regular Staff Members by Field of Work (31 December 2011)

Field of Work	Professional	General Service	Total
Evaluation Section	2	1	3
International Monitoring System Division	35	23	58
International Data Centre Division	68	11	79
On-Site Inspection Division	20	6	26
Total, verification related	**125 (73.10%)**	**41 (51.62%)**	**166 (65.87%)**
Office of the Executive Secretary	4	3	7
Internal Audit	2	0	2
Division of Administration	22	21	43
Legal and External Relations Division	18	16	34
Total, non-verification-related	**46 (26.90%)**	**40 (49.38%)**	**86 (34.13%)**
Total	**171**	**81**	**252**

was 88.8%, compared with 84.8% in 2010.

The number of States that had paid their 2011 assessed contributions in full as of 31 December 2011 was 91, lower than 101 in 2010. Regarding 2010 assessed contributions, the collection rate as of 31 December 2011 amounted to 99.11%.

Expenditure

The expenditure for the Programme and Budget in 2011 amounted to $115 814 580, of which $19 394 564 was from the CIF. For the General Fund, the unused budget amounted to $7 160 778. For the CIF, approximately 34.4% of the allotment was executed by the end of 2011.

PROCUREMENT

In 2011, the PTS obligated approximately $35.5 million through 645 contractual instruments and approximately $2.5 million for small value purchases. At the end of the year, there were 112 open requisitions for future obligation in the procurement pipeline with a total value of approximately $13.4 million: $11.4 million for the CIF and $2.0 million for the General Fund.

As of 31 December 2011, 128 IMS stations, 10 radionuclide laboratories and the testing of 26 noble gas systems were under contract for testing and evaluation or for PCAs.

HUMAN RESOURCES

The PTS secured the human resources for its operations by recruiting and maintaining highly competent and diligent staff for all programmes. Recruitment was based on securing the highest standards of professional expertise, experience, efficiency, competence and integrity. Due regard was paid to the principle of equal employment opportunity, to the importance of recruiting staff on as wide a geographical basis as possible, and to other criteria stipulated in the relevant provisions of the Treaty as well as the Staff Regulations.

As of 31 December 2011, the PTS had 252 staff members from 77 countries, compared with 246 staff members from 70 countries at the end of 2010. The pie chart shows the distribution of staff members in the Professional category by geographical region. Table 5 shows the distribution of regular staff members by field of work.

The PTS continued its efforts to increase the representation of women in the Professional category. At the end of 2011, there were

In a profession that has traditionally been dominated by men, two of the seven radionuclide team officers responsible for building and certifying IMS radionuclide stations are women. The picture shows them preparing a filter sample from a station for analysis.

50 women in Professional positions, corresponding to 29.24% of the Professional staff. For the first time in the history of the PTS, there was 20% female representation at the Director level (D1) in 2011. In comparison with 2010, there were increases of 5.56% and 16.67% in the numbers of female staff members at the P3 and P2 levels respectively. The representation of women at P5 and P4 was maintained at the same level as in 2010.

The staff were provided with opportunities to increase their skills in areas relevant to achieving the objectives of the organization. A variety of programmes were delivered in 2011 which were tailored for the benefit of the PTS in carrying out its work programmes and to enhance job performance and career development.

In general, throughout 2011 the PTS continued to focus on smart planning, to streamline its activities and to increase synergies and efficiencies. It also accorded priority to results based management.

IMPLEMENTATION OF AN IPSAS-COMPLIANT ENTERPRISE RESOURCE PLANNING SYSTEM

The Commission in November 2010 approved the budget for a project to develop and implement an IPSAS-compliant ERP system through partnership with an international organization. After careful analysis of various international organizations, the World Food Programme (WFP) was identified as the most suitable partner. In 2011, a memorandum of understanding with WFP was successfully negotiated.

The ERP team, consisting of 15 PTS staff members, was recruited during 2011. The initial work carried out by the team consisted of establishing a project plan, important milestones and a list of tasks with corresponding deadlines. As a next step, the team mapped the business processes of the Commission and performed a high level gap analysis to compare the Commission with WFP.

A review of the regulatory framework of each organization is under way and the required changes to the Financial Regulations and Rules of the Commission are being identified.

The ERP team reviewed and drafted accounting policies and procedures to ensure consistency and transparency in line with IPSAS, particularly for assets and liabilities, including assessed contributions, voluntary contributions, property, plant and equipment, expense recognition, inventories, provisions and contingent liabilities. It also continued to liaise with WFP on a number of important areas, such as key success factors in ERP implementation, lessons learned by WFP, the scope of work and working modalities.

Facilitating the Treaty's Entry into Force

Article XIV of the CTBT concerns the Treaty's entry into force. The article foresees a mechanism of regular conferences to facilitate entry into force (commonly referred to as 'Article XIV conferences') if this has not taken place three years after the Treaty is opened for signature. The first Article XIV conference took place in Vienna in 1999. Subsequent conferences were held in New York in 2001, 2005, 2009 and 2011 and in Vienna in 2003 and 2007.

The Secretary-General of the United Nations convenes the Article XIV conferences at the request of a majority of States that have ratified the Treaty. Both ratifying and signatory States participate in these conferences. Decisions are taken by consensus of the ratifying States, taking into account views expressed at the conference by signatory States. Non-signatory States, international organizations and non-governmental organizations are invited to attend as observers.

Article XIV conferences discuss and decide on what measures, consistent with international law, may be undertaken to accelerate the ratification process in order to facilitate entry into force of the Treaty.

The Executive Secretary of the CTBTO Preparatory Commission, Tibor Tóth, and (*right*) the United Nations Under-Secretary-General and High Representative for Disarmament Affairs, Sergio Duarte, at a press briefing.

Ban Ki-moon, United Nations Secretary-General.

CONDITIONS FOR ENTRY INTO FORCE

The entry into force of the CTBT is conditioned on its ratification by all 44 States listed in its Annex 2. These so-called Annex 2 States are States that formally participated in the final stage of the negotiation of the Treaty in the Conference of Disarmament in 1996 and possessed nuclear power reactors or nuclear research reactors at that time. As of 31 December 2011, 35 of these 44 States had ratified the Treaty. Of the Annex 2 States that had still to ratify the Treaty, three had not yet signed it.

NEW YORK, 2011

Convened on 23 September 2011 at the United Nations Headquarters in New York, the seventh Conference on Facilitating the Entry into Force of the CTBT served as another forum demonstrating the reinvigorated political determination of the international community to achieve the Treaty's entry into force and its universality. At that conference, around 160 States Signatories gathered to take stock of progress, discuss strategies and coordinate efforts to generate further support for the Treaty and its universality. A significant number of foreign ministers and high level officials from ratifying, signatory and non-signatory States participated in the conference, including representatives from seven States whose pending ratification is required for entry into force: China, Egypt, Indonesia (whose Parliament subsequently ratified the Treaty), Iran (Islamic Republic of), Israel, the USA and Pakistan (a non-signatory State).

> "these years have been well spent in carefully building up an unprecedented global verification system for the CTBT"
>
> CARL BILDT, MINISTER FOR FOREIGN AFFAIRS OF SWEDEN

SHARED PRESIDENCY

The presidency of the conference was shared by the Secretary of Foreign Affairs of Mexico, Ms Patricia Espinosa Cantellano, and the Minister for Foreign Affairs of Sweden, Mr Carl Bildt.

Patricia Espinosa Cantellano, Secretary of Foreign Affairs of Mexico, and Carl Bildt, Minister for Foreign Affairs of Sweden, shared the presidency of the 2011 conference.

Yerzhan Kazykhanov, Minister of Foreign Affairs of Kazakhstan.

Marty Natalegawa, Minister for Foreign Affairs of Indonesia.

This reflected the global nature of the Treaty. In her opening remarks, Ms Espinosa stressed the importance of the Treaty's entry into force, pointing out that "it will make the world safer", "it will support the final goal of achieving nuclear disarmament and non-proliferation on a global level", and "we must give future generations a world free of nuclear weapons." Ms Espinosa's call was reiterated by Mr Bildt, who said that "with the CTBT in place we can build a more secure global environment for all." Referring to the 15 years since the Treaty was opened for signature, Mr Bildt stated that "these years have been well spent in carefully building up an unprecedented global verification system for the CTBT."

EXPRESSIONS OF STRONG SUPPORT

The conference was characterized by numerous expressions of strong support for the Treaty and its entry into force. It was opened by the Secretary-General of the United Nations, Mr Ban Ki-moon, who referred to the Treaty as "an indispensable stepping stone to a nuclear-weapon-free world." While urging the remaining Annex 2 States to ratify the Treaty without further delay, he pointed out that "the time for waiting has passed" and that "we must make the most of existing – and potentially short lived – opportunities."

The Executive Secretary, Mr Tibor Tóth, called the Treaty "a uniting force in the nuclear non-proliferation and disarmament regime." The 182 signatures and 155 ratifications of the Treaty were "an unprecedented vote of confidence in the CTBT." He repeated the call to outstanding States to sign and ratify the Treaty and said that "the best way forward is to make the de facto norm banning nuclear tests a legally binding commitment." (Following the conference, the Parliaments of Guatamala and Indonesia ratified the Treaty.)

The conference unanimously adopted a strongly worded Final Declaration that offers 10 practical measures to accelerate the ratification process and bring the Treaty into force. It calls upon the remaining countries to sign and ratify the Treaty without delay and expresses the commitment of participating States to spare no efforts and use all avenues open

Alain Juppé, Minister of Foreign and European Affairs of France (*left*), and Taïb Fassi Fihri, Minister of Foreign Affairs and Cooperation of Morocco, who served together in the office of the presidency of the 2009 Article XIV conference, addressed the opening of the 2011 conference.

to them to encourage further signature and ratification of the Treaty. The Final Declaration also recognizes the achievements made in the universalization of the Treaty and in advancing the operational readiness of its verification regime. It emphasizes the significance of the Treaty, stating that "entry into force of the CTBT is of vital importance as a core element of the international nuclear disarmament and non-proliferation regime." It is imperative that the international community implement the Final Declaration. As the last barrier against nuclear weapons, the Treaty offers a systematic approach to addressing the challenges to the nuclear non-proliferation regime.

States commended the progress achieved in the establishment of the regime, saying that "it is essential to maintain momentum in building all elements of the verification regime."

The civil and scientific applications of the monitoring technologies received considerable expressions of appreciation. Delegations acknowledged the rapid response of the Commission to the tsunami and the ensuing nuclear accident at Fukushima. The conference was held one day after the High-level Meeting on Nuclear Safety and Security convened by the United Nations Secretary-General. This helped delegations to build on the findings of the United Nations system-wide study on the implications of the Fukushima accident. In its analysis and recommendations, the study features numerous references to the role of the Commission and its verification regime. It recognizes, in particular, the importance of the network of radionuclide stations in nuclear emergencies and highlights the critical role played by the network during the accident.

Many of these points were also echoed in national statements made during the parallel general debate of the General Assembly session of the United Nations. Many States Signatories in their statements expressed their support for the Treaty and the work of the Commission.

WORLDWIDE MEDIA COVERAGE

A multifaceted proactive media campaign was launched to promote the Treaty and the work of the conference. In the run-up, a number of op-ed articles by prominent personalities, media advisories and the new "Close the Door on Nuclear Testing" campaign on YouTube prepared the ground. Press conferences were held before (including on the occasion of the International Day against Nuclear Testing) and on the margins of the conference. A live stream, video–audio recordings, photographic material and statements were provided in near real time on a dedicated web page. Key quotes were broadcast via Twitter. These activities resulted in good media coverage of the conference in broadcast, print and online media, with a total of 274 articles appearing, including in a number of the remaining Annex 2 States.

> "fifteen years after the opening of the Treaty for signature, its entry into force is more urgent than ever before"
>
> FINAL DECLARATION OF THE 2011 ARTICLE XIV CONFERENCE

SIGNATURE AND RATIFICATION

STATES WHOSE RATIFICATION IS REQUIRED FOR THE TREATY TO ENTER INTO FORCE (31 DECEMBER 2011)

State	Date of Signature	Date of Ratification
Algeria	15 Oct. 1996	11 Jul. 2003
Argentina	24 Sep. 1996	4 Dec. 1998
Australia	24 Sep. 1996	9 Jul. 1998
Austria	24 Sep. 1996	13 Mar. 1998
Bangladesh	24 Oct. 1996	8 Mar. 2000
Belgium	24 Sep. 1996	29 Jun. 1999
Brazil	24 Sep. 1996	24 Jul. 1998
Bulgaria	24 Sep. 1996	29 Sep. 1999
Canada	24 Sep. 1996	18 Dec. 1998
Chile	24 Sep. 1996	12 Jul. 2000
China	24 Sep. 1996	
Colombia	24 Sep. 1996	29 Jan. 2008
Democratic People's Republic of Korea		
Democratic Republic of the Congo	4 Oct. 1996	28 Sep. 2004
Egypt	14 Oct. 1996	
Finland	24 Sep. 1996	15 Jan. 1999
France	24 Sep. 1996	6 Apr. 1998
Germany	24 Sep. 1996	20 Aug. 1998
Hungary	25 Sep. 1996	13 Jul. 1999
India		
Indonesia	24 Sep. 1996	
Iran (Islamic Republic of)	24 Sep. 1996	

State	Date of Signature	Date of Ratification
Israel	25 Sep. 1996	
Italy	24 Sep. 1996	1 Feb. 1999
Japan	24 Sep. 1996	8 Jul. 1997
Mexico	24 Sep. 1996	5 Oct. 1999
Netherlands	24 Sep. 1996	23 Mar. 1999
Norway	24 Sep. 1996	15 Jul. 1999
Pakistan		
Peru	25 Sep. 1996	12 Nov. 1997
Poland	24 Sep. 1996	25 May 1999
Republic of Korea	24 Sep. 1996	24 Sep. 1999
Romania	24 Sep. 1996	5 Oct. 1999
Russian Federation	24 Sep. 1996	30 Jun. 2000
Slovakia	30 Sep. 1996	3 Mar. 1998
South Africa	24 Sep. 1996	30 Mar. 1999
Spain	24 Sep. 1996	31 Jul. 1998
Sweden	24 Sep. 1996	2 Dec. 1998
Switzerland	24 Sep. 1996	1 Oct. 1999
Turkey	24 Sep. 1996	16 Feb. 2000
Ukraine	27 Sep. 1996	23 Feb. 2001
United Kingdom	24 Sep. 1996	6 Apr. 1998
United States of America	24 Sep. 1996	
Viet Nam	24 Sep. 1996	10 Mar. 2006

35 Ratified **41** Signed **3** Not signed **9** Not ratified

STATUS OF SIGNATURE AND RATIFICATION OF THE TREATY (31 DECEMBER 2011)

State	Date of Signature	Date of Ratification
Afghanistan	24 Sep. 2003	24 Sep. 2003
Albania	27 Sep. 1996	23 Apr. 2003
Algeria	15 Oct. 1996	11 Jul. 2003
Andorra	24 Sep. 1996	12 Jul. 2006
Angola	27 Sep. 1996	
Antigua and Barbuda	16 Apr. 1997	11 Jan. 2006
Argentina	24 Sep. 1996	4 Dec. 1998
Armenia	1 Oct. 1996	12 Jul. 2006
Australia	24 Sep. 1996	9 Jul. 1998
Austria	24 Sep. 1996	13 Mar. 1998
Azerbaijan	28 Jul. 1997	2 Feb. 1999
Bahamas	4 Feb. 2005	30 Nov. 2007
Bahrain	24 Sep. 1996	12 Apr. 2004
Bangladesh	24 Oct. 1996	8 Mar. 2000
Barbados	14 Jan. 2008	14 Jan. 2008
Belarus	24 Sep. 1996	13 Sep. 2000
Belgium	24 Sep. 1996	29 Jun. 1999
Belize	14 Nov. 2001	26 Mar. 2004
Benin	27 Sep. 1996	6 Mar. 2001
Bhutan		
Bolivia (Plurinational State of)	24 Sep. 1996	4 Oct. 1999
Bosnia and Herzegovina	24 Sep. 1996	26 Oct. 2006
Botswana	16 Sep. 2002	28 Oct. 2002
Brazil	24 Sep. 1996	24 Jul. 1998
Brunei Darussalam	22 Jan. 1997	
Bulgaria	24 Sep. 1996	29 Sep. 1999
Burkina Faso	27 Sep. 1996	17 Apr. 2002
Burundi	24 Sep. 1996	24 Sep. 2008
Cambodia	26 Sep. 1996	10 Nov. 2000
Cameroon	16 Nov. 2001	6 Feb. 2006
Canada	24 Sep. 1996	18 Dec. 1998
Cape Verde	1 Oct. 1996	1 Mar. 2006
Central African Republic	19 Dec. 2001	26 May 2010
Chad	8 Oct. 1996	
Chile	24 Sep. 1996	12 Jul. 2000
China	24 Sep. 1996	
Colombia	24 Sep. 1996	29 Jan. 2008
Comoros	12 Dec. 1996	
Congo	11 Feb. 1997	
Cook Islands	5 Dec. 1997	6 Sep. 2005
Costa Rica	24 Sep. 1996	25 Sep. 2001
Côte d'Ivoire	25 Sep. 1996	11 Mar. 2003
Croatia	24 Sep. 1996	2 Mar. 2001

State	Date of Signature	Date of Ratification
Cuba		
Cyprus	24 Sep. 1996	18 Jul. 2003
Czech Republic	12 Nov. 1996	11 Sep. 1997
Democratic People's Republic of Korea		
Democratic Republic of the Congo	4 Oct. 1996	28 Sep. 2004
Denmark	24 Sep. 1996	21 Dec. 1998
Djibouti	21 Oct. 1996	15 Jul. 2005
Dominica		
Dominican Republic	3 Oct. 1996	4 Sep. 2007
Ecuador	24 Sep. 1996	12 Nov. 2001
Egypt	14 Oct. 1996	
El Salvador	24 Sep. 1996	11 Sep. 1998
Equatorial Guinea	9 Oct. 1996	
Eritrea	11 Nov. 2003	11 Nov. 2003
Estonia	20 Nov. 1996	13 Aug. 1999
Ethiopia	25 Sep. 1996	8 Aug. 2006
Fiji	24 Sep. 1996	10 Oct. 1996
Finland	24 Sep. 1996	15 Jan. 1999
France	24 Sep. 1996	6 Apr. 1998
Gabon	7 Oct. 1996	20 Sep. 2000
Gambia	9 Apr. 2003	
Georgia	24 Sep. 1996	27 Sep. 2002
Germany	24 Sep. 1996	20 Aug. 1998
Ghana	3 Oct. 1996	14 Jun. 2011
Greece	24 Sep. 1996	21 Apr. 1999
Grenada	10 Oct. 1996	19 Aug. 1998
Guatemala	20 Sep. 1999	
Guinea	3 Oct. 1996	20 Sep. 2011
Guinea-Bissau	11 Apr. 1997	
Guyana	7 Sep. 2000	7 Mar. 2001
Haiti	24 Sep. 1996	1 Dec. 2005
Holy See	24 Sep. 1996	18 Jul. 2001
Honduras	25 Sep. 1996	30 Oct. 2003
Hungary	25 Sep. 1996	13 Jul. 1999
Iceland	24 Sep. 1996	26 Jun. 2000
India		
Indonesia	24 Sep. 1996	
Iran (Islamic Republic of)	24 Sep. 1996	
Iraq	19 Aug. 2008	
Ireland	24 Sep. 1996	15 Jul. 1999
Israel	25 Sep. 1996	

155 Ratified **182** Signed **14** Not signed **41** Not ratified

State	Date of Signature	Date of Ratification
Italy	24 Sep. 1996	1 Feb. 1999
Jamaica	11 Nov. 1996	13 Nov. 2001
Japan	24 Sep. 1996	8 Jul. 1997
Jordan	26 Sep. 1996	25 Aug. 1998
Kazakhstan	30 Sep. 1996	14 May 2002
Kenya	14 Nov. 1996	30 Nov. 2000
Kiribati	7 Sep. 2000	7 Sep. 2000
Kuwait	24 Sep. 1996	6 May 2003
Kyrgyzstan	8 Oct. 1996	2 Oct. 2003
Lao People's Democratic Republic	30 Jul. 1997	5 Oct. 2000
Latvia	24 Sep. 1996	20 Nov. 2001
Lebanon	16 Sep. 2005	21 Nov. 2008
Lesotho	30 Sep. 1996	14 Sep. 1999
Liberia	1 Oct. 1996	17 Aug. 2009
Libya	13 Nov. 2001	6 Jan. 2004
Liechtenstein	27 Sep. 1996	21 Sep. 2004
Lithuania	7 Oct. 1996	7 Feb. 2000
Luxembourg	24 Sep. 1996	26 May 1999
Madagascar	9 Oct. 1996	15 Sep. 2005
Malawi	9 Oct. 1996	21 Nov. 2008
Malaysia	23 Jul. 1998	17 Jan. 2008
Maldives	1 Oct. 1997	7 Sep. 2000
Mali	18 Feb. 1997	4 Aug. 1999
Malta	24 Sep. 1996	23 Jul. 2001
Marshall Islands	24 Sep. 1996	28 Oct. 2009
Mauritania	24 Sep. 1996	30 Apr. 2003
Mauritius		
Mexico	24 Sep. 1996	5 Oct. 1999
Micronesia (Federated States of)	24 Sep. 1996	25 Jul. 1997
Monaco	1 Oct. 1996	18 Dec. 1998
Mongolia	1 Oct. 1996	8 Aug. 1997
Montenegro	23 Oct. 2006	23 Oct. 2006
Morocco	24 Sep. 1996	17 Apr. 2000
Mozambique	26 Sep. 1996	4 Nov. 2008
Myanmar	25 Nov. 1996	
Namibia	24 Sep. 1996	29 Jun. 2001
Nauru	8 Sep. 2000	12 Nov. 2001
Nepal	8 Oct. 1996	
Netherlands	24 Sep. 1996	23 Mar. 1999
New Zealand	27 Sep. 1996	19 Mar. 1999
Nicaragua	24 Sep. 1996	5 Dec. 2000
Niger	3 Oct. 1996	9 Sep. 2002
Nigeria	8 Sep. 2000	27 Sep. 2001
Niue		
Norway	24 Sep. 1996	15 Jul. 1999
Oman	23 Sep. 1999	13 Jun. 2003
Pakistan		
Palau	12 Aug. 2003	1 Aug. 2007
Panama	24 Sep. 1996	23 Mar. 1999
Papua New Guinea	25 Sep. 1996	
Paraguay	25 Sep. 1996	4 Oct. 2001
Peru	25 Sep. 1996	12 Nov. 1997
Philippines	24 Sep. 1996	23 Feb. 2001
Poland	24 Sep. 1996	25 May 1999
Portugal	24 Sep. 1996	26 Jun. 2000
Qatar	24 Sep. 1996	3 Mar. 1997
Republic of Korea	24 Sep. 1996	24 Sep. 1999
Republic of Moldova	24 Sep. 1997	16 Jan. 2007
Romania	24 Sep. 1996	5 Oct. 1999
Russian Federation	24 Sep. 1996	30 Jun. 2000
Rwanda	30 Nov. 2004	30 Nov. 2004
Saint Kitts and Nevis	23 Mar. 2004	27 Apr. 2005
Saint Lucia	4 Oct. 1996	5 Apr. 2001
Saint Vincent and the Grenadines	2 Jul. 2009	23 Sep. 2009
Samoa	9 Oct. 1996	27 Sep. 2002
San Marino	7 Oct. 1996	12 Mar. 2002
Sao Tome and Principe	26 Sep. 1996	
Saudi Arabia		
Senegal	26 Sep. 1996	9 Jun. 1999
Serbia	8 Jun. 2001	19 May 2004
Seychelles	24 Sep. 1996	13 Apr. 2004
Sierra Leone	8 Sep. 2000	17 Sep. 2001
Singapore	14 Jan. 1999	10 Nov. 2001
Slovakia	30 Sep. 1996	3 Mar. 1998
Slovenia	24 Sep. 1996	31 Aug. 1999
Solomon Islands	3 Oct. 1996	
Somalia		
South Africa	24 Sep. 1996	30 Mar. 1999
South Sudan[a]		
Spain	24 Sep. 1996	31 Jul. 1998
Sri Lanka	24 Oct. 1996	
Sudan	10 Jun. 2004	10 Jun. 2004
Suriname	14 Jan. 1997	7 Feb. 2006
Swaziland	24 Sep. 1996	

State	Date of Signature	Date of Ratification
Sweden	24 Sep. 1996	2 Dec. 1998
Switzerland	24 Sep. 1996	1 Oct. 1999
Syrian Arab Republic		
Tajikistan	7 Oct. 1996	10 Jun. 1998
Thailand	12 Nov. 1996	
The former Yugoslav Republic of Macedonia	29 Oct. 1998	14 Mar. 2000
Timor-Leste	26 Sep. 2008	
Togo	2 Oct. 1996	2 Jul. 2004
Tonga		
Trinidad and Tobago	8 Oct. 2009	26 May 2010
Tunisia	16 Oct. 1996	23 Sep. 2004
Turkey	24 Sep. 1996	16 Feb. 2000
Turkmenistan	24 Sep. 1996	20 Feb. 1998
Tuvalu		
Uganda	7 Nov. 1996	14 Mar. 2001
Ukraine	27 Sep. 1996	23 Feb. 2001
United Arab Emirates	25 Sep. 1996	18 Sep. 2000
United Kingdom	24 Sep. 1996	6 Apr. 1998
United Republic of Tanzania	30 Sep. 2004	30 Sep. 2004
United States of America	24 Sep. 1996	
Uruguay	24 Sep. 1996	21 Sep. 2001
Uzbekistan	3 Oct. 1996	29 May 1997
Vanuatu	24 Sep. 1996	16 Sep. 2005
Venezuela (Bolivarian Republic of)	3 Oct. 1996	13 May 2002
Viet Nam	24 Sep. 1996	10 Mar. 2006
Yemen	30 Sep. 1996	
Zambia	3 Dec. 1996	23 Feb. 2006
Zimbabwe	13 Oct. 1999	

[a]Annex 1 to the Treaty provides the list of States at the time of its conclusion. South Sudan has since been recognized by the United Nations as an independent State.

STATUS OF SIGNATURE AND RATIFICATION OF THE TREATY BY GEOGRAPHICAL REGION (31 DECEMBER 2011)

Africa (54 States)

51 Signatories
40 Ratifiers

Middle East and South Asia (26 States)

21 Signatories
15 Ratifiers

Eastern Europe (23 States)

23 Signatories
23 Ratifiers

North America and Western Europe (28 States)

28 Signatories
27 Ratifiers

Latin America and the Caribbean (33 States)

31 Signatories
30 Ratifiers

South-East Asia, the Pacific and the Far East (32 States)

28 Signatories
20 Ratifiers