CTBTO PREPARATORY COMMISSION | preparatory commission for the comprehensive nuclear-test-ban treaty organization

On-site inspections the ultimate verification measure

Having existed for a mere six weeks in 2008, the State of Arcania was short-lived. The fictitious state helped to test on-site inspections, a key element of a global alarm system that monitors the Earth for signs of nuclear explosions. The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is mandated to build this system to verify States' compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

On-site inspections (OSI) complement the verification regime's other elements: the International Monitoring System with its network of 337 facilities, the International Data Centre with its extensive data analysis capacities, and the Global Communications Infrastructure.

Facts gathered on the ground help establish whether a nuclear explosion has indeed taken place.

Final verification measure

On-site inspections can be invoked only after the Treaty's entry into force. A Member State may request an inspection should the analysis of monitoring data indicate that a nuclear explosion was carried out in violation of the CTBT. Facts gathered directly on the ground during an inspection will help States to establish whether or not a nuclear explosion did indeed take place. Thus, on-site inspections constitute the final verification measure under the Treaty.

First comprehensive inspection simulation

Over the years, the CTBTO has tested several of the elements of an OSI in different exercises. These efforts culminated in the Integrated Field Exercise in 2008, IFE08, in Kazakhstan. For the first time, the CTBTO simulated an entire on-site inspection, from launching procedures in Vienna to the actual inspection on the ground and the submission of inspection reports.

THE INTEGRATED FIELD EXERCISE 2008 TOOK PLACE IN THE STEPPE IN NORTHERN KAZAKHSTAN.

ON-SITE INSPECTION TIMELINES

INSPECTORS BUILT THEIR OWN CAMP FACILITIES.

CTBTO COULD COUNT ON LOGISTICAL SUPPORT FROM THE GOVERNMENT OF KAZAKHSTAN.

IFE08 was the biggest ever single project in the CTBTO's history. Never before had so many experts and scientists gone to the field for such a long period of time. Almost 200 international experts, CTBTO staff, support personnel, observers, evaluators and media representatives participated in the exercise. Over 50 tonnes of equipment were shipped to a remote location in Kazakhstan with the next town a three-hour car journey away. The exercise lasted more than five weeks, with a month spent in the Kazakh steppe.

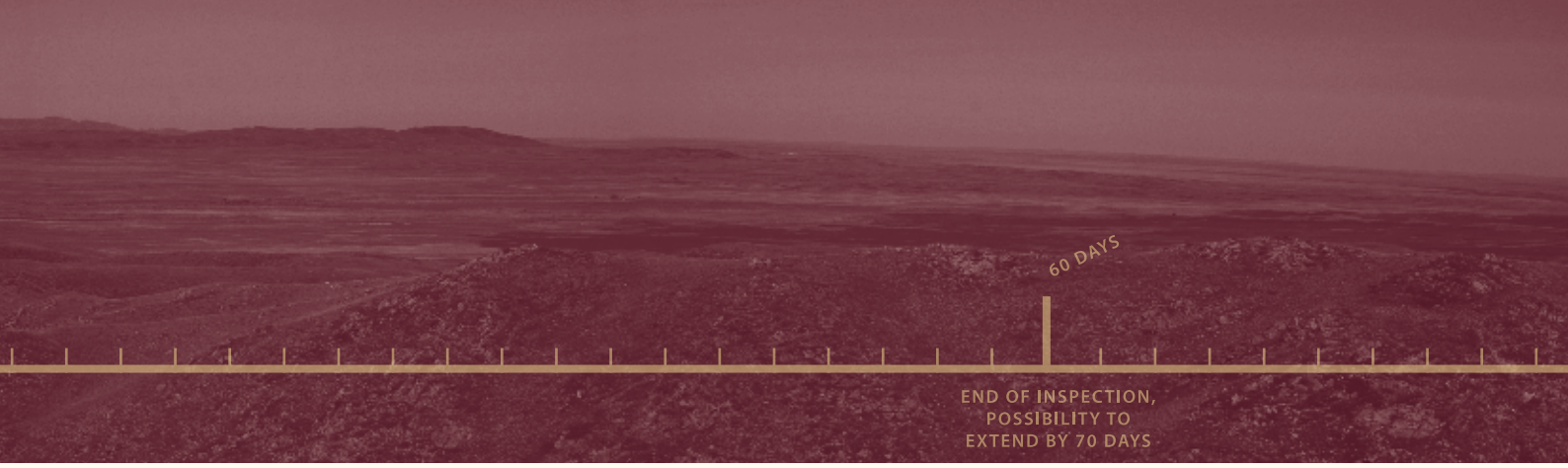
Realistic scenario and setting

With a suspected Treaty violation by the fictitious State of Arcania, surrogate inspectors had a realistic scenario on their hands. The inspection area was located inside the former Soviet Union nuclear test site at Semipalatinsk in Kazakhstan, which provided an authentic setting for a simulation. Between 1949 and 1989, over 450 nuclear explosions were carried out at this site.

THE EXERCISE CAMP WAS COMPLETELY SELF-SUFFICIENT, INCLUDING INDEPENDENT COMMUNICATIONS SETUPS.

With 200 personnel and 50 tonnes of equipment sent to a remote location in Kazakhstan for an entire month, IFE08 was the biggest ever single project in the CTBTO's history.

The game scenario itself was as realistic a setting as possible. CTBTO staff and international experts assumed the roles of both CTBTO inspectors and representatives of Arcania, the inspected State Party. Important negotiation skills could thus be tested while finding a balance between an effective inspection and protecting the inspected State Party's national interests.



CTBTO STAFF AND INTERNATIONAL EXPERTS PLAYED THE ROLES OF INSPECTORS AND INSPECTED STATE PARTY REPRESENTATIVES.

INSPECTORS USED VISUAL OBSERVATION TECHNIQUES PRIMARILY DURING THE FIRST PHASE OF THE INSPECTION.

Developing guiding documents

The CTBT provides basic guidelines on all aspects of an inspection: its initiation and launch, its methods and techniques, as well as its reporting tools. These guidelines, however, are not detailed enough. When finalized, the OSI Operational Manual will be the document in which States flesh out the details for the implementation of relevant Treaty provisions. Work on the OSI Manual has reached a stage where practical application in an exercise setting was expected to provide the necessary insights to advance the document. A dedicated test manual was therefore created for IFE08.

Specific requirements

The Treaty prescribes unambiguous specifications for a number of issues:

- Timelines are very strict. For launch procedures they are measured in hours and days. The first phase of an inspection must be concluded within 25 days from the approval of the inspection. A full inspection can last up to 60 days, but may be extended to a maximum of 130 days if drilling is required.

- The inspection area can be no bigger than 1000 square kilometres. The area is identified based on analysis of monitoring data.

- The inspection team cannot exceed 40 members at any time during the inspection. Team members may change during the cause of the inspection depending on the required technical expertise.

EVERYONE WORKING INSIDE THE INSPECTION AREA WITHIN THE FORMER NUCLEAR TEST SITE HAD TO UNDERGO RADIATION PROTECTION PROCEDURES.

Previous OSI exercises

Kazakhstan 1999 : Tested visual observation and seismic techniques.

Austria 2000 : Tested seismic aftershock monitoring following an earthquake south of Vienna.

Kazakhstan 2002 : Simulated techniques of the initial inspection period.

Slovakia 2004 : Refined seismic aftershock monitoring.

Kazakhstan 2005 : Tested overflights and radiation monitoring.

Croatia 2006 : Streamlined logistics, in particular base of operations build-up and management.

Ukraine 2007 : Tested procedures for radiation measurements.

IFE08 adopted all these requirements. The inspection simulation lasted some 20 days and was conducted in an area that measured 1000 square kilometers. For the entire duration of the simulation, the inspection team included no more than 40 members at any given time.

Initial inspection period

An OSI becomes increasingly more intrusive. Typical techniques during the initial inspection period are:

- Visual observation to detect anomalies on the surface.
- Radiation monitoring to identify elevated gamma radiation and the emitting substances.
- Environmental sampling and analysis to detect radioactive particles and noble gases.
- Seismic aftershock monitoring to identify geological changes in the underground.

These techniques enable an inspection team to become acquainted with the area and identify locations for further examination.

IFE08 applied all of these techniques. The inspection team did not identify any clear signs of a nuclear explosion, but singled out several areas of interest that it decided would need further scrutiny. Consequently, the team recommended the inspection should continue with more intrusive techniques.

More intrusive techniques during continuation period

During the continuation period, the second phase of the inspection, inspectors use the more intrusive geophysical methods. These techniques are time consuming and cover very limited areas. Inspection methods include:

CLOSE TO 30 SEISMIC MINI ARRAYS PROVIDED DATA ON SEISMIC AFTERSHOCKS IN THE GROUND.

INSPECTORS COLLECT SOIL SAMPLES FOR RADIATION ANALYSIS.

GEOPHYSICISTS PREPARE FOR AIR-BORNE MAGNETIC FIELD MEASUREMENTS.

- Mapping the Earth's magnetic field from the air and on the ground to identify deviations caused by iron-containing objects in the ground.
- Measuring the ground's electrical properties to detect metal objects and identify possible disturbances in the ground.
- Using ground penetrating radar to locate objects buried in the ground.

These techniques help to locate features of possible nuclear explosions conducted underground. Such features include traces of the infrastructural setup for the explosion or changes in the underground geology that are not visible from the surface.

In addition to applying geophysical techniques, the IFE08 inspection team conducted air sampling in the ground for the first time under field conditions. This technique, which is normally applied during the initial inspection period, helps to detect traces of the radioactive noble gas Argon 37 which does not occur naturally. It is only found after a nuclear explosion and would be a clear indicator that a nuclear explosion has indeed taken place.

Size of inspection area

The Treaty stipulates that the inspection area should not exceed 1000 square kilometres. Monitoring data and their analysis contribute to meeting this requirement. They help to reduce the uncertainty of estimating the location of a suspicious event. An area of 1000 square kilometres, which compares to the territorial size of a big city like Berlin, is still a large area for an on-site inspection.

The Integrated Field Exercise 2008 provided additional attestation for the verifiability of the CTBT.

No evidence for nuclear explosion

The IFE08 surrogate inspectors travelled extensively throughout the inspection area, using all possible technical means at their disposal. However, the inspection simulation unearthed none of the usual tell-tale signs of a nuclear explosion. Arcania's claim that an earthquake had caused the data which had suggested a nuclear explosion was confirmed.

Lessons learned to give directions for future work

The fictitious State of Arcania ceased to exist when the exercise ended. Its existence provided an opportunity to establish a clear picture of where the CTBTO stands in terms of preparing for a functioning and operational on-site inspection regime as the ultimate element of the CTBT global alarm system. Lessons learned from this endeavour will now be identified, providing directions for future work. Going full circle, the outcome of this process will be tested in yet another field exercise in a few years to come.

Verifiability of the CTBT

The successful completion of the exercise demonstrated the organization's capacity to launch and conduct an effective on-site inspection. It illustrated that the CTBTO has come a long way in preparing for the Treaty's entry into force.

The Integrated Field Exercise 2008 provided additional attestation for the verifiability of the CTBT. It sent out a clear message that on-site inspections as the final verification measure under the Treaty are a strong and reliable deterrent to any potential violator of the nuclear test ban.

THE TEAM SAMPLED AIR IN THE GROUND TO LOOK FOR THE NOBLE GAS ARGON.

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Printed in Austria, April 2009