

# CTBT: CONFIDENCE BUILDING MEASURES AND ON-SITE ACTIVITIES

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*Technical Report*

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13. ABSTRACT (Maximum 200 words) <p>This report examines the role and likely effectiveness of a range of proposed and additional Confidence Building Measures (CBMs) and On-Site Inspections to the Comprehensive Test Ban Treaty (CTBT). It also identifies what personnel involved in CBM and/or OSI need to be able to do; what means need to be available to them; and what constraints will limit their activities. Additionally, the report developed a structure that will allow the evaluation of various activities that will be performed during the first 25 days of an OSI.</p> <p>The report first concentrates on CBM and identifies additional CBM that may be useful in support of the CTBT. It also identifies CBM reporting procedures. Next the report looks at OSI and develops the functions, qualifications and training that will be required of an CTBT inspector. It also examines various compositions of OSI Teams and identifies inspector specialties. The report also contains the paper with associated briefing slides presented by DSWA at the first OSI Workshop in Vienna.</p> <p>Included in this report is a comparison of OSI inspection measures between the CTBT and other treaties.</p>			
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## PREFACE

The analysis and recommendations contained in this report were prepared primarily by BDM International, Inc. in conjunction with Science & Engineering Associates, Inc. (SEA) during the period September 1996 through December 1997. ( In December 1997, BDM International, Inc was purchased by TRW.) The work was performed for the Defense Special Weapons Agency (DSWA) and was funded under Contract No. DSWA01-96-G-0062.

Mr. Jerry R. Stockton was the Program Manager for this work; Mr. Roy S. Finno was the principal investigator. BDM analysis was performed by Mr. Sean Teague and supporting analysis by SEA was performed by Mr. Randy Beaty. The analytic effort was monitored by Mr. Michael Shore, DSWA.

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## **SECTION 1**

### **INTRODUCTION**

#### **1.1 BACKGROUND.**

On September 10, 1996 the United Nations General Assembly voted to adopt the Comprehensive Test Ban Treaty (CTBT). President Clinton signed the treaty on September 24, 1996 and the CTBT currently is awaiting ratification by the Senate. It is hoped that the treaty will enter into force in late CY 1998 or early CY 1999. In the meantime, the U.S. User and R&D Communities are assessing and developing the means by which the United States can: exercise all of its rights under the terms of a CTBT; comply with all of its obligations under the terms of the CTBT; and verify compliance with the terms of the treaty by other countries who are party to the CTBT.

Previous work performed for the Defense Special Weapons Agency (DSWA) in support of the CTBT included developing scenarios for evasively conducting underground nuclear tests; identifying the signatures such a test was likely to produce; and assessing the likely effectiveness of proposed architectures for an International Monitoring System (IMS). In addition, the work identified measures the violators might use in order to make the detection and identification of the testing more difficult.

The objectives of the current work is to perform analyses that will:

- Provide insights to and/or confirm the beliefs of U.S. government policy makers, negotiators, and other officials with regard to the role and likely effectiveness of a range of proposed and additional confidence building measures (CBMs) and on-site inspections (OSI) conducted under the auspices of the CTBT.
- Identify what personnel involved in CBMs and/or OSI need to be able to do; what means need to be available to them; and what constraints might be placed on their activities.

- 
- Develop a structure that will allow the evaluation of the various activities and processes that will be involved in CBMs and OSI.
  - Develop recommendations for equipment, procedures and training related to CBMs and OSI.

## **1.2 ANALYTICAL APPROACH.**

The Defense Special Weapons Agency is represented on the Verification and Monitoring Task Force's (VMTF) Confidence Building Measures and On-Site Inspection sub-groups. DSWA decided that the most efficient way for the BDM Team to meet the objectives of this contract was to provide technical support to the DSWA representative to the CBM and OSI sub-groups. In this way, DSWA would insure that it was addressing the most important and time sensitive issues relating to the CTBT.

The BDM Team performed the following activities in support of DSWA requirements:

- Provided papers on various subjects, at DSWA's direction, for submission formally to the CBM and OSI subgroups or informally to selected members of the subgroups.
- Provided support, through DSWA to the CTBT Interagency Working Group, in the form of papers on subjects relating to the CTBT.
- Analyzed functions, qualifications, and training required of CTBT inspectors and provided our results in a series of papers to DSWA.
- Analyzed activities required during the first 25 days of an OSI. This work culminated in a paper, with associated briefing materials, which was presented to the OSI Workshop in Vienna, Austria by DSWA.
- Reviewed and provided comments on documents provided by other members of the CBM and OSI subgroups.

Depending on the specifics of the tasking and the amount of time allowed for the completion of each task, papers prepared for DSWA were of three types: briefings; short “think pieces” where problems or key issues were identified; and finished pieces with detailed conclusions and accompanying rationale.

### **1.3 OVERVIEW OF THE REPORT.**

The remaining two sections of this report address work performed on Confidence Building Measures and On-Site Inspections activities. The key papers prepared during this effort by the BDM Team are contained in the appendices.

The organization of each of the remaining sections is similar. There is a brief description of the work performed, the reasons behind the work (if applicable); and key conclusions/observations noted. Papers referenced in the discussion will be found in the appendices. In essence, the critical part of this final report are the papers contained in the appendices. The material in Sections 2 and 3 places these papers in perspective and assists the reader in understanding why these reports were prepared.

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## **SECTION 2**

### **CONFIDENCE BUILDING MEASURES**

#### **2.1 INTRODUCTION.**

Initial work performed by the BDM Team under this contract was related to Confidence Building Measures. The reason for the initial emphasis on CBMs was simply that the CBM sub-group organized faster and had several short suspense requirements imposed on it by the Verification Monitoring Task Force.

#### **2.2 KEY ISSUES.**

There are four specific CBMs contained in Part III of the Protocol to the Comprehensive Test Ban Treaty. These CBMs deal with: reporting requirements for large scale chemical explosions (two separate measures); voluntary visits to sites where large scale explosions have or may occur; and potential calibration explosions for purposes of calibrating the International Monitoring System.

As one of its initial tasks, the BDM Team developed a series of complimentary confidence building measures that had a goal to increase transparency. These CBMs were briefed to DSWA (see Appendix A). Further investigation of these new CBMs was halted as it was quickly decided by the CBM sub-group that pursuing any new CBMs was a 'dead-end' path and only those CBMs specifically mentioned in the treaty protocol would remain viable.

Our next efforts concentrated on sharpening U.S. thinking on the existing CBMs. Visits were made to the Nuclear Treaty Program Office, Center for Monitoring Research and the U.S. Geological Survey to develop additional information and determine what actions the U.S. would need to take in order to be in compliance with these measures. A white paper entitled, "A Snapshot of Current Thinking on Notification of Chemical Explosions" (Appendix B) was developed and delivered to DSWA. Included in this paper was a description of the data (see Table 2-1) that mining operations would need to make

Table 2-1. Strawman reporting information for confidence building measures.

I. Mine Location
Owner
Nearest town
Coordinates
Other
II. Point(s) of Contact
Name
Mailing address
Phone number
Fax number
E-mail address
III Event Specification
Yield
Location (nearest tenth of a minute)
Time (to nearest 0.1 seconds)
Purpose (fragmentation, move material, etc.)
Depth of burial
IV Explosive Specification
Type
Amount
Detonation type (timing and pattern of the charges)
Configuration (specifics of placement, stemming, etc.)
V. Other
Geological environment
How this shot fits into overall blasting scheme?
Can this detonation be observed?

available to the government, so the U.S. could supply useful verification related information under the CBMs. A follow-up paper was then developed (Appendix C) for the CBM sub-group which identified how information collected in support of CBMs would be reported by the U.S. to the CTBT Permanent Technical Secretariat as required by the treaty. This paper examined such issues as: the type of data that should be collected; how frequently reports should be forwarded to the CTBT Technical Secretariat; and the form (i.e., hard copy, electronic) in which the data should be transmitted.

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Attention then turned to visits permitted under the CBMs. A paper was produced (Appendix D) that identified: a) the criteria that should be used to select facilities to be visited under the CBMs; b) things a team should look for during these visits; and c) the activities a visiting team might perform in conjunction with these visits.

### **2.3 SUMMARY.**

After an initial flurry of activity, interest in CBMs waned and On-Site Inspections activities moved to the forefront. Many of the issues raised in the papers discussed above were never completely resolved. The BDM Team believes that, as a minimum, the U.S. should formulate a position that identifies the information that should be collected from mines to support reporting requirements under the CBMs and should identify the mechanism for collecting this information (i.e., use existing reports; generate new reporting requirements, etc.). Additionally, the agency responsible for collecting and organizing this information must be identified.

## SECTION 3

### ON-SITE INSPECTION ACTIVITIES

#### 3.1 INTRODUCTION.

The majority of the effort under this contract was devoted to analyzing all aspects of On-Site Inspection Activities. Specifically, the following principal areas were addressed:

- Organization and manning of the CTBT permanent staff responsible for OSIs.
- Functions and qualifications of inspectors.
- Training issues.
- Methodology for conducting an inspection.

Taking advantage of previous work performed on other arms control treaties, the BDM Team prepared a white paper entitled "Comparison of On-Site Inspection Measures in the CTBT and other Treaties." (Appendix E). This paper summarized the role played by on-site inspections in earlier treaties and presented a comparison of those measures with the CTBT OSI protocols. By assessing similarities and differences between CTBT and past treaties, lessons can be learned relating to manning, training, inspection activities, and preparation of Operations Manuals for inspections.

The BDM Team also prepared a classified white paper on a seismic event that occurred on the Kola Peninsula. The purpose of this paper was to outline the data collected from the subject event and to address lessons learned regarding information needed to support a request for an on-site inspection. Additionally, this paper identified the type of information that might be available to an OSI team prior to its deploying on an inspection. This white paper entitled "The Kola Peninsula Seismically Identified Disturbance of 29 September 1996" was provided to DSWA under separate cover and subsequently provided by DSWA to other members of the VMTF. This paper is not included with this final report to keep this report unclassified.

### **3.2 ON-SITE INSPECTIONS (GENERAL).**

The BDM Team prepared and delivered a briefing, “CTBT OSI Concept of Operations Issues,” (see Annex F, page F-1) to the VMTF OSI Subgroup Leader on OSI Concept of Operations Issues . The purpose of the briefing was to identify areas that needed to be addressed by the U.S. Government, with emphasis on OSI Inspection Team size and structure, inspector functions and qualifications, and inspector training. This was followed by a white paper, “Some Issues Impacting the Size, Structure and Procedures of the Technical Secretariat Inspection Staff and OSI Teams,” (see Appendix F, page F-6) that discussed in greater detail issues relating to OSI Team size, structure and procedures. Specifically, the paper examines three structures for an OSI staff: a) a large permanent cadre; b) a small administrative staff with reliance placed on augmentees for inspections; and c) a small cadre of permanent inspectors to be supplemented by augmentees on inspections (preferred solution). The paper also discussed the possibility of phasing inspection team members into an inspection area and rotating personnel into and out of the Inspected State Party based on inspection activity and needs.

The BDM Team continued to pursue these subjects and presented a briefing, “CTBT On-Site Inspection Insights,” (see Appendix F, page F-11) to representatives of DOE, ACDA and OSIA. In this briefing we “sized” the permanent OSI staff, contrasted costs and training requirements of a permanent staff vis-à-vis augmentee inspectors; looked at alternate OSI team composition; identified Port of Entry activities; and made an estimate of the size of a “bare bones” inspection team.

As a distinct effort, the BDM Team collaborated with representatives from DSWA and OSIA to make an estimate of permanent party staffing requirements. This was done at the request of the chairman of the OSI subgroup. The results of this effort are contained in Appendix G.

### 3.3 TRAINING.

The BDM Team devoted extensive time studying the training requirements for CTBT inspectors. Initially, a short paper entitled, "Methodology for Determining CTBT Training Requirements" (see Annex H, page H-1) was prepared that discussed the Chemical Weapon Convention's (CWC) approach to training and identified how this approach could be adapted to CTBT requirements. This paper was followed by a briefing, "CTBT Training Requirements" (see Annex H, page H-4) to the VMTF OSI Subgroup Leader. This briefing identified key training issues for on-site inspection personnel. It was well received and circulated among other members of the OSI subgroup.

The BDM Team expended considerable effort in identifying inspector functions, specialties and team composition. Appendix I contains three papers on the subject. The first paper, "CTBT Inspector Functions," (page I-1) uses various sources (the CTBT and its protocols, work performed by other contractors for DSWA, and previous work performed by the BDM Team on other arms control treaties) to identify functions that a CTBT OSI inspector would be required to perform. In the second paper, "Inspector Specialties and Related Functions," (page I-22) these functions are grouped into specialties and an "unconstrained" straw man inspection team was developed (Table 3-1). Both of these papers are used extensively by various members of the OSI subgroup and are considered to be the "bible" as they relate to inspector functions.

The final paper contained in Appendix I, "Preliminary Determination of Qualifications and Training for Inspectors Required to Capture Short-Lived Phenomenology," (page I-43) explores inspection team composition in more detail. It examines a "bare bones" team postulated by DOE (see Table 3-2) as well as the maximum allowed by treaty 40 person inspection team (see Table 3-3), developed from the unconstrained team identified above. It should be noted that the 'bare bones' team is considered to be the smallest team that could technically perform an inspection; however, there is considerable doubt as to whether this minimal inspection team would be effective or efficient.

Table 3-1. Unconstrained list of potential OSI team members.

**OPERATIONAL**

- Team Chief
- Deputy Team Chief
- Functional Team Leader
  - Overflight
  - Ground Survey
  - Underground Survey
  - Radiation
  - Drilling
- Driller
- Drill Helpers
- Geologist/Geophysicist/Geotechnical Eng
- Interviewer
- Mining Engineer
- Photographer (still and video)
- Photographic Interpreter
- Radiation Sampler
- Sample Analysis Expert
- Records Reviewer
- Surveyor
- Sensor Technician
  - Seismic
  - Radiation
  - Magnetic Field Mapping
  - Ground Penetrating Radar
  - Gravitational Field Mapping
  - Electrical Conductivity
  - Other multispectral
- Data Reduction Technician
  - Seismic
  - Magnetic Field Mapping
  - Ground Penetrating Radar
  - Gravitational Field Mapping
  - Electrical Conductivity

**ADMINISTRATION/LOGISTICS**

- Administration Team Leader
- Logistics Team Leader
- Aircrew
- Clerk/Typist
- Communication
- Driver
- Linguist
- Maintenance (Repair) Technician
  - Vehicle
  - Computer
  - Sensor
  - Communications
  - Radiation
  - Multispectral
  - Aircraft
  - Other (e.g., generator)
- Medical
- Safety
  - Mine Safety
  - Radiation
- Sample Handler

Table 3-2. Bare Bones Inspection team.

Primary Personnel <sup>1</sup>	Auxiliary Personnel
3 Geologists	1 Data Management Specialists
1 Seismologist	1 Mining Engineer
1 Radiochemist	1 Seismologist
3 Equipment Technicians (Seismic & Sampling)	1 Radiochemist
1 Health & Safety	2 Linguists
	2 Equipment Technicians
<b>TOTAL: 9</b>	<b>TOTAL: 8</b>

<sup>1</sup> One of these individuals will be designated as team leader.

Table 3-3. 40 person OSI team - initial inspection (Days 1 - 25).

OPERATIONAL		ADMIN/LOG	
Position	Number	Position	Number
Team Chief	1	Admin/Log Team Leader	1
Deputy Team Chief	1	Clerk/Typist	2
Geologist	3	Communication Specialist	1
Seismologist	2	Interpreter	2
Ground Survey Team Leader <sup>1</sup>	1	Maintenance Technician	2
Seismic Technician	10	Health and Safety	1
Underground Survey Team Leader <sup>2</sup>	1	Sample Handler	1
Radiation Team Leader <sup>3</sup>	1		
Radiation Sampler	6		
Sample Analysis Expert <sup>3</sup>	2		
<b>Total</b>	<b>30</b>	<b>Total</b>	<b>10</b>

<sup>1</sup> Geologist/Geophysicist/Geotechnical Engineer

<sup>2</sup> Mining Engineer

<sup>3</sup> Radiochemist

Many issues still remain unresolved relating to inspector functions, qualifications, and specialties as well as OSI team composition. Appendix J contains two papers the BDM Team prepared on the subject. The first, "Unresolved Inspector Issues," (page J-1) discusses 19 of these issues, divided into the following categories: a) issues affecting inspector functions and specialties; b) issues affecting inspection team composition; c) issues affecting inspector qualifications; and d) issues affecting inspector training. The second paper, "On-Site Inspection (OSI) Issues Impacting Inspection Team Composition and Specialties," (page J-9) addresses the following inspection team issues:

- "One size" fits all, 40 person OSI team with no replacements vs. phasing OSI team members into an Inspected State Party when required.
- Equipment repair and maintenance requirements.
- Requirement for a Deputy Team Chief.
- Requirement for dedicated data analysis personnel.
- Inspection team functions vs. Inspected State Party functions.
- Dedicated safety specialist.

For several reasons, the BDM Team feels that it is imperative that the OSI subgroup address the issues identified in both papers and develop positions relating to them. First, these issues will become increasingly important as decisions relating to training are made by the CTBT permanent staff. Second, many of these issues are interrelated. A decision in one area can have significant impact on another area. For example, phasing team members on an inspection allows the placement of the right person with the right skill on the inspection team at the right time. When an inspectors tasks are completed, he will leave and be replaced by another inspector. Use of this approach affects training. Specifically, cross training requirements will be reduced which will reduce the overall cost of inspector training.

Appendix K contains four flow diagrams that depict the relationship among various aspects of inspector training. The first chart shows the relationships among activities in developing a training program. The second identifies the relationships among various training activities that would be performed by the CTBT OSI Permanent Staff. The third shows a process for recruiting, training and hiring inspectors. The last chart basically integrates the first three to show the relationships between selecting, training and qualifying inspectors.

### **3.4 ON SITE INSPECTION WORKSHOP.**

DSWA was invited to make a presentation at the first On-Site Inspection Workshop held in Vienna, Austria in late July/early August 1997. DSWA decided to present a paper that proposed a "systems approach" to the initial phase (Days 1 - 25) of an OSI rather than present a paper on a specific inspection technology or item of equipment. The BDM Team prepared the first draft of the proposed paper entitled "Concept for Narrowing the Inspection Area on an On-Site Inspection."

The objective of this paper was twofold: a.) to propose a methodology independent of any specific scenario, that could be utilized to reduce the size of the inspection area; and b) to explain how inspection activities permitted in the Initial Phase (Days 1-25) of an inspection fit into the proposed methodology. In addition to the draft paper, the BDM Team prepared the briefing presentation for the Workshop. Both the paper and briefing material are found in Appendix L.

### **3.5 BUDGET FOR OSI PERMANENT STAFF.**

The BDM Team, in coordination with representatives from DSWA and ACDA, made a first order estimate of a budget for the OSI Permanent Staff. There were several key assumptions associated with this estimate. Specifically, the CTBT would go into effect in late CY 1998; 20 full time inspectors and 100 augmentees would require training prior to that time; and there would be one OSI performed in CY 1998 and two in each

succeeding year. The budget estimates of \$27.1M in CY 1998 and \$32.7M in the out years along with the appropriate assumptions are contained in Appendix M (page M-1). This estimate raised several issues, the most important of which was equipment costs. The BDM Team, in conjunction with representatives of DSWA and ACDA, performed a more detailed analysis of OSI equipment costs. Equipment was divided into six categories: overflight; remotely deployed sensors; geophysical equipment; analytical equipment; support equipment (base camp) and special equipment. The total estimated cost was \$3.2M - \$3.5M. Details of this cost are also found in Appendix M (page M-3).

### **3.6 OTHER ISSUES.**

During the course of the past year, the Verification and Monitoring Task Force OSI subgroup generated numerous issues relating to the CTBT during their discussions. On several occasions, the BDM Team was tasked to prepare papers on these issues for use by the sub-group. These papers generally did not propose recommendations or draw conclusions, rather they were designed to focus and stimulate discussions. The following seven papers are representative of the work completed by the BDM Team and are contained in Appendix N.

- Procedures for Overflights and Use of Inspection Equipment During Overflights (page N-1)
- On Site Inspection Infrastructure (page N-4)
- Procedures for Certifying Laboratories for Off-Site Analysis (page N-8)
- Calibration, Maintenance and Protection of Inspection Equipment (page N-10)
- Procedures Covering OSI Team Safety and Health, and Confidentiality Issues (page N-12)
- Procedures for Storing and Handling the OSI Data and Samples after the Completion of the Inspection (page N-14)

- Procedures for Storing and Training and Qualifications of Inspectors (page N-16)

### **3.7 OBSERVATIONS.**

The work the BDM Team performed in support of the CTBT is similar to the work we performed for DSWA in support of the Chemical Weapons Convention (CWC). One of the deficiencies we noted during our CWC work was the lack of a systems approach to problem solving. Without a systems approach and a common set of standards, it is difficult to evaluate competing ideas and much unnecessary and duplicative work often results. The DSWA representative to the various CTBT subgroups has continually advocated using a systems approach and the DSWA paper presented during the first OSI Workshop strongly recommended a systems approach to CTBT problems. The BDM Team strongly supports these efforts and believes that DSWA should continue to be an advocate for a systems approach to problem solving in various CTBT related forums.

The DSWA representative to the CBM and OSI subgroups constantly advocated developing a near-term, mid-term, and long-term agenda for these sub-groups. Because of his experience with program management and related activities, the DSWA representative volunteered to take the lead in setting these goals. By establishing a specific agenda, it was felt that the sub-groups would become pro-active rather than reactive and make better use of their scarce resources. The BDM Team supported DSWA and provided several briefings which outlined near, mid and long term goals. We strongly believe that DSWA should continue to pursue developing these types of agendas for the sub-groups.

# APPENDIX A

# Proposed Confidence Building Measures (CBM)

October 9, 1996

# Proposed CBM #1

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- Data exchange provided by States Parties, on a voluntary basis, of national monitoring station information which provides equal transparency at the existing nuclear test sites.

# Proposed CBM #2

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- Conduct voluntary chemical explosive events to help calibrate the national, regional and IMS seismology detection systems.
- Conduct site characterization at/calibration for large scale mining areas within States Parties. (Expansion of existing CBM.)

## Proposed CBM #3

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- Cooperating national facilities shall make data available to the Director General as supplementary information, not for public release, to be used in support of consultation and clarification.
- Provide access to all relevant national facilities data when it can help during consualtation and clarification process, to include commercial satellite and land based systems.

# Proposed CBM #4

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- Provide to the Technical Secretariat relevant information available on possible test preparation activities if related to a suspicious event.
- Provide access, on a voluntary basis, to visit a site on the basis of preparation activities. (Similar to existing CBM for on-site visit to a chemical explosion site.)



# Proposed CBM #5

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- Provide specific technical assistance to any State Party for automated data processing tools to aid in the analysis/interpretation of seismic events.

# Proposed CBM #6

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- Assist, through technology exchange, in the development of national and regional monitoring capabilities to enhance the data available to individual States Parties.

# Proposed CBM #7

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- In support of the consultation and clarification provisions specified in Section C, Article IV of the treaty, perform visits (limited in time, team size and equipment) to obtain clarification concerning non-compliance concerns with the basic obligations of this treaty.

# **APPENDIX B**

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## SNAPSHOT OF CURRENT THINKING ON NOTIFICATION OF CHEMICAL EXPLOSIONS

### BACKGROUND.

During negotiations on a Comprehensive Test Ban Treaty (CTBT), the U.S. proposed a mandatory “baseline” exchange of information on sites—such as mines, other industrial sites, or any other location—within the territory of States Parties where certain large chemical explosions are planned. This position was not accepted. Rather, the CTBT’s Confidence Building Measures (CBM) request voluntary notification of explosions. The specifics of the circumstances when this voluntary proffering of information is desired and the possible specifics of the information are scoped in paragraphs 1 and 2 of Part III of the Protocol to the CTBT (attachment).

Additionally paragraph 4 of Part III of the Protocol raises the possibility of State Parties liaising with the Technical Secretariat to carry out chemical calibration explosions for the purpose of calibrating the International Monitoring System (IMS). This paper does not address the notification or information transfer associated with such a joint effort.

There are two schools of thought within the U.S. with regards to notification/reporting of large chemical explosions. One school feels that since the U.S. pushed for mandatory reporting of chemical explosions, the U.S. should take the lead and make the CBM relating to reporting large chemical explosions mandatory on the U.S. mining industry. By the U.S. showing good faith, the theory goes, other countries would follow the U.S. lead and report large mining explosions. Such continuing reporting is not required for improving calibration of locations from seismic data; one or a few pieces of data from a site is adequate for improved calibration.

The second school of thought is not concerned about future explosions *per se*, but would have existing mines report their three largest explosions. This information would be used for calibrating the location for these sites for the seismic network. New mining sites, once they come on line would be required to report their three largest explosions. This approach basically requires a one time report from mines.

A check with the National Mining Association revealed that mines currently do not report the desired information to the Government that would support the information needs of paragraphs 1 and 2 of Part III of the Protocol.

Both schools of thought agree that any reports required from the mines must not be onerous and only essential information should be collected. “Something that can be reduced to one page” and “easily transmitted over the Internet” appear to be good guidelines. It should also be noted that several U.S. Allies have expressed concern about placing additional reporting requirements on their mines and this concern probably played a role in defeating the U.S. position on mandatory reporting.

## REPORTING INFORMATION.

The following table is a description of the information it is generally believed that mines would need to provide in order to supply useful verification related information and to comply with the information needs specified in paragraphs 1 and 2, Part III of the Protocol.

Sections I and II simply contain information on the mine and the points of contact at the site. Section III contains information regarding the event; while Section IV contains information on the explosive. Most of the data required would be "fill in the blank" or at worst a sentence long. The only reason for having "Purpose" in Section III and "Configuration" in Section IV is that this information is requested under paragraph 1, Part III of the Protocol. It is the "Configuration" requirement that has the potential for making the proposed report longer than one page. Section V contains the "nice to have" information and is not necessary to accomplish the objectives specified above, but is included to identify other information in which interest has been expressed.

Strawman Reporting Information	
I.	Mine Location Owner Nearest town Coordinates Other
II.	Point(s) of Contact Name Mailing address Phone number Fax number E-mail address
III	Event Specification Yield Location (nearest tenth of a minute) Time (to nearest 0.1 seconds) Purpose (fragmentation, move material, etc.) Depth of burial
IV	Explosive Specification Type Amount Detonation type (timing and pattern of the charges) Configuration (specifics of placement, stemming, etc.)
V.	Other Geological environment How this shot fits into overall blasting scheme? Can this detonation be observed?

## **POSSIBLE NEXT STEPS.**

Within the community the next step is to more completely develop the notification process and determine to what use the data will be put. Issues relating to data collection, data use, and data sharing need to be fully explored; some issues are described briefly below.

The National Authority (NA) is ultimately responsible for collecting the data. The issue is what government agency will the NA designate to act in its behalf. (For example, the Commerce Department will collect commercial data for the NA in support of the Chemical Weapons Convention.) While the Bureau of Mines might seem the logical choice, the Bureau's mission has changed significantly during recent government reorganizations. More likely the United States Geological Survey (USGS) is the more appropriate choice; however, this needs to be explored. Both the Bureau and the USGS are in the Department of Interior.

The ultimate use of the explosion data (whether the data is on past, current, or future events) will be to calibrate seismic stations. When the U.S. makes submissions to the Technical Secretariat under the CBM, it should be done in such a way to encourage other countries to make similar submissions. The issue becomes what leverage the U.S. has to encourage other countries to make the voluntary submissions under the CBM.

In principle, the U.S. explosion data could be used to calibrate all seismic stations in the U.S. (Both IMS and U.S. National) for those sites that provided the data. In theory, this improved seismic calibration would reduce any ambiguities that would raise compliance concerns. However, there are several problems. Chief among these is that the IDC would be unable to validate this data. A country could provide inaccurate information (either deliberately or by accident) which would have a detrimental impact on IMS calibration. The IDC might prefer to collect data using the Confidence Building Measures - liaise with a country that has voluntarily provided information on a large chemical explosion and then visit that location for the purposes of validation. If the IDC refused to accept unsubstantiated data for the purposes of validating the IMS locations in the U.S. one would be left with the situation where U.S. national stations would be better calibrated than IMS stations.

A possible alternative would be to establish regional data exchanges. Specifically, the U.S., Canada, and Mexico could exchange seismic data from mine detonations. They could explore ways of validating exchanged data and conduct tests to validate any calibration applied to their seismic systems. Validated data received from a regional agreement might be more palatable to the IDC. Additionally, countries might find regional data exchanges more appealing than proving data directly to the IDC.

# APPENDIX C

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# ***REPORTING PROCEDURES***

## **Introduction**

The language of the Comprehensive Test Ban Treaty (CTBT) suggests that Confidence Building Measures (CBM) be developed to increase the likelihood and perception that States Parties are complying with the requirements of the treaty. For a CBM to be useful to both the CTBT organization and individual States Parties, some standardized method must be developed by which information relating to CBMs is collected and reported. In developing reporting procedures, the assumption was made that data will be collected using one of the four options developed by Bill Leith. These options are: A) use annual mine surveys; B) supplement annual mine surveys with follow up contacts; C) establish a function within the Office of the National Authority (ONA) to solicit this information directly; and D) establish mandatory (via legislation) reporting by mines. Only reporting procedures that can be supported by data collected under one of these postulated options will be recommended.

Additionally, it was assumed that the organization that collects the data will perform a quality assurance check. As a minimum, this should include ensuring that all entries have been completed and the data entries are logical and internally consistent. Although all data will be confirmed by the collecting organization, the Interagency Working Group will be the approving authority on what data is submitted.

## **Confidence Building Measure #1**

This CBM requires notification of any chemical explosion greater than 300 tons of TNT, and if possible, this notification should be provided in advance. Data collected by any of the Options specified above will allow the submission of an annual report. If a more frequent report is desired (i.e., monthly, quarterly) only Options B, C and D would provide the required data and only Option D would insure that the report submitted is complete. Since the purpose of CBMs are to build trust in the treaty, a quarterly report seems to be reasonable compromise between placing additional (i.e., more frequent) reporting requirements on mines and the usefulness of the data to the Technical Secretariat

(TS) and the International Data Center (IDC). Submission of a quarterly report eliminates Option A as a viable data collection measure.

There are three possible format alternatives for the post-event report. The first is a summary report of 300 ton explosions. This report would simply list the location, time, and size of each qualifying detonation in tabular form. On the other extreme, the post-event report could consist of a compilation of the individual reports submitted by the mines on qualifying detonations. A compromise between these two extremes would be to eliminate all data relating to a specific mine (i.e., name, owner, POC etc.) from the reports submitted by the mining industry and to retain only that data pertaining to the detonation. This information would then be compiled and submitted. Negative reports would be submitted. None of these alternatives would require additional manpower.

For advanced notification of 300 ton detonations, only Options B, C and D would collect the required data and only Option D would insure that data on all qualifying events were collected. Due to the vagaries of the mining industry, it is difficult to predict the precise detonation time of a planned explosion very far in advance. Assuming there is no intent to have the mining industry alter operations simply to meet a scheduled detonation time, the actual time of detonation would have to be updated in a follow-on report.

The format of the advanced report would be relatively simple and follow the CBM requirements: location, time, quantity and type of explosive used, as well as the configuration and intended use. The follow-up report - if required - would be an update solely to the time of detonation.

The PREPCOM will determine who will receive the reports. One feasible method of transmission is for the ONA to transfer the report electronically, with concurrent submission of a hard copy, to the designated office in the Technical Secretariat. This duplication of data (hard copy and electronic) will allow for a quality assurance check by the receiving office.

## **Confidence Building Measure #2**

This CBM requests that States Parties, on a voluntary basis, provide an Entry into Force (EIF) report and an annual report on the national use of all other chemical explosions greater than 300 tons of TNT. The discussion for CBM #1 is applicable to this CBM with one exception: all data collection options will allow submission of this annual report.

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### **Confidence Building Measure #3**

This CBM deals with site visits. The assumption is made that the U.S. has decided what type of visit(s) it will support and has “convinced” a mine or other organization to accept this visit. For this CBM, the “report” is a letter of invitation either to the Director General of the CTBT Organization or to the “National Authority” of other States Parties with an information copy to the Director General inviting their representatives to visit sites within the U.S. referred to in CBMs #1 and #2. This letter would contain such information as: location(s) and date(s) of visit; number of personnel invited; activities to be viewed; activities that the visitors will be allowed to perform (e.g., photography) etc. Once the invitation has been accepted, a standard process for coordinating and conducting an international visit will be followed.

### **Confidence Building Measure #4**

This CBM deals with calibration of the International Monitoring System. There are currently many unknowns relating to the calibration explosions specified under CBM #4. Are routine mining explosions acceptable, or are special, singled-fired calibration shots required? Are the explosions monitored on site, in the presence of representatives of other nations? of the CTBT Organization? The answers to these questions and other similar questions are needed before the specifics of the “reporting procedures” for this CBM can be completely determined, however, it is possible to lay out the general format of these “reports”

Regardless of whether the explosion is a routine mining blast or a special calibration shot, the “report” under this CBM would be a letter from the ONA to the Director General indicating the U.S. willingness to carry out a calibration explosion under CBM #4 and stating the terms of reference for this explosion. The letter would specifically invite representatives of the TS to liaise with U.S. personnel. The exact details of the event, the role of the TS, whether on-site monitoring will be allowed etc. will be developed during this liaison and need not be part of the initial letter to the Director General.

A second possibility, under this CBM, would be for the U.S. to provide enhanced details on a past explosion that it believes would be of significant value in calibrating the

monitoring system. The "report" would be similar to the report described for CBM #1 but would contain such additional information as: more precise data on the location of the explosion in time and space; more details regarding the setup of the explosion, (e.g. single shot or ripple fire); timing of the ripple fire; description of the charge array; degree of tamping; and details on site geology. This report would be submitted in both hard copy and electronic format.

A U.S. drafted final report pertaining to the calibration explosion/event could be a third submission under this CBM. This report would undergo the same scrutiny that any U.S. technical report going to an overseas organization. Once approved, the ONA would formally submit this report to the CTBT Organization.

## **Summary**

The above discussion is a preliminary snapshot of the reporting procedures required by the Confidence Building Measures. There are many unanswered questions regarding these CBM. What do they really mean and what do they really require? What data collection effort will be chosen by the U.S.? What calibration activities are allowed? What is an acceptable impact on the U.S. mining community? These questions are all related to one another and a decision on one will impact thinking on the other questions. Consequently the development of reporting procedures, data formats, data collection methods, calibration activities and site visit protocols will be an iterative process.

It should also be noted that the language and content of the Comprehensive Test Ban Treaty (CTBT) consciously draws from the Chemical Weapons Convention (CWC). Consequently, one should look to the Reporting Procedures being developed for the CWC (which goes into effect on 29 April 1997) as a template for the procedures to be developed for the CTBT. Unfortunately, these reporting procedures are currently under negotiations and have not been finalized. Furthermore, in using the CWC as a model, one must keep in mind that the CWC requires mandatory declarations while the CTBT requires voluntary reports. Mandatory declarations imply that any CWC report will be accurate and complete. Under a voluntary reporting system, a CTBT report could be accurate as to the data it presents but incomplete because mines chose not to report qualifying events. Only data collection Option D would insure both accuracy and completeness.

# **APPENDIX D**

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# *On-site Visits Permitted by CTBT Part III Confidence Building Measures (CBM)*

## **Introduction**

The CTBT Confidence Building Measures (See attachment) allow representatives of the Technical Secretariat (TS) to visit a State Party's territory. CBM #3 permits visits on a "voluntary and mutually - acceptable basis" to sites where chemical explosions using 300 tons or greater of TNT- equivalent blasting material occur. CBM #4 allows liaison between States Parties and the Technical Secretariat for the purpose of calibrating the International Monitoring System. Implied in this liaison are visits to sites where calibration explosions will take place.

The purpose of this paper is threefold: a) to identify what criteria the TS should use to select facilities that might be visited under CBM #3; b) to identify what a visiting team should look for during these visits; and c) to identify what activities a visiting team should perform during visits under CBM #4.

## **Background**

The Chemical Weapons Convention (CWC) requires that each country declare its chemical facilities based on prescribed set of guidelines. It then provides for routine inspection of these facilities based on their perceived threat (from Schedule 1 facilities (those that produce toxic chemicals) - through facilities that produce "other discrete organic chemicals"). The greater the risk, the more frequent and lengthy the inspection. The treaty also permits challenge inspections of declared or undeclared facilities as well as inspections for alleged use.

While the "style" of the CTBT closely parallels the CWC, the CTBT has no equivalent to routine inspections under the CWC. However, the procedures, techniques and objectives applicable to routine inspections under the CWC should provide a guide to the types of activities that could be performed during voluntary visits under the CTBT as well as activities that might be conducted under CBM #4. This will be discussed in detail below. Challenge inspections under the CWC are equivalent to On-Site Inspections under the CTBT and are not the subject of this paper.

### **Confidence Building Measure #3 Visits**

One can envision three "types" of visits occurring under CBM #3. States Parties attempting to live up to the spirit of the CTBT might request the TS visit one or more of their mining sites. Their long term goal would be to make these visits "routine" and build transparency into the treaty. A second type visit would be initiated by the TS. Following the concept developed for the CWC, visits would be requested to those activities perceived to pose the greatest threat to the treaty. A third type visit could occur during the Consultation and Clarification process. In order to satisfy non-compliance concerns, a State Party could invite the TS and/or the challenging State Party to visit the site raising those concerns. Each of these visits will be explored in more detail below.

"Routine" visits (i.e., visits initiated by a State Party) should be non-confrontational. During these visits, the TS would try to understand blasting practices (e.g., type explosive used, charge size) normally followed by the mining industry in the country visited. Logistical considerations (e.g., location of the Port of Entry, difficulty in reaching the mining area etc.) would also be noted for future reference.

A visit initiated by the TS poses more difficulties. Under the CWC, States Parties declare their chemical facilities. Using guidance contained in the CWC treaty regarding the number of times a particular facility can be visited in a year and the total number of visits a country has to accept each year, an inspection schedule is developed

The CTBT has no "declared" facilities. (In the CTBT negotiations, the U.S. developed a scheme for declaring mining activities but this approach was not accepted.) Consequently, the TS will have to develop a list of facilities in each State Party. This could be done by requesting that States Parties voluntarily provide this information to the TS, by the TS searching open literature to develop such a list, or by a combination of both approaches. In any event, after the list is developed, the TS will have to develop an algorithm for determining which of these facilities pose the greatest threat to the CTBT. However, since visits are voluntary under CBM #3, a State Party could refuse to accept the visit. Assuming that the visit is permitted, the visiting team will collect the same type of information described above for "routine" visits. In addition, it might also look for

indicators that the site is being used for purposes other than legitimate mining activities. These indicators will be addressed below.

The most challenging visit will be one conducted (if permitted) under the Consultation and Clarification process. During this visit, the TS would be looking for specific indicators that a violation of the CTBT might or has occur. A sampling of these indicators are as follows:

#### FUNDING AND PERSONNEL

- Military Funding
- High Salary
- Funding exceeds product/research output
- Scientist/technician ratio high
- Elite work force/foreign trained
- Foreign Language Competency
- High ratio of military to civilian

#### FACILITIES, SECURITY, AND EQUIPMENT

- Access Control: High wall, guard towers, motion detectors, video cameras, elite security force, badges and clearances
- Advanced software, external data base, ADP Security
- Military with weapons expertise
- High quality cable (large spools)
- Excessive Instrumentation
  - Bunkers outside mines
  - Trailers/skids
- Large diameter drilling equipment
- High grade piping
- High grade welding capability
- Excessive generator capacity
- Mine alcoves that have no apparent purpose
- Extra “safetying” of mine (extra bolts, netting, reinforced concrete etc.)

More than just visual inspection is required to determine whether these indicators are present at a mining site. Records would have to be checked and interviews conducted.

This immediately leads to the question of what activities will be permitted during these visits and will these activities be delineated by the PREPCOM. Specifically, will the activities permitted be left undefined, subject to negotiations between the representatives of the TS and the State Party or will the PREPCOM define activities permitted on visits (e.g., sampling, interviews etc.)

#### **Confidence Building Measure #4**

CBM #4 deals with calibration explosions for the International Monitoring System. Currently, the calibration plan for the International Monitoring System relies on past events not future ones and consequently, visits are not required. However, CBM #4 does not preclude the TS from taking advantage of planned mining explosions in a State Party. Additionally, a State Party may voluntarily conduct an explosion to assist IMS calibration. (In no case will the TS plan, conduct and pay for its own calibration experiments.) In either of these scenarios, the TS might find it necessary to visit the proposed sites of the calibration explosions. During these visits, the TS will, as a minimum, ascertain the details of the calibration explosion. These details would include event information (yield, location, time, depth of burial); explosive information (type, amount, timing pattern, configuration); geological environment etc. Additionally, the TS may wish to install additional seismometers in the State Party to improve the calibration process. If these seismometers are going to remain in place for a period of time, tags and seals will be installed.

Visitation requirements will vary. If the calibration experiment is "piggybacking" on a scheduled mining explosion, one visit by a two man team for two days may be sufficient. If a State Party is planning and conducting a unique calibration experiment for the TS, then several visits by a 5 - 10 person visiting team might be required.

#### **Conclusions**

In contrast to the CWC which contains great detail on visits and inspections, the CTBT is silent as to the composition of the visiting team, the activities it can perform, the equipment it carry etc. The visitation scenarios described above and the activities postulated for the TS appear to be implied by CTBT and were discussed in various papers submitted to the Conference on Disarmament during its negotiation. It would appear to be prudent for the PREPCOM to carefully discussed and define the role of the visiting team

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and its activities to preclude problems after the treaty goes into effect. Since CBM visits have the potential to enhance regard for the treaty, reduce ambiguity and contribute to trust, a broad interpretation on visits appears to be justified.

The number and types of visits permitted under Confidence Building Measures will have an effect on TS staffing. If the CTBT is interpreted to permit a large number of visits, this would of necessity require a larger “inspection staff” within the TS. The repercussions would be greater if, in fact, there is an attempt to minimize the size of the TS. Many people feel that an On-Site inspection would be the exception rather than the rule and thus the requirement for a large, permanent, “inspection staff” is not necessary. Again this spells out the necessity of clearly defining CBM visits during the PREPCOM.

# APPENDIX E

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## *Comparison of On-site Inspection (OSI) Measures in the CTBT and Other Treaties*

### **Summary:**

On-site inspection (OSI) is a critical verification measure of several treaties, and has been incorporated into the Comprehensive Nuclear Test-Ban Treaty (CTBT). This paper includes a summary of the roles played by OSI in previous treaties, and a comparison of those OSI measures to the CTBT OSI protocol. By assessing similarities and differences between proposed OSI under the CTBT and past treaties, lessons can be learned to assist in establishing the final CTBT OSI protocols and in the execution of actual inspections.

This paper briefly compares the CTBT to the following treaties and agreements: the Chemical Weapons Convention (CWC); Antarctic Treaty; Non-Proliferation Treaty (NPT); and the IAEA; Geneva Protocol and the Biological Weapons Convention (BWC); Limited Test Ban Treaty (LTBT) and the Threshold Test Ban Treaty (TTBT); Intermediate-Range Nuclear Forces (INF) Treaty; UN Convention Against Traffic in Narcotic Drugs and Psychotropic Substances; Treaty on Conventional Forces in Europe (CFE); Strategic Arms Reduction Treaty (START); and the Open Skies Treaty. Select examples of OSI similarities and differences are discussed in the following sections (with a principal focus on CTBT versus CWC), and an overview comparison of treaty provisions is provided in the attachment..

The details of the OSI protocol for CTBT will be determined during a PrepCom phase. These deliberations will likely be conducted in a manner similar to the CWC PrepCom, since the CTBT and CWC PREPCOM language is very similar.

### **Similarities:**

The similarities between CTBT OSI and OSI under various previous treaties range from general to specific issues. The issues include General Rules of Verification; Consultation, Clarification, and Inspection Request Activities; Pre-Inspection Activities; Conduct of Inspections; and Post-Inspection Activities.

### General Rules of Verification:

In terms of the general rules, procedures, and organizations for treaty verification and specifically OSI, the CTBT is similar to previous treaties such as the CWC. The organization structure, responsibilities, and relationships among entities such as the Conference of the State Parties, Executive Council, Technical Secretariat, and the Director-General are very similar between the CTBT and CWC. Additionally, the Designation and Selection of Inspectors is similar between the CWC and CTBT in areas of: qualification, regulation, and privileges and immunities. Other similar standing arrangements cover the areas of: Points of Entry (POE); Arrangements for Use of Non-scheduled Aircraft; and Approved Inspection Equipment.

### Consultation, Clarification, and Inspection Activities:

The CTBT provisions for consultation and clarification of compliance concerns are similar to the resolution bodies of the Antarctic Treaty and the CWC. Additionally, while the specific response times may vary between treaties (e.g., CTBT Executive Council has 96 hours to decide on an inspection request versus differing time limits in CWC decision making), the general process of inspection request review is similar. In terms of justifications for inspection requests, both the CWC and CTBT allow for multiple sources of information (ranging from treaty-related information exchanges to information based on national technical means).

Similarly, there are some basic parallels between the pre-inspection, inspection, and post-inspection activities of the CTBT and the CWC. Most of the similar CTBT inspection activities with the CWC center on the CWC's challenge inspection elements. Pre-inspection activities require notifications to the inspected state party, as well as preparations for the specific inspection activities. Aspects of the actual conduct of the inspections are similar in: requirements for host nation support; equipment and logistics issues (e.g., use of hand-held certified equipment); and specific inspection activity protocols (e.g., sampling and analysis procedures). Additionally, the CTBT shares many "general" or overarching inspection protocols or rules such as: the inspected party's right to protect confidential information; the provisions of managed access; and the understanding that the inspection will be conducted in the least intrusive and disruptive manner as possible. In terms of specific OSI activities and data collection tools, the CTBT most closely mirrors the OSI verification measures of the TTBT. In terms of post-inspection requirements, there are

substantial similarities between the CTBT and CWC, such as preparation and submission of preliminary and final inspection reports.

## **Differences:**

### Nature and Frequency of Inspections:

Whereas most treaties with OSI measures include routine inspections as well as challenge inspections (e.g., CWC), the CTBT only includes challenge inspections. Thus, the nature and purpose of the CTBT inspection regime is solely resolution and clarification of a challenge, rather than including routine confirmation and confidence building activities.

Given that CTBT OSI is limited to challenge inspections, the number and frequency of inspections will likely be lower than under a treaty with routine as well as challenge inspections. Additionally, the CTBT protocols emphasize the importance of eliminating frivolous inspections, and include provisions to ensure that inspection requests are thoroughly examined and deliberated. Unlike agreements such as the CWC which have provisions for the Executive Council to vote to *override* a challenge inspection, the CTBT Executive Council is required to secure a minimum 30 of 51 votes to *allow* an inspection. These and other stringent measures - as well as the comprehensive Consultation and Clarification provisions - will also likely contribute to a limited number of actual inspections. Obtaining approval for a challenge inspection under the CTBT would seem to be relatively difficult, especially when compared to the "anytime anywhere" inspections of the Antarctic Treaty or even the requirements of the CWC.

The limit on the number of actual inspections is also driven by inspection cost, time, and scope issues to be addressed later in this section. One would expect that the limited number of inspections would dictate a more *ad hoc* pool of inspectors rather than a permanent professional secretariat as in the CWC.

### Duration and Scope of Inspections:

Some of the critical distinctions between CTBT OSI and OSI in other treaties are centered on the duration and scope of the CTBT inspections. While other treaties include guidance for 24-96 hour inspections (e.g., routine CWC inspections), the CTBT

provisions allow for up to 60 day inspections with the ability to extend inspections an additional 70 days (130 total days).

These longer running inspections also cover a much larger geographic inspection area. While facility inspections under the CWC and special access visits under START cover relatively small geographic areas, CTBT inspections can include up to 1000 km<sup>2</sup>. In line with the large scope of CTBT inspections, the CTBT allows for up to 40 inspectors (with possibly more during drilling) while other treaties (e.g., CWC) limit the inspection team size to 10 individuals.

The duration and size of inspections place a great logistical and financial burden on the inspected state party, and confound issues such as protecting confidential information. The burden on the host country, and the eventual financial burden on the CTBT organization, add further to a focus on conducting an OSI only when necessary to clarify legitimate compliance concerns. Given the high cost of these inspections, preliminary measures such as Consultation and Clarification provisions become increasingly important in order to prevent unnecessary inspections.

#### Unique Inspection Activities, Equipment and Requirements:

Although CTBT inspections share many of the same general rules of conduct and specific inspection tools of other treaties, there are some unique aspects of CTBT inspection activities, equipment, and requirements. These unique activities include particularly intrusive and extensive activities such as drilling to obtain radioactive samples. Additionally, the CTBT allows for overflights of the inspected area, both for orientation and for collection of data (e.g., imagery, gamma spectroscopy). Although overflights are central aspects of treaties such as Open Skies and the Antarctic, this is a unique orientation and data gathering component of a test-ban treaty. The CTBT is also distinct in that OSI provisions allow the inspection team to leave behind seismological equipment after the on-ground inspection. The changing activities during the inspection (e.g., surface sampling, drilling, overflights), and the resulting changes in the number of personnel during the inspection, present unique logistical and financial challenges for the inspected state party and the CTBT organization.

## **Lessons Learned:**

There are general similarities between the CTBT OSI and other treaty OSI measures such as treaty organization, rules of verification, and procedures (e.g., managed access) which carry over from treaties such as the CWC. Additionally, there are specific protocols and procedures which might provide lessons as to effective CTBT OSI (e.g., CWC sampling and analysis procedures, START procedures for POEs, and LTBT / TTBT OSI tools).

Although there are potential "lessons" to be learned from treaties preceding the CTBT, the fact that most of the critical treaty OSI measures have not been exercised (e.g., CWC challenge inspections, OSI measures under the TTBT) makes it difficult to transfer any practical lessons to the CTBT. Further, there are critical areas of "uncharted" OSI territory within the CTBT, including: large size of inspected territory; long duration of inspections; large number of inspectors; and unique activities such as drilling. These unique challenges coupled with a lack of real world experience in relevant treaty inspections (e.g., CWC, TTBT) make it difficult to translate concrete lessons to CTBT OSI. This fact may change if, for example, CWC challenge inspections are conducted prior to CTBT entry into force. Clearly, there are organizational and procedural lessons - both of general and specific nature - to be carried over to the CTBT, but the majority of the critical OSI issues remain untested in real world arms control treaty inspections.

## **Comparison by Treaty:**

The attachment presents an overview comparison of CTBT OSI provisions and verification measures of other international treaties and agreements.

**KEY VERIFICATION**

PROVISIONS	CTBT	CWC	ANTARCTIC
ON-SITE INSPECTION REGIME	Challenge Inspections only	Initial inspection Routine inspection Challenge inspection Alleged use of chemical weapons	Anytime, anywhere inspection
DIVERSION PREVENTION AND MONITORING PROVISIONS	Continuous monitoring (IMS) Sample collection and analysis National Technical Means (NTM) Intrusive Drilling	Continuous monitoring Data reporting/declarations Sample analysis Perimeter securing at challenge site	None
TECHNICAL COMPLEXITY OF VERIFICATION PROVISION	High levels	Low to high levels	Unlimited; however, in practice li simple means
UNIVERSALITY	Requires ratification by all 44 SP listed in IAEA's "Nuclear Power Reactors in the World" prior to EIF Seats on Executive Council allocated by geographical distribution regardless of SP Nuclear Reactor capabilities	Assist and protect against chemical weapons Research, share, and exchange chemicals, equipment and information relating to development and non-prohibited application of chemistry	None
SANCTIONS	Organization can restrict or suspend SP rights and privileges Collective measures in conformity with international law Penalties for frivolous or abusive OSI	SPs will enact penal legislation Organization can restrict or suspend SP rights and privileges Collective measures in conformity with international law. UN General Assembly, and Security Council	None
INSPECTORS AND EQUIPMENT FOR COMPLIANCE MONITORING	Types of inspection TBD during PREPCOM International Inspection Teams System includes sensors (IMS), ancillary equipment, radiation monitors, transmission equipment, sampling devices, cameras Extensive list of specialized equipment Complex, heavy drilling equipment	Types and use of inspectors defined by PREPCOM System may include sensors, ancillary equipment, transmission systems and employ sampling devices, seals, cameras	Mix of civilian/ military inspectors Department leadership No specialized equipment
RESOLUTION BODY	The International Organization: Possibly involve the International Court of Justice and the UN General Assembly and Security Council	The International Organization: Possibly involve the International Court of Justice and the UN General Assembly and Security Council	Antarctic Treaty Consultative Mee
OTHER	Voluntary Confidence Building Measures Unique Consultation and Clarification regime.	Facility agreements	Environmental issues dominate Inspections sought to enforce other related conventions

## KEY VERIFICATION PROVISIONS (1 of 2)

CTBT	CWC	ANTARCTIC	IAEA	BWC
Inspections only	Initial inspection Routine inspection Challenge inspection Alleged use of chemical weapons	Anytime, anywhere inspection	Ad hoc Routine Special Unannounced	None
Continuous monitoring (IMS) Detection and analysis Technical Means (NTM) Sealing	Continuous monitoring Data reporting/declarations Sample analysis Perimeter securing at challenge site	None	Material accountancy (primary) Containment/surveillance (secondary) Seals Continuous monitoring Sample collection and analysis	None
	Low to high levels	Unlimited; however, in practice limited to simple means	Analysis of samples - high level Others - low to moderate levels	None
Verification by all 44 SP listed in nuclear Power Reactors in the world or to EIF Protective Council allocated by UN distribution regardless of SP reactor capabilities	Assist and protect against chemical weapons Research, share, and exchange chemicals, equipment and information relating to development and non-prohibited application of chemistry	None	Technical assistance on R&D projects Equitable contributions Proof of adherence	Being developed
Organization can restrict or suspend SP privileges Measures in conformity with international law Frustrated or abusive OSI	SPs will enact penal legislation Organization can restrict or suspend SP rights and privileges Collective measures in conformity with international law. UN General Assembly, and Security Council	None	Curtailment of assistance Call for return of materials/equipment Suspension of membership privileges Adverse publicity	Domestic legislation through BW Anti-Terrorism Act of
Inspection TBD during PREPCOM Inspection Teams Includes sensors (IMS), ancillary radiation monitors, transmission sampling devices, cameras Use of specialized equipment Heavy drilling equipment	Types and use of inspectors defined by PREPCOM System may include sensors, ancillary equipment, transmission systems and employ sampling devices, seals, cameras	Mix of civilian/ military inspectors with State Department leadership No specialized equipment	Safeguard inspectors Inspection assistants Nuclear counting instruments Surveillance devices	None
Final Organization: Involve the International Court of the UN General Assembly / Council	The International Organization: Possibly involve the International Court of Justice and the UN General Assembly and Security Council	Antarctic Treaty Consultative Meeting (ATCM)	The IAEA consisting of: General Conference, Board of Governors, and Staff Possibly involve the International Court of Justice	UN Security Council
Confidence Building Measures Consultation and Clarification	Facility agreements	Environmental issues dominate Inspections sought to enforce other Antarctic-related conventions	Facility agreements	BWC is developing CBMs

**ATION PROVISIONS (1 of 2)**

C	IAEA	BWC	TTBT	PNET
	Ad hoc Routine Special Unannounced	None	None	None
	Material accountancy (primary) Containment/surveillance (secondary) Seals Continuous monitoring Sample collection and analysis	None	NTM Hydrodynamic yield measurements Seismic yield measurements Information exchange	Information exchange Local seismic network Hydrodynamic yield measurements NTM
limited to	Analysis of samples - high level Others - low to moderate levels	None	Medium to high levels	Medium to high levels
	Technical assistance on R&D projects Equitable contributions Proof of adherence	Being developed	Not applicable	Not applicable
	Curtailment of assistance Call for return of materials/equipment Suspension of membership privileges Adverse publicity	Domestic legislation through the BW Anti-Terrorism Act of 1989	None	None
is with State	Safeguard inspectors Inspection assistants Nuclear counting instruments Surveillance devices	None	Inspectors will be scientist from U.S. national labs and DoE Escorts from OSIA Extensive list of specialized equipment	Inspectors/scientists from U.S. national labs and DoE Escorts from OSIA Extensive list of specialized equipment
ing (ATCM)	The IAEA consisting of: General Conference, Board of Governors, and Staff Possibly involve the International Court of Justice	UN Security Council	Bilateral Consultative Commission	Joint Consultative Commission
r Antarctic-	Facility agreements	BWC is developing CBMs	Confidence-building measures	None

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**KEY VERIFI**

PROVISIONS	CTBT	INF	UN CONVENTION
ON-SITE INSPECTION REGIME	Challenge Inspections only	Close-out inspections Challenge inspections	Signatories cooperate in inspection of suspect vessels under LOS
DIVERSION PREVENTION AND MONITORING PROVISIONS	Continuous monitoring (IMS) Sample collection and analysis National Technical Means (NTM) Intrusive Drilling	Continuous portal monitoring Eliminations TLI holdings confirmation Destructions, close-outs, locations	Provisions for diversion of hazardous chemicals at national level Monitoring includes suspicious shipments and documentation of precursor chemicals in Tables I and II
TECHNICAL COMPLEXITY OF VERIFICATION PROVISION	High levels	Relatively low level	None
UNIVERSALITY	Requires ratification by all 44 SP listed in IAEA's "Nuclear Power Reactors in the World" prior to EIF Seats on Executive Council allocated by geographical distribution regardless of SP Nuclear Reactor capabilities	Not applicable	70+ nations have signed
SANCTIONS	Organization can restrict or suspend SP rights and privileges Collective measures in conformity with international law Penalties for frivolous or abusive OSI	None	Sanctions applicable to enacting domestic penal legislation
INSPECTORS AND EQUIPMENT FOR COMPLIANCE MONITORING	Types of inspection TBD during PREPCOM International Inspection Teams System includes sensors (IMS), ancillary equipment, radiation monitors, transmission equipment, sampling devices, cameras Extensive list of specialized equipment Complex, heavy drilling equipment	Russian linguists OSIA-sponsored training Measuring and weighing devices Radiation detection Cameras, imaging devices, and other agreed equipment	Coast Guard and DEA inspect after consent of ships' state of registry
RESOLUTION BODY	The International Organization: Possibly involve the International Court of Justice and the UN General Assembly and Security Council	Special Verification Commission (SVC)	International Narcotics Control Board UN Commission on Narcotic Drugs International Court of Justice
OTHER	Voluntary Confidence Building Measures Unique Consultation and Clarification regime.	None	None

## KEY VERIFICATION PROVISIONS (2 of 2)

T	INF	UN CONVENTION	MOU	US-SOVIET CW	CF
us only	Close-out inspections Challenge inspections	Signatories cooperate in inspection of suspect vessels under LOS	Phase II -- initial and routine OSI; challenge	Initial and routine OSI Trial challenge inspection	Declared facilities Destruction process Certification process Challenge inspection (right of refusal)
ing (IMS) d analysis teams (NTM)	Continuous portal monitoring Eliminations TLI holdings confirmation Destructions, close-outs, locations	Provisions for diversion of hazardous chemicals at national level Monitoring includes suspicious shipments, and documentation of precursor chemicals in Tables I and II	Data exchange	Continuous presence of inspectors Continuous monitoring with on-site instruments Data exchange	No verification of production Tagging and sealing NTM
	Relatively low level	None	Low level	Low to high level	Low level
y all 44 SP listed in wer Reactors in the ouncil allocated by uon regardless of SP abilities	Not applicable	70+ nations have signed	Not applicable	Not applicable	Not applicable
ect or suspend SP n conformity with or abusive OSI	None	Sanctions applicable to enacting domestic penal legislation	None	None	None
BD during PREPCOM on Teams ors (IMS), ancillary monitors, transmission devices, cameras alized equipment ng equipment	Russian linguists OSIA-sponsored training Measuring and weighing devices Radiation detection Cameras, imaging devices, and other agreed equipment	Coast Guard and DEA inspect after consent of ships' state of registry	Types of inspectors unspecified Seals, cameras	Types of inspectors include team leaders and deputy team leaders Military and medical specialists Sampling devices, seals, and camera equipment	Familiarity with in- tary equipment and Linguistic support Cameras, binoculars
anization: International Court of eneral Assembly	Special Verification Commission (SVC)	International Narcotics Control Board UN Commission on Narcotic Drugs International Court of Justice	None; employ normal diplomatic channels, specifically designated representatives, or other means agreed upon	Bilateral Chemical Weapons Commission (proposed)	Joint Consultative (
e Building Measures and Clarification	None	None	None	Facility agreements and cooperative activities (proposed)	None

ICATION PROVISIONS (2 of 2)

MOU	US-SOVIET CW	CFE	START	OPEN SKIES
Phase II -- initial and routine OSI; challenge	Initial and routine OSI Trial challenge inspection	Declared facilities (quotas) Destruction process Certification process Challenge inspections (quotas, right of refusal)	Nine types of OSI	None
Data exchange	Continuous presence of inspectors Continuous monitoring with on-site instruments Data exchange	No verification of non- production Tagging and sealing NTM	PPCM and NTM Data exchanges Unencrypted telemetry Exhibitions Deployment area for mobiles ICBMs	None
Low level	Low to high level	Low level	Low level	Potentially very high level
Not applicable	Not applicable	Not applicable	Not applicable	None
None	None	None	None	None
Types of inspectors unspecified Seals, cameras	Types of inspectors include team leaders and deputy team leaders Military and medical specialists Sampling devices, seals, and camera equipment	Familiarity with inspected mili- tary equipment and operations Linguistic support Cameras, binoculars, aircraft	No unique inspector qualifications OSI equipment relatively unsophisticated	Pilots Fixed wing aircraft SLAR IR Commercial Cameras Technicians
None; employ normal diplomatic channels, specifically designated representatives, or other means agreed upon	Bilateral Chemical Weapons Commission (proposed)	Joint Consultative Group	Joint Compliance and Inspection Commission (JCTC)	None
None	Facility agreements and cooperative activities (proposed)	None	None	Aerial observation

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# **APPENDIX F**

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# CTBT OSI Concept of Operations Issues

January 22, 1997

# CTBT OSI:

## OSI Inspection Team Issues

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- Size and Structure
- Functions and Qualifications
- Certification
- Training
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  - 
  -
- Number of Simultaneous Inspections

# CTBT OSI:

## Inspection Team Size and Structure

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- Permanent CTBTO Staff vs. Augmentees
- Functions for permanent staff
  - Core inspectors
  - Process mission requests
  - Admin duties (e.g., keeping inspector lists)
  - Training of inspectors
  - Equipment certification and maintenance
- Team Chief role
  - diplomat vs. technical
  - permanent party vs. augmentee
- Rotation of inspectors to inspected site

# CTBT OSI:

## Inspector Functions and Qualifications

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- What functions must be performed?
- What qualifications are necessary to perform these functions?
- Related Issues
  - Level of cross-training
  - Functions vs. event type
  - Core concept viability
  - Rotation of inspectors when needed

# CTBT OSI:

## Inspector Training

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- Training in addition to equipment operation
- Team-building exercises required
- Training prior to acceptance of inspector
- How, where, and by whom will any required training be accomplished?
- Frequency of training new inspectors? Refresher training required?
- Role of mock inspections in training

# **SOME ISSUES IMPACTING THE SIZE, STRUCTURE AND PROCEDURES OF THE TECHNICAL SECRETARIAT INSPECTION STAFF AND OSI INSPECTION TEAMS**

## **INTRODUCTION**

This paper identifies and discusses some issues that could significantly impact the size and structure of the Technical Secretariat (TS) inspection staff and OSI inspection teams. Additionally, it postulates possible options that will resolve problems raised by these issues and provides advantages and disadvantages for each of these options.

One of the critical questions that must be settled is the number of simultaneous inspections that could occur under the CTBT. This will ultimately be a "political decision" and this paper will not attempt to answer that question. However, it seems unlikely that there will ever be truly simultaneous inspections (i.e., multiple inspection requests arrive at the CTBTO at the same time). Rather it seems likely that, at worst, inspections will be concurrent (i.e., one inspection will be ongoing when the request for the second inspection occurs). This assumption, in itself, has implications on how inspections would be conducted and will be discussed below.

## **ISSUE 1 TEAM SIZE AND STRUCTURE**

The first issue is the size and structure of the CTBTO permanent inspection staff. There are three possible options: 1) a large permanent cadre ("CWC like"); 2) no standing cadre of inspectors, there is only a small administrative staff with reliance placed on augmentees for the conduct of an OSI; and 3) a small "core" of permanent party inspectors who will form the nucleus of an OSI Team (to be supplemented by inspector augmentees).

Option 1 offers many advantages. Since all the inspectors will be located at one site, scheduling of individual and team training will be simplified. Additionally, inspectors could be formed into teams. Thus cross training requirements for members of the team could be identified and the necessary training completed. Since TS personnel on these teams would work with each other on a daily basis, team building exercises would not be required immediately prior to arrival at the Point of Entry (POE) for an OSI. Inspection logistics would also be simplified. There would be no need to assemble an inspection team at gateways. Equipment would be located at the CTBTO headquarters thus eliminating one possible need to maintain equipment at gateways and reducing the need for multiple sets of equipment. (The number of simultaneous inspections becomes the driver for equipment purchases under this option.) Meeting mandated inspection timelines will be simplified

since there is no time lost in assembling a team of augmentees. However, there are two main drawbacks. First, maintaining a large permanent inspector staff will be costly. Secondly, there is insufficient work (e.g., no routine inspections as is the case with the CWC) to keep this large inspection staff occupied between, what are postulated to be, rather infrequent inspections.

The advantages and disadvantages of Option 2 are mirror images of Option 1. This option has two principal advantages: since there is no requirement for a large permanent staff, costs would be minimized and the administrative staff could be sized to fit required routine work. However, there are many disadvantages. First, scheduling of training becomes difficult and costly in that augmentees from different countries (who might have their own scheduling conflicts) would have to assemble at a centralized location at fixed time for training. Second, since, as a matter of course, augmentees would not be formed into teams, it would be difficult to identify individual cross training requirements. Consequently, cross training requirements for individual inspectors would be increased in order to ensure that an inspection team comprised of augmentees had the appropriate skills. Third, conducting team training would be difficult and require advance planning. Fourth, alerting augmentees for an inspection and ensuring that the assembled inspection team has the correct skill sets would not be an easy task. Fifth, the alerting and assembly process consumes valuable time that could be used for inspection preparation and movement to the POE. Team building exercises prior to arrival at the POE would be difficult to accomplish. In order to reduce travel time to POEs, team assembly at gateways may be required. These gateways will also require a stockage of inspection equipment. Consequently, for this option, the number of gateways and not the number of simultaneous inspections could drive equipment purchase. Finally, a dedicated division of the Technical Secretariat would have to manage training, alerting and certification of augmentees, as well as, maintain or contract out maintenance of inspection equipment at gateways.

Option 3 offers a reasonable compromise between options 1 and 2. A small cadre (perhaps 20) of permanent party personnel would be formed into three teams consisting of six or seven persons. One of these three teams would form the nucleus of the OSI team and would concentrate on the operational aspects of the inspection while the second team would be concerned with the logistics of the inspection. This would allow the third team to form the nucleus of an inspection team for any "concurrent" OSI that might occur or to provide operational support to the Executive Council during an OSI. There are many advantages to this approach. Personnel costs would be significantly less than those in Option 1. These teams would form a cadre of personnel that an OSI team could be rapidly built around.

Additionally, the core team could deploy on an OSI and perform initial inspection tasks without waiting for the augmentees to arrive. This would ease problem of meeting early inspection timelines. As the augmentees assembled, they would be phased into country as needed (see discussion below). The need for gateways with their associated inspection equipment would be reduced and possibly eliminated. Additionally, this 20 person group would perform the following "routine" tasks within the CTBTO: OSI equipment certification and maintenance; management of inspector training (assumes, as is the case with the CWC, that individual countries will conduct inspector training for the CTBTO); perform administrative duties (e.g., maintain inspector lists); process mission requests and potentially, conduct Confidence Building Measure (CBM) visits.

There are, however, several disadvantages. Under this option, a requirement still exists to train augmentees and the problems associated with training these augmentees discussed in Option 2 would also apply to this option. Additionally, phasing augmentees into country will present additional logistical problems that will be discussed below.

## **ISSUE 2 TEAM INSPECTION PROCEDURES**

The second issue relates to the procedures for conducting OSI. Paragraph 9, Part II of the Inspection Protocols states that, "The total number of members of the inspection team present on the territory of the Inspected State Party at any given time, except during the conduct of drilling, shall not exceed 40 persons." Thus phasing of inspection team members onto the territory of the Inspected State Party (ISP) and rotating of members into and out of the ISP appears to be an acceptable inspection procedure. This creates many opportunities for the OSI team. First, the whole team does not have to arrive in country at one time. The "core" team, described above, would be the first to arrive with necessary equipment to begin the inspection. They might be accompanied by the overflight team. Team members necessary to perform activities specified in paragraphs 69 (a) - (e) (Activities permitted within the first 25 days after inspection approval) would rotate into country as needed. As the inspection progresses, personnel required to perform tasks specified in paragraphs 69 (f) - (g) (Activities permitted after approval of an inspection continuation in accordance with Article IV, Paragraph 48) would rotate into the ISP while those whose tasks are completed would leave.

This rotation approach has several advantages. Firstly, it minimizes the number of people and amount of equipment that must reach the POE within six days following receipt of the challenge by the Executive Council. Secondly, it gets the right people with the right equipment on site when needed. Thirdly, it simplifies training. If a fixed team is deployed without rotating people into and out of country, there must be a considerable amount of

inspector cross-training to ensure all inspector skills and functions are adequately 'covered.' By rotating personnel we can get the right skills into country and minimize cross-training requirements. Fourth, under a fixed 40 person team, there is a zero sum game between administrative/logistic personnel and technical personnel. Add a technical person and lose an administrative/logistic individual and vice versa. This is not a problem using a rotation system. Finally, if concurrent inspections are taking place, personnel who have completed their work or awaiting doing their work on one inspection could be utilized on the other inspection.

The major drawback to this approach is logistics. Personnel must be rotated into and out of country without exceeding the 40 person ceiling mandated in the CTBT, consequently, the 40 person ceiling must be carefully managed. If one chooses to use dedicated aircraft to fly personnel into the inspected state, the issue of whether or not the aircrews count as inspection assistants and are therefore counted against the OSI team ceiling must be addressed. Also the vagaries of weather, transportation to the ISP and in-country transportation could impact on the rotation concept. The logistical requirements of this approach could also place a burden on the ISP, depending on the amount of support they are providing to the inspection team..

## **ADDITIONAL ISSUES**

It appears that the concepts of a small cadre of inspectors in the TS and of phasing an inspection team into country as well as rotating personnel in and out of country, as needed, are both viable. However, there are a myriad of other issues that could significantly impact the size and structure of the TS inspection staff and OSI inspection team and must be addressed. Will gateways be required? If yes, how many and where? What job specialties or functions are required for the inspection staff and the inspection team? How scenario dependent is team composition? What particular skills are required for each inspection technology? Are team building exercises immediately prior to arriving at the POE required? What skills are inspector "selection" criteria and what skills will be trained after acceptance? How much cross training is required? How should the team be organized and lead? What are the responsibilities of the TS in the areas of current operations? training? and maintenance of equipment?

## **RECOMMENDATIONS**

The next step in this process should be to identify the functions required of the permanent TS inspection staff and inspection team. Subsequently, we recommend that the idea of a "core" inspectorate staff as part of the CTBTO and the concept of phasing of

inspection team members onto the territory of the ISP and rotating members into and out of the ISP during an inspection be explored in more detail so their feasibility and utility can be confirmed. A parallel effort should be undertaken to identify the training required for inspectors.



CTBT  
On-Site Inspection Insights

F-12

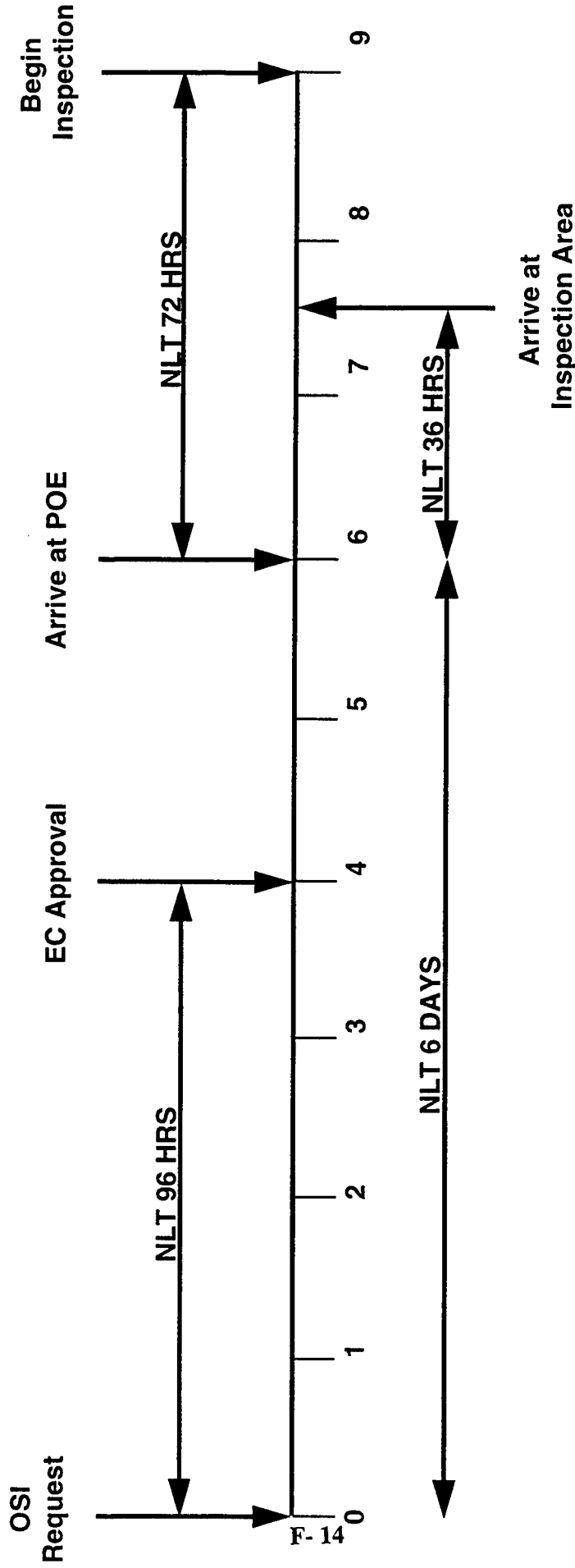
May 2, 1997

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# Background

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# OSI TIMELINES



- Issues:
- OSI Team meeting the six day deadline to arrive at POE
  - Size and composition of OSI Team Day 6 - Day 9

13/01/2011

# Inspection Activities

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- Day 1 - 25
  - » Position Finding
  - » Visual Observation - video/still photography; multi-spectral imaging
  - » Radioactivity measurements (gamma radiation monitoring)
  - » Environmental Sampling
  - » Passive seismological monitoring
- After approval of continuation of inspection
  - » Any activity for Day 1 - 25
  - » Resonance seismometry; active seismic surveys
  - » Magnetic and gravitational field mapping
  - » Ground penetrating radar; electrical conductivity measurements
- Drilling conducted only with Executive Council approval

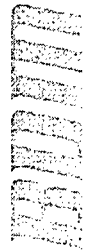
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# Discussion Topics

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- Unresolved issues from time line chart
- Rotation/Phasing of Inspection Team
  - » Logistics/cost implications
  - » Inspector Count - in-country or in inspection area
  - » Forward staging area required?
- Cross Training
  - » “Laborers” vs. “High tech”
  - » Third world inspectors
- Permanent Party Inspectors vs. Augmentees
  - » Proper mix
  - » Impact on acceptance of inspection results
- Other issues



# Permanent Staff Size

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# Permanent OSI Staff

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- Upper Limit 100 personnel. All inspections performed by permanent party. Capable of performing two concurrent inspections.
- Lower Limit 20 personnel. Majority of the inspectors are augmentees. Permanent party forms core team (~10 people) that deploys to meet inspection timelines. Limited capability for two concurrent inspections

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# Permanent Staff vs. Augmentees

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## Permanent Staff

- » Most costly option.
- » Team training easy to accomplish especially for “upper limit” option.
- » Requires significant cross training to insure all inspector functions are covered.
- » Simplifies transportation of inspectors to POE within required timelines.
- » Difficult to keep usefully employed between inspections.
- » Loyalty to International Organization.

## Augmentees

- » Minimizes inspector cost.
- » Team training difficult. Might need to consider “stable” augmentee teams.
- » Potentially minimizes cross training if phased inspection approach is adopted.
- » Difficult to transport augmentees to POE within timelines. May require “core” team of permanent inspectors to deploy to meet timelines.
- » Pursue “everyday” jobs between inspections.
- » Loyalty to International Organization or to a State Party?

**BRUNN**

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# Alternate Team Compositions

2016/07/11

# OSI Team Approach

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- “Permanent” Approach - 40 man OSI team. No inspector rotation, replacement or additions (except for drilling). Team members remain in-country for the duration of the inspection.
- “Phased” Approach - OSI Team composition continuously changing. Right inspector with right skills phased into country at right time to perform specific inspection functions. Replaced by other inspectors upon task completion..
- The approach selected effects:
  - » Inspector qualifications
  - » Inspector training
  - » Inspection logistics (Both ISP and OSI Team)
  - » Team management
  - » Meeting treaty deadlines



# OSI Team Approach Comparison

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<b>Permanent Approach</b>	<b>Phased Approach</b>
» Requires significant cross training.	» Cross training minimized.
» More demanding selection criteria.	» Select inspectors for specific skills.
» Inspection logistics simplified. Team enters country and leaves country together.	» Logistics complicated for both ISP and OSI Team. Personnel and equipment continuously moving into and out of country.
» Difficult to get entire OSI Team into country to meet treaty timelines.	» Easy to get a “core” team into country with rest of team following as needed.
» Team Chief concentrates on operational aspects of OSI.	» Team Chief required to manage both operations and logistics carefully.
» Inspectors skilled in multiple disciplines.	» Inspectors usually skilled in one discipline.

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# Point of Entry Activities

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# Activities at POE

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- Present inspection mandate and inspection plan
- Receive briefing from Inspected State Party
- Modify inspection plan
- Undergo equipment inspection
- Arrange for transportation from POE to inspection area
- Negotiate logistics (food, quarters etc.)
- Prepare for initial overflight

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# Proposed Team at POE

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## Total 11 inspectors

- Team Chief
- Deputy Team Chief
- Logistics Team Chief
- Equipment experts (2 each)
- Interpreters (2 each)
- Initial Overflight Team (3 each)
- Communication Expert



# **APPENDIX G**

CTBTO/OSI STAFFING<sup>1</sup>

This paper is a follow-on to the paper “Man Power Estimates for the CTBT TS OSI Branch”. That previous paper estimated the amount of effort required to carry out identified OSI functions at the CTBTO. Implementing OSI functions in many instances, particularly when an OSI deployment is occurring requires a number of people working for a short time. Not all these people will be part of the OSI permanent staff; some may be from other elements of the Technical Secretariat, others may be augmentees. Thus, the total level of effort identified in this earlier paper cannot be equated to a staffing level. In the following material the thrust is to identify and quantify the permanent OSI staffing level. The notional structure of the TS OSI component is a directorate with two elements---operations and support.

OSI Staffing

OSI Positions	OSI Effort (w/o deployment)	Other TS Employment
<u>Operations</u>		
Deputy Director	1.0	
Admin Asst	1.0	
Admin Asst	1.0	
Analysis		
Analyst 1	0.3	0.7
Analyst 2	0.3	0.7
Analyst 3	0.3	0.7
Operations		
Engineer 1	0.5	0.5
Engineer 2	0.5	0.5
Engineer 3	0.5	0.5
Readiness		
Trainer 1	1.0	
Trainer 2	1.0	
Data Management	1.0	
<u>Subtotals--Operations</u>		
OSI Positions 12 FTEs	OSI Effort 8.4 FTEs	TS Employment 3.6 FTEs

<sup>1</sup>June 4, 1997  
 Jeff Weston  
 Fielden Dickerson

OSI Staffing (Continued)

OSI Positions	OSI Effort (w/o deployment)	Other TS Employment
<u>Support</u>		
Deputy Director	1.0	
Admin Asst	1.0	
<u>Maintenance/Storage</u>		
Maintenance Tech	1.0	
Maintenance Tech	1.0	
Maintenance Tech	1.0	
Storage/Shipping Tech	1.0	
Storage/Shipping Tech	1.0	
<u>Logistics</u>		
Engineer	0.5	0.5
Engineer	0.5	0.5
Engineer	0.5	0.5
<u>Subtotals--Support</u>		
OSI Positions 10 FTEs	OSI Effort 8.5 FTEs	TS Employment 1.5 FTEs

OSI Staffing (Continued)

OSI Positions	OSI Effort (w/o deployment)	Other TS Employment
<u>OSI</u> (2 FTEs)		
Director	1.0	
Admin Asst	1.0	
<u>Operations</u> (12 FTEs)		
	8.4	3.6
<u>Support</u> (10 FTEs)		
	8.5	1.5
<u>Totals</u>		
OSI Positions 24 FTEs	OSI Effort 18.9 FTEs	TS Employment 5.1 FTEs

## Caveats and Comments

1. This estimation exercise does not include the staffing of an inspection team. Both this paper and the previous paper, "Man Power Estimates for the CTBT TS OSI Branch", address the OSI functions that must be implemented at the CTBTO. Neither paper identifies the functions of the inspection team.
2. A number of positions have been identified for which a significant portion of the staff member's time is utilized in components of the TS other than the OSI component. No identification has been made of the TS components that might utilize OSI staff on a part-time basis.
3. The level of effort required within the OSI CTBTO during an inspection will be achieved by utilizing staff members from elsewhere in the TS and augmentees.
4. Staff members of the OSI will form the team leadership for an inspection. In particular, it was postulated that from the OSI staff the following would constitute the inspection team leadership:
  - Deputy Director, Operations
  - Two engineers from Operations
  - Two trainers from Readiness
  - One maintenance tech from Maintenance/Storage
  - Two engineers from LogisticsThese positions at the OSI CTBTO, during an inspection, would be filled with augmentees or staff members from elsewhere in the TS.
5. It has been assumed that role of augmentees will be broader than just being inspectors.
6. The purpose of the w/o deployment caveat in the OSI Effort column is to indicate that the identified numbers represent the steady-state effort within OSI. During an inspection, this effort will increase; however, the number of permanent OSI staff will not change.

# APPENDIX H

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## DRAFT

# *METHODOLOGY FOR DETERMINING CTBT TRAINING REQUIREMENTS*

## INTRODUCTION

Although the development of Operations Manuals will generally address CTBTO activities and provide some insights into training requirements, there are additional benefits gained from a more comprehensive analysis of CTBTO member functions, qualifications, and training requirements rooted in the various CTBTO activities (e.g., International Data Center - IDC, On Site Inspection - OSI, Consultation and Clarification). Essentially, the end goal of developing an appropriate training program relies upon acquiring a fundamental understanding of the interrelated functions, qualifications, and training requirements which should occur in conjunction with the development of Operations Manuals. This paper addresses some of the possible limitations of solely looking at the Operations Manuals for training requirements, and then provides an overview of the analytical approach utilized for the Chemical Weapons Convention (CWC) training program development which could be used for the CTBT. The subject of On Site Inspection is used as an example to draw out the training issues.

## POSSIBLE LIMITATIONS OF THE OPERATIONS MANUAL APPROACH

In a basic sense, the Inspection Operations Manual will tell the inspectors to “do” something in a particular situation, manner, and sequence. For example, the manual might direct the inspector to initiate an overflight, and employ the use of field glasses, passive location-finding equipment, video cameras, and hand-held still cameras. Although the manual will direct the inspector to “do *x*”, it will not necessarily get to the root of *how* the inspector “does *x*”, nor to what are the inspector performance skills and qualifications necessary for that specific task or function, or to whether or not the inspector performs to standards. A solid understanding of the activity, and required skills and qualifications, is

## DRAFT

critical to the development of an appropriate training program. In terms of cross training requirements, the Operations Manual will not necessarily draw these associations from activity to activity.

If the analysis of the Operations Manual took the manual "down" to the next level of detail in terms of the actual performance of specific tasks - i.e., the development of "technical manuals" for each task, then the core inspector functions, skills, and qualifications could possibly be drawn out. However, such an approach of determining training development from the Operations Manual is in a sense "backing into" the answers - at least when dealing with OSI issues.

### APPLYING THE CWC APPROACH TO TRAINING - A FOCUS ON FUNCTIONS

Although a modified assessment of an OSI Operations Manual - i.e. development of sub-technical manuals - *could* get to the root of inspector training requirements, there is an alternative, more sequential approach to addressing the training issue. In order to determine the CTBT inspector training requirements and the most appropriate training program, the analytical approach developed for the CWC provides an ideal template.

Figure 1 graphically portrays the analytical approach utilized to determine training requirements. The first step in the process involves identifying the individual functions or activities required to fulfill the OSI-related provisions of the CTBT. This long list of functions would be highly diasaggregated so that each function *could* be performed by a single individual with a circumscribed set of skills and experience. The second step is to group these wide-ranging functions into functional specialities, based on presumed similarities in recruitment/selection criteria and operational roles. Additionally, an effort is made to try to limit the number of separate specialities potentially requiring unique training. The third step is to aggregate the functional specialities into teams based upon select model inspection scenarios (ground vs. water inspection, drilling vs. no drilling, etc.). Estimates are made regarding the types and numbers of specialists given explicit assumptions about the scope of effort required. In this step, assuring that all required functions are covered by at least one speciality serves as a check on the adequacy of the specialty descriptions. Once the specialities and teams have been constructed, the analysis focuses on proposing initial selection qualifications and eventual performance qualifications for each speciality (prioritized by importance). There is a requirement to form inspector certification criteria

## DRAFT

which should also be factored into the development of training programs. Finally, after this complete analysis of inspector functions, specialities, and qualifications, the analysis focuses on training. Training requirements and opportunities for cross training are developed into training modules, which include related course material and estimated course duration. These training modules are then aggregated into strawman course outlines or tracks with different combinations of modules proposed for each speciality. This above method which was employed for the CWC provides a logical approach to developing training requirements and programs for the CTBT.

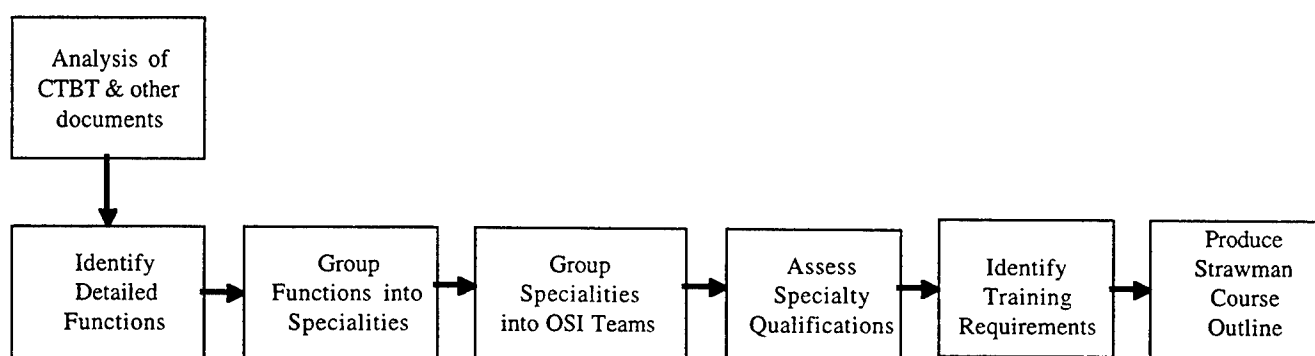


Figure 1. The CWC Methodology for Evaluating Inspector Training Requirements

## CONCLUSION

Although the Operations Manual approach will provide some insights into training requirements, the most straightforward approach to developing CTBT training programs is to follow the sequential CWC model of identifying and assessing functions, specialities, qualifications, certification, and finally training. This approach clearly worked for the CWC inspector training issues, and would similarly aid in developing training plans for CTBT inspectors. Notably, other components of the CTBTO - e.g., the IDC - may be better suited for the use of the Operations Manual model for developing training programs. For example, the IDC has been in operation for several years, and may not require the “building block” approach of the CWC model to training requirements and plans as would be necessary with an untested or unestablished inspection organization. In terms of inspector issues, the CWC approach provides added value above the use of Operations Manuals as the basis for developing training programs.

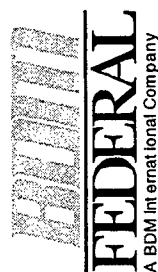
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# CTBT Training Requirements

March 3, 1997

H-5



# Training for the CTBTO

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- Key Question:
  - » Is training required to provide CTBTO personnel with adequate knowledge and skills to effectively perform required duties?
  
- Elements of the CTBTO potentially requiring training:
  - » International Data Center (IDC)
  - » International Monitoring System (IMS)
  - » Technical Secretariat (TS) Permanent Party
  - » On-Site Inspection
  - » Inspected State Party (ISP) Procedures

# IDC Training Issues

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- Strong cadre already exists
  - » personnel already conducting the required functions
  - » manuals, protocols already exist to perform IDC functions
  - » considerable international experience in data analysis exists
  
- Accept individuals based upon standard minimum technical qualifications
  
- IDC requires only On-The-Job Training, not a dedicated training program

# IMS Training Issues

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- All monitoring systems operated by a State Party
- IMS Personnel within State Party knowledgeable of their jobs
- State Party selects those who should be operating their stations
- No dedicated training program required
  - » On-the-Job Training (OJT)
  - » “Assistance” provided to requesting State Parties (by CTBTO or bilaterally)

# TS Permanent Party (Non-OSI) Training Issues

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- Non-OSI Functions to be performed by TS permanent party:
  - » Administrative Duties
  - » Logistics (e.g., Travel arrangements)
  - » Liaison with State Parties and Executive Council/Director-General regarding inspection requests
  - » CBM submissions and activities
  - » Consultation and Clarification
- Accept individuals based upon standard minimum qualifications
- No requirement for dedicated technical training program
  - » Rely upon On-The-Job training
  - » Offer treaty orientation course

# On-Site Inspection Personnel Training Issues

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- Inspectors will have basic technical skills but will require training on:
  - » Common skills (safety; communications, medical etc.)
  - » Knowledge on the use and maintenance of inspection equipment selected by the Technical Secretariat for use on an OSI
  - » Knowledge of how to conduct an inspection (inspection organization and functions; overflights; ground survey etc.)
- Team training and Team “building” are critical
- Realistic training is necessary to address the potential adverse conditions of an OSI (i.e., exercises and mock inspections)
- A dedicated training program is required for OSI elements

# Inspected State Party (ISP) Procedures

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- Inspected State Party, or “Host” country, procedures training is the responsibility of each State Party
- Existing level of inspection preparation experience and level of knowledge concerning related issues varies by State Party
- Some State Parties may request assistance in developing procedures
  - » Assistance provided by CTBTO or bilaterally

H. II

# Conclusion

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- Inspector Training will be the major training requirement of the Technical Secretariat

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# CTBT Training Requirements

## Supporting Materials

H- 13

# Types or Levels of Training

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- “Dedicated” Training Program
- On-the-Job Training (OJT)
- “Assistance”

# Discussion of Key Findings

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- **Key Conclusion:** Inspector Training will be the major training requirement of the Technical Secretariat
  - » OSI is the only element requiring a dedicated training program
  - » OSI training is different and more comprehensive than other elements
  - » Other areas (e.g., IDC, IMS) will require OJT and/or “assistance”, but not a dedicated training program

# Benefits of an OSI Training Program

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- An effective training program can:
  - » Build on the candidate's experience
  - » Provide instruction in areas pertinent to nuclear explosions
  - » Provide a uniform base of knowledge in inspection procedures and equipment
  - » Expand the pool of potential inspectors by lowering the requirements for pre-CTBT experience
  - » Improve inspection team cohesion and efficiency by providing standardized procedures

# Further Training Issues

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- Size of the CTBTO Permanent Party dedicated to inspections versus number of augmentees required to perform inspections.
- Selection criteria versus post-hiring training requirements.
- Who will conduct training - Technical Secretariat or selected member States for the Technical Secretariat?
- What training should the US offer to conduct?
- What are the best tools for the CTBTO training program?
  - » Hands-on training
  - » Exercises
  - » Computer-based training (CBT)
  - » Combination of the above

# APPENDIX I

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## BACKGROUND

The attached document is a first attempt at compiling a list of functions that would be performed by CTBT inspectors. The following approach was used:

- Reviewed Article IV and Part II of the Protocol and identified inspection activities (e.g., ship sample). Assigned inspector functions (i.e., document sample; pack, tag and seal sample; observe hazmat safety, etc.) to each activity identified.
- Reviewed Article IV and Part II of the Protocol and identified activities permanent cadre at the Technical Secretariat might perform in support of On-Site Inspections. Assigned inspector functions to each activity identified.
- Reviewed BDM Report, “Examination of the Functions, Qualifications, and Training of Inspectors for the CWC.” Identified General and Implied Inspector functions applicable to the CTBT.
- Reviewed DOE Document, “Concept of Operations for a CTBT On-Site Inspection.” Identified General and Implied Inspector functions applicable to the CTBT.
- Reviewed JAYCOR Report, “Comprehensive Test Ban Treaty: On-Site Inspection Options.” Identified inspection activities and associated functions.
- Finally, the separated functions from their activities and placed in alphabetically order.

The attached document basically displays inspector functions in two distinct ways: 1) associated with specific activities and 2) in alphabetically order. Both forms will probably prove useful as we try to identify inspector specialties and training requirements.

## CTBT INSPECTOR FUNCTIONS

### TREATY

- Article IV, Para 47 “...inspection team shall transmit ... a progress inspection report.”  
Function: Write report. (Operations Manual describes format.)
- Article IV, Para 48 “...inspection team may submit...proposal to conduct drilling.”  
Function: Write proposal. (Operational manual describes format.)
- Article IV, Para 49 “The inspection team may request ... to extend inspection duration by a maximum of 70 days.”  
Function: Write request. (Operations Manual describes format.)
- Article IV, Para 50 “...inspection team may submit ... a recommendation to terminate [the inspection].”  
Function: Write recommendation. (Operations Manual describes format.)
- Article IV, Para 53 “The inspection team shall arrive at the POE no later than six days following the receipt of an On-Site Inspection request.”  
Function: Plan logistics (both people and equipment).
- Article IV, Para 57 Inspected State Party rights.  
Function: Conduct inspection using managed access.
- Article IV, Para 58 “On-site Inspection shall be conducted in the least intrusive manner possible [consistent] with the procedures set forth in the Protocol.”  
Function: Plan Inspection.
- Article IV, Para 60 ISP restricts access and demonstrates compliance through alternate means.  
Function: Conduct inspection using managed access.
- Article IV, Para 62 “Inspection reports shall contain: ...”  
Function: Write report. (Operations Manual describes format.)

## PROTOCOL

- Part II, Para 11 “Inspected State Party shall provide ... communication means, interpretation services, transportation, working space, lodging, meals and medical care.”  
Functions: - Communicate intra-team and with Executive Council - (radio procedures; antenna dish set up; fax use; e-mail? etc.); provide interpretation services; provide transportation (driving, maintenance etc.); effectively utilize working space; provide logistical support (meals, lodging etc.); provide medical support (physician? physician assistant; EMT?); administer basic first aid.
- Part II, Para 14 Defines inspection assistants - technical and administrative personnel, aircrews and interpreters.  
Functions: Perform administrative functions (computer use, keyboarding, communications(?), journal keeping, scheduling, etc.); perform technical functions (equipment maintenance, repair etc.), provide interpretation services; fly aircraft; maintain aircraft.
- Part II, Para 27(b) “ ... inspectors living quarters and offices...shall be [inviolable].  
Functions: Apply tags and seals; provide site security.
- Part II, Para 27(c) “Papers and Correspondence...[inviolable].  
Functions: Apply tags and seals; apply site security.
- Part II, Para 27(d) “Samples and approved equipment ... [are inviolable]. Hazardous samples shall be transported IAW relevant regulations.”  
Functions: Apply tags and seals; collect samples; document samples; pack/ship/transport samples; observe hazmat safety.
- Part II, Para 29 Members of IT respect laws and regulations of the ISP.  
Functions: Practice cultural awareness; know legal responsibilities under CTBT.
- Part II, Para 36-40 Approved inspection equipment.  
Functions: Use equipment; calibrate equipment; maintain equipment; repair equipment; safe use of equipment; apply tags and seals.

- Part II, Para 41      Provide basic information for on-site inspection.  
Functions: Read a map; determine location using PLRS; estimate geographic and vertical coordinates.
- Part II, Para 42      Inspection mandate.  
Functions: Read a map; determine location using PLRS; estimate geographic and vertical coordinates; plan an inspection; identify inspection activities.
- Part II, Para 48      “ ... head of inspection team [and] Inspected State Party shall agree on a basing point and flight plan ... to basing point ... ”  
Functions: Read a map; understand flight planning; plan a flight.
- Part II, Para 50      “ ... no restriction ... on the inspection team bringing approved equipment into the territory of the ISP ... ”  
Functions: Plan equipment movement, perform equipment inventory; apply tags and seals.
- Part II, Para 52-53    Pre-inspection briefing activities.  
Functions: Receive in-briefing; conduct negotiations; modify inspection plan.
- Part II, Para 54      Move to inspection area.  
Functions: Move to base camp from point of entry; establish “base camp.”
- Part II, Para 55      “ ... the inspection team shall have the right to use approved location-finding equipment.”  
Function: Determine location using PLRS.
- Part II, Para 60      Rights/Obligations of Inspection Team.  
Functions: Plan inspection; conduct inspection IAW with CTBT provisions; conduct inspection using managed access; provide copies of information and data collected to the ISP.

- Part II, Para 61 Inspected State Party rights.  
Functions: Liaise with the ISP; conduct inspection using managed access; provide to the ISP duplicate copies of all photographs and measurements; apply tags and seals; receive data from the ISP
- Part II, Para 62 “ [Inspection team can] ... communicate with each other and the Technical Secretariat.”  
Functions: Communicate intra-team and with the Technical Secretariat; employ own telecommunications; utilize ISP telecommunications; maintain telecommunications.
- Part II, Para 63-68 Observer rights.  
Functions: Liaise with the ISP and observer; receive recommendations from observer; inform observer of inspection activities.
- Part II, Para 69(a) Position finding from air or ground.  
Functions: Utilize aerial observer techniques; read a map; determine location utilizing PLRS.
- Part II, Para 69(b) Visual observation; video/still photography and multispectral imaging.  
Functions: Conduct inspection using managed access; utilize aerial and ground observation techniques; record location utilizing PLRS; take video/still photography (utilize digital camera?, 35 mm camera?, Polaroid camera?, video camera); supervise the ISP in taking video/still photography (see Para 61 (e)); process film?; scan photography; utilize computer and commercial software to analyze/enhance photography; transmit photography in digital form to the Technical Secretariat ; employ multi-spectral imagery (What else do we do here?).
- Part II, Para 69(c) Develop monitoring plan; measure radioactivity at and below the surface; utilize gamma radiation monitoring and energy resolution analysis from air, surface or under the surface.  
Functions: Perform gamma radiation monitoring; perform energy resolution analysis; record location utilizing PLRS; evaluate radiation data; observer radiation safety; observe mine safety; utilize film badges?; determine background levels of radiation; identify anomalies; digitally transmit data back to the Technical Secretariat for analysis.

- Part II, Para 69(d) Environmental sampling and analysis.  
Functions: Develop sampling plan; collect solid, liquid and gas samples above, at and below the surface; analyze samples on site; prepare samples for shipping off-site; observe hazmat safety; subdivide samples, as necessary, and share with the ISP; record location utilizing PLRS; identify anomalies.
- Part II, Para 69(e) Passive seismological monitoring.  
Functions: Develop a monitoring plan; employ sensors; evaluate seismological data; record location utilizing PLRS; transmit data in digital form to the Technical Secretariat ; reduce size of search area.
- Part II, Para 69(f) Resonance seismometry and active seismic survey.  
Functions: Develop a monitoring plan; employ sensors; evaluate seismological data; record location utilizing PLRS; transmit data in digital form to the Technical Secretariat ; identify underground anomalies to include cavities and rubble zones.
- Part II, Para 69(g) Magnetic/gravitational field mapping; radar measurements; electrical conductivity measurements.  
Functions: Develop a (magnetic) (gravitational) field mapping survey plan; perform measurements at the surface and from the air using (magnetic) (gravitational) field mapping instruments; develop a (ground penetrating radar) (electrical conductivity) measurement plan; perform measurements using (ground penetrating radar) (electrical conductivity) instruments; identify anomalies or artifacts; transmit data, as required, to the Technical Secretariat ; record location utilizing PLRS.
- Part II, Para 70(h) Drill to obtain samples.  
Functions: Develop a drilling plan; request permission from the EC to conduct drilling; request inspection extension, if required; conduct (vertical), (horizontal), (slant) drilling; coordinate drilling logistics; coordinate, if necessary, with the ISP to obtain drilling equipment.
- Part II, Para 71-85 Overflights.  
Functions: Plan an initial overflight; plan additional overflights, as required; coordinate with the ISP for additional overflights; file flight plan; conduct inspection using managed access; conduct overflight(s) to narrow inspection area and collect factual data; utilize aerial and ground observation techniques; record location utilizing PLRS; take video/still photography (utilize digital camera?, 35 mm

camera?, Polaroid camera?; video camera); supervise the ISP in taking video/still photography (see Para 61 (e)); use field glasses; perform gamma radiation monitoring; conduct multi-spectral imaging (including infrared); perform magnetic field mapping.

Part II, Para 86-96      Managed access.

Functions: Observe rights and obligations of the ISP (See Part II, Para 88); observe ISP measures to protect sensitive installations and locations to prevent disclosure of sensitive information; conduct inspection and place equipment, as required, up to the boundaries of a restricted area; visually observe activities within restricted area from area boundary; negotiate with the ISP to allow minimum number of inspectors into a restricted area, if required, to fulfill inspection mandate.

Part II, Para 97-104      Collection, Handling and Analysis of Samples.

Functions: Collect samples; document samples; remove samples; analyze samples; request the ISP provide assistance with sample analysis, if required; transfer samples to an off-site laboratory; observe hazmat regulations; apply tags and seals; record location utilizing PLRS; sub-divide samples, as necessary, and share with the ISP; provide all unused samples or portions thereof to the ISP; comply with the Technical Secretariat guidance on security, integrity and preservation of samples.

Part II, Para 109      Post Inspection Procedures.

Functions: Review findings of the inspection team with the ISP; clarify ambiguities; provide the ISP preliminary findings in written form; provide list of samples taken.

## GENERAL AND IMPLIED INSPECTOR FUNCTIONS

General knowledge of the CTBT.

Abide by and apply appropriate provisions of the CTBT.

Understand and operate in accordance with the Technical Secretariat administrative/operational guidelines and procedures.

Understand rights and privileges under CTBT.

Effectively communicate verbally and in writing with team members and the ISP.

Function as a member of an inspection team.

Understand general personal health considerations, precautions, and treatments relevant for the various geographic areas and areas in which inspections may be held (safety of food, water and beverages; endemic diseases; required inoculations; etc.).

Observe personnel safety precautions:

mine safety

radiation safety

equipment operation safety

etc.

Administer first aid.

Apply diplomacy and good judgment.

Achieve computer literacy.

Provide site security.

### Team Chief Functions:

Manage and direct inspection team efforts.

Coordinate with the ISP.

Develop and modify (as needed) an inspection plan.

### Deputy Team Chief Functions:

Manage inspection team in absence of Team Chief.

### Team Leader Functions:

Manage and direct (sensor) (ground survey) (overflight) (etc.) team efforts.

### Administrative/Logistics Functions:

Plan, manage, coordinate and repair team communication equipment.

Manage and provide logistic and administrative support for team.

Possess Computer literacy and ability to use COTS office products.

Seal, tag, pack and maintain chain of custody for samples.

Provide security for team work areas.

## POTENTIAL TECHNICAL SECRETARIAT FUNCTIONS

### TREATY

- Art IV, Para 29-33 Consultation and Clarification.  
Functions: Coordinate with the IDC; provide information to the Director-General, as appropriate; provide technical support, as required, to the Executive Council.
- Art IV, Para 34-38 Request for On-Site Inspection.  
Functions: Provide technical support, as required, to the Executive Council and the Director-General.
- Art IV, Para 39-45 Follow-up After Submission of an On-Site Inspection Request.  
Functions: Assist Director-General in determining if inspection request meets requirements of Part II, Para 41 of the protocol; begin preparations for On-Site Inspections (logistics - prepare equipment, arrange for transportation etc.; administrative - begin alerting inspectors, etc.); assist the Director-General in obtaining clarification from the challenged State Party; coordinate with the IDC on data available from IMS.

### PROTOCOL

- Part II, Para 10 Director-General determines the size of the inspection team.  
Functions: Assist the Director-General in determining the size of the inspection team; select inspectors and inspection assistants; alert inspectors and inspection assistants.
- Part III, Para 3 “A State Party may ... invite representatives of the Technical Secretariat ... to visit sites within its territory.”  
Functions: Conduct visits under Confidence Building Measure #3.
- Part III, Para 4 Calibration activities.  
Functions: Support CBM #4, as necessary, by performing visits in support of calibration activities.

## DRAFT CONCEPT OF OPERATIONS FOR A CTBT ON-SITE INSPECTION

- Para IV, Page 4      Pre-Arrival Activities: Provide a general site orientation and develop an initial inspection plan.
- Functions: Develop site specific and event specific information prior to arrival at POE, develop an initial inspection plan.
- Para V, Pages 4-5      Point of Entry Activities: Provide political and logistic infrastructure necessary for the efficient conduct of future activities.
- Functions: Provide inspection mandate; liaise with ISP; select a location for basecamp; receive ISP briefing; conduct ISP in-briefing; arrange/finalize transportation/lodging; modify inspection plan;; off load inspection equipment from transportation; inspect equipment; undergo equipment inspection; apply tags and seals.
- Para VI, pages 5-8      Inspection Activities in first 25 Days: Initial On-Site Activity; Initial Overflight; Visual Inspection; Passive Seismic Survey; Reconnaissance Radionuclide Survey.
- Functions (Initial On-Site Activity): Establish basecamp; determine location using PLRS; verify operation of inspection equipment; conduct radiological survey; maintain equipment; perform administrative functions (computer use; keyboarding etc.), liaise with ISP.
- Functions (Initial overflight): Conduct initial overflight to narrow inspection area and collect factual data; utilize aerial observer techniques; document key surface features (man made and natural); conduct visual observation and photography using treaty mandated equipment; communicate air to ground.
- Functions (Visual inspection): Conduct visual inspection from the ground; document features that may indicate occurrence of a nuclear test; coordinate visual inspection activities with reconnaissance radioactivity survey; determine location using PLRS; locate precisely (survey?) any evidence collected/identified.
- Functions (Passive seismic survey): Deploy seismic sensors; deploy recording/communication systems; collect recorded data; evaluate data; re-deploy sensors as needed.
- Functions (Reconnaissance radionuclide survey): Collect air samples; use hand held Geiger counters; analyze radioactive samples; coordinate with visual survey team.

Para VI, pages 8-10

Inspection Activities in days 26 - 60: Continuation of activities from first 25 days; magnetic field mapping at the surface; ground penetrating radar surveys; soil gas sampling; additional overflights.

Functions (Continuation of activities from first 25 days): Conduct initial overflight; conduct visual inspection; conduct passive seismic survey; conduct radiological survey.

Functions (Magnet field mapping at the surface): Conduct magnetic field mapping measurements; determine location using PLRS; interpret magnet field data; modify magnetic field mapping plan.

Functions (Ground penetrating radar surveys): Develop a ground penetrating radar survey plan; perform measurements using ground penetrating radar.

Functions (Soil gas sampling): Collect gas samples from the ground by: 1) drawing from wellpoint; 2) drawing from the bottom of small augured holes; and 3) by collecting from underneath tarps; reduce size of radioactive sample by gettering; analyze sample on site; transfer samples off site.

Functions (Additional overflights): Negotiate with ISP for additional overflights; plan additional overflights; perform magnetic, gamma or multi-spectral monitoring from the air.

Para VIII, pages 10-11

Inspection Activities in days 61 - 130: Continuation of soil gas sampling; active seismic and electrical surveys; gravitational field mapping; drilling.

Functions (Continuation of soil gas sampling): Collect gas samples from the ground by: 1) drawing from wellpoint; 2) drawing from the bottom of small augured holes; and 3) by collecting from underneath tarps; reduce size of radioactive sample by gettering; analyze sample on site; transfer samples off site.

Functions (Active seismic and electrical surveys): Perform measurements using active seismic and electrical conductivity instruments; reduce data using a computer.

Functions (Gravitational field mapping): Perform measurements using gravitational field mapping instruments; reduce data using a computer and digital terrain maps.

Functions (Drilling): Deploy a drilling system to the field; conduct drilling; employ safety procedures to prevent accidental radiation release.

## JAYCOR CTBT: ON-SITE INSPECTION OPTIONS

- Para 2.5.2            Gather facts.  
Functions: Identify: locations to visit, personnel to interview, records to copy; conduct interviews; examine records (will this be allowed?); use tape recorders, photocopiers, computers and cameras.
- Para 2.5.3            Aerial Survey.  
Functions: Plan an initial overflight; plan for additional overflights; utilize sensors; perform photo interpretation and analysis; narrow inspection area.
- Para 2.5.4            Ground Survey.  
Functions: Plan a ground survey; collect data; conduct geological and geophysical survey; operate multi-terrain vehicles; conduct surveys (utilize surveying equipment); conduct sampling (air, surface, water); trap radioactive gases; determine location using PLRS; utilize radiation detection instruments; utilize seismological instruments; conduct geophysical measurements (acoustic, magnetic, gravity, electrical resistivity and radar imaging); conduct atmospheric radiation sampling (using balloons?); observe safety procedures; conduct inspection using managed access.
- Para 2.5.5            Ground Excavation.  
Functions: Plan drilling operations; conduct drilling; observe safety procedures; conduct inspection using managed access.
- Para 2.5.6            Underwater Inspections.  
Functions: Collect data; sample water; conduct seabed drilling; map ocean floor; conduct aerial surveys; determine location using PLRS.

### OTHER IMPLIED FUNCTIONS

Coordinate logistics with the ISP.

Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).

Establish inspection priorities; update as required.

Interact with the ISP.

Below is a “big picture” list of equipment developed by JAYCOR. It is included to give a feel for the variety of equipment that will be used on an On-Site Inspection and provide some feeling for the magnitude of inspector training requirements.

### **Equipment for the Conduct and Support of an On-Site Inspection**

<p><b>Aerial Survey</b></p> <ul style="list-style-type: none"> <li>• Multispectral cameras:             <ul style="list-style-type: none"> <li>- optical panoramic and framing cameras</li> <li>- video cameras with real time display</li> <li>- sideways looking synthetic aperture radar</li> <li>- ultraviolet cameras</li> </ul> </li> <li>• radionuclide detectors</li> <li>• Fixed wing aircraft</li> <li>• Helicopter (provided by the ISP)</li> </ul>	<p><b>Ground Survey</b></p> <ul style="list-style-type: none"> <li>• Geological/geophysical survey field equipment (team and individual)</li> <li>• Portable computers</li> <li>• Gravity gradiometer</li> <li>• Magnetic field mapping</li> <li>• Air and particulate sampling and analysis equipment</li> <li>• Seismic equipment</li> <li>• Ground penetrating radar</li> </ul>
<p><b>Underground Survey</b></p> <ul style="list-style-type: none"> <li>• Drilling equipment (e.g., directional core drilling rig - truck mounted Longyear Model 44 or equal with NaviDrill directional drilling equipment)</li> <li>• Vertical hole surveying equipment</li> <li>• Vertical hole coring equipment</li> <li>• Instrument for determining position within mine. Options include backpack inertial guidance system (expensive) or Brunton compass if mine maps are accurate.</li> </ul>	<p><b>Logistics</b></p> <ul style="list-style-type: none"> <li>• Aircraft for the transport of personnel and equipment to point of entry and to site in the ISP</li> <li>• Ships for the transport of equipment to inspection site in the ISP</li> <li>• Trucks and vans for the transport of personnel and equipment from POE to inspection site in the ISP including transportation during inspection</li> <li>• Aircraft for the transport of personnel and equipment to the ISP</li> </ul>
<p><b>Command and Control Center</b></p> <ul style="list-style-type: none"> <li>• power generators</li> <li>• computers and data recording equipment</li> <li>• communications equipment</li> </ul>	<p><b>Safety</b></p> <ul style="list-style-type: none"> <li>• Mine safety equipment (gas and structural analysis)</li> <li>• Medical supplies</li> </ul>

## CONSOLIDATED INSPECTOR FUNCTIONS

(Note!: Common function is a function that all inspection team members need to be able to perform and should receive training on.)

Abide by and apply appropriate provisions of the CTBT. (**common function**)

Achieve proficiency in the use of tape recorders, photocopiers, computers, and cameras.

Administer basic first aid. (**common function**)

Alert inspectors and inspection assistants for possible inspection duty.

Analyze samples for radioactivity on site.

Apply diplomacy and good judgment. (**common function**)

Apply tags and seals.

Arrange/finalize inspection transportation/lodging.

Assist Director-General in determining if inspection request meets requirements of Part II, Para 41 of the Protocol.

Assist the Director-General in determining the size of the inspection team.

Assist the Director-General in obtaining clarification from the challenged State Party.

Begin preparations for On-Site Inspections (logistics - prepare equipment; arrange for transportation etc.; administrative - begin alerting inspectors, etc.) when On-Site Inspection request fulfills requirements (see Article IV, Para 41).

Calibrate inspection equipment.

Clarify ambiguities with the ISP during exit briefing.

Collect air samples.

Collect gas samples from the ground by: 1) drawing from a wellpoint; 2) drawing from the bottom of small augured holes; and 3) collecting from underneath tarps.

Collect ground survey data.

Collect recorded data from seismic sensors.

Collect solid, liquid and gas samples above, at and below the surface.

Communicate effectively, verbally and in writing, with team members and the ISP. (**common function**)

Communicate intra-team (**common function**), with the Technical Secretariat, and with Executive Council - (radio procedures; antenna dish set up; fax use; e-mail? etc.).

Communicate air to ground.

Comply with Technical Secretariat guidance on security, integrity and preservation of samples.

Conduct ISP in-briefing.

Conduct geological and geophysical surveys.

Conduct the OSI and place equipment, as required, up to the boundaries of a restricted area.

Conduct inspection in accordance with CTBT provisions. (**common function**)

Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive.)

Conduct inspection using managed access. (**common function**)

Conduct interviews, as permitted.

Conduct negotiations.

Conduct initial overflight to narrow inspection area and collect factual data.

Coordinate with the ISP for additional overflights.

Conduct calibration activity visits, as necessary, in support of CBM #4.

Conduct visits under CBM #3.

Conduct magnetic field mapping measurements.

Conduct radiological survey.

Conduct seismic survey.

Conduct visual inspection from the ground.

Conduct visual observation and photography using treaty mandated equipment.

Coordinate logistics with the ISP.

Coordinate radionuclide survey with visual survey team.

Coordinate visual inspection activities with reconnaissance radioactivity survey.

Coordinate with the ISP.

Coordinate with the International Data Center.

Coordinate, if necessary, with the ISP to obtain drilling equipment.

Copy records, as permitted.

Deploy a drilling system to the field.

Deploy recording/communication systems for seismic devices.

Deploy seismic sensors; re-deploy as needed.

Determine background levels of radiation.

Determine/record location using PLRS. (**common function**)

Develop a drilling plan.

Develop a ground survey plan.

Develop a (ground penetrating radar) (electrical conductivity) measurement plan.

Develop a (magnetic) (gravitational) field mapping survey plan.

Develop an active seismic monitoring plan.

Develop a passive seismic monitoring plan.

Develop a radiation sample collection plan.

Develop a records review plan.

Develop an interview plan.

Develop and modify (as needed) an overall inspection plan.

Develop site specific and event specific information prior to arrival at POE.

Document features that may indicate occurrence of a nuclear test (ground visual inspection).

Document key surface features (man made and natural - initial overflight).

Document samples.

Effectively utilize working space. (**common function**)

Employ multi-spectral imagery (includes infrared - What else do we do here?).

Employ safety procedures while drilling to prevent accidental radiation release.

Establish base camp. (**common function**)

Establish inspection priorities; update as required.

Estimate/determine geographic and vertical coordinates.

Evaluate radiation data.

Evaluate seismic data.

Examine records, as permitted.

File flight plan.

Fly/maintain aircraft.

Function as a member of an inspection team. (**common function**)

General knowledge of the CTBT. (**common function**)

Identify anomalies or artifacts using magnetic/gravitational field mapping, ground penetrating radar and/or electrical conductivity measurements.

Identify radiation anomalies.

Identify underground anomalies to include cavities and rubble zones.

Inform observer of inspection activities.

Inspect equipment at POE.

Interact with the ISP. (**common function**)

Interpret magnet field data.

Know legal responsibilities under CTBT. (**common function**)

Liaise with the ISP.

Liaise with observer.

Locate precisely (survey?) any evidence collected/identified.

Maintain aircraft.

Maintain inspection and personal equipment.

Maintain telecommunications.

Manage and direct (sensor) (ground survey) (overflight) etc. team efforts.

Manage and direct inspection team efforts.

Manage and provide logistic and administrative support for inspection team.

Manage inspection team in absence of Team Chief.

Modify magnetic field mapping plan.

Modify inspection plan.

Move to base camp from point of entry. **(common function)**

Negotiate with ISP for additional overflights.

Negotiate with the ISP to allow minimum number of inspectors into a restricted area, if required, to fulfill inspection mandate.

Observe (visually) activities within restricted area from the area boundary.

Observe hazmat regulations. **(common function)**

Observe hazmat safety. **(common function)**

Observe ISP measures to protect sensitive installations and locations to prevent disclosure of sensitive information. **(common function)**

Observe personnel safety precautions (mine safety, radiation safety, equipment operation safety, etc.). **(common function)**

Observe rights and obligations of the ISP (See Part II, Para 88). **(common function)**

Off load inspection equipment from transportation. **(common function)**

Operate multi-terrain vehicles. **(common function)**

Organize drilling logistics.

Pack, seal, tag, and maintain chain of custody for samples.

Perform administrative functions (computer use; keyboarding, communications(?), journal keeping, scheduling, etc.). **(common function)**

Perform energy resolution analysis.

Perform equipment inventory. **(common function)**

Perform gamma radiation monitoring on the ground and as an aerial observer.

Perform measurements at the surface and from the air using (magnetic) (gravitational) field mapping instruments.

Perform measurements using active seismic and electrical conductivity instruments.

Perform measurements using ground penetrating radar instruments.

Perform multispectral monitoring from the air.

Perform technical functions (equipment maintenance, repair etc.).

Plan a flight.

Plan a ground survey.

Plan an initial overflight.

Plan additional overflight(s).

Plan drilling operations.

Plan equipment movement.

Plan inspection.

Plan logistics.

Plan, manage, coordinate and repair inspection team communication equipment.

Possess computer literacy and ability to use COTS office products.

Practice cultural awareness. **(common function)**

Prepare samples for shipping off-site.

Process film?

Provide all unused samples or portions thereof to the ISP.

Provide copies of information and data collected to the ISP.

Provide information to the Director-General, as appropriate, to support the consultation and clarification process as well as On-Site Inspection requests.

Provide inspection mandate.

Provide interpretation services.

Provide the ISP with preliminary findings in written form during exit briefing.

Provide the ISP with a list of samples during the exit briefing.

Provide logistical support (meals, lodging etc.).

Provide medical support (physician? physician assistant? EMT?).

Provide security for team work areas.

Provide site security.

Provide technical support, as required, to the Executive Council to support the consultation and clarification process as well as On-Site Inspection requests.

Provide the ISP duplicate copies of all photographs and measurements.

Provide transportation (driving, maintenance).

Read a map. **(common function)**

Receive data from the ISP.

Receive in-briefing. **(common function)**

Receive recommendations from observer.

Reduce active seismic and electrical survey data using a computer.

Reduce gravitational field mapping data using a computer and digital terrain maps.

Reduce size of radioactive sample by gettering.

Reduce size of search area.

Repair equipment.

Request inspection extension, if required, to conduct drilling.

Request the ISP provide assistance with sample analysis, if required.

Request permission from the EC to conduct drilling.

Review findings of inspection team with the ISP during exit briefing.

Safe use of equipment. **(common function)**

Scan photography.

Select a location for basecamp.

Select inspectors and inspection assistants.

Sub-divide samples, as necessary, and share with the ISP.

Supervise the ISP in taking video/still photography (see Para 61 (e)).

Take video/still photography (utilize digital camera?, 35 mm camera?, Polaroid camera?, video camera).

Transfer (ship/transport) samples to an off-site laboratory while observing hazmat regulations.

Transmit magnetic, gravitational, ground penetrating radar and/or electrical conductivity data, as required, to the Technical Secretariat.

Transmit photography to the Technical Secretariat.

Transmit radiation data, in digital form, to the Technical Secretariat for analysis.

Transmit seismological data, in digital form, to the Technical Secretariat for analysis.

Trap radioactive gases.

Undergo equipment inspection at POE.

Understand and operate in accordance with Technical Secretariat administrative/operational guidelines and procedures. **(common function)**

Understand flight planning.

Understand general personal health considerations, precautions, and treatments relevant for the various geographic areas and areas in which inspections may be held (safety of food, water and beverages; endemic diseases; required inoculations; etc.). **(common function)**

Understand rights and privileges under CTBT. **(common function)**

Use equipment associated with inspection specialty. **(common function)**

Use field glasses as an aerial observer.

Use hand held Geiger counters.

Use ISP telecommunications.

Use own telecommunications. (**common function**)

Use surveying equipment.

Utilize aerial observer techniques.

Utilize computer and commercial software to analyze/enhance photography.

Utilize film badges?

Utilize ground observer techniques.

Verify operation of inspection equipment.

Write (report) (proposal) (request) (recommendation) in format prescribed by Operations Manual. (**common function**)

## POTENTIAL OSI TEAM MEMBERS

### OPERATIONAL

Team Chief

Deputy Team Chief

#### Functional Team Leader

- Overflight
- Ground Survey
- Underground Survey
- Radiation
- Drilling

Geologist/Geophysicist

Geotechnical Engineer

Mining Engineer

Driller

Drill Helpers

Photographer (still and video)

Radiation Sampler

Sample and Analysis Expert

#### Sensor Technician

- Seismic
- Radiation
- Magnetic Field Mapping
- Ground Penetrating Radar
- Gravitational Field Mapping
- Electrical Conductivity
- Other multispectral

Photographic Interpreter

#### Data Reduction Technician

- Seismic
- Magnetic Field Mapping
- Ground Penetrating Radar
- Gravitational Field Mapping
- Electrical Conductivity

Records Reviewer

Interviewer

Surveyor

### ADMINISTRATION/LOGISTICS

Logistic Team Leader

Administration Team Leader

#### Maintenance (Repair) Technician

- Vehicle
- Computer
- Sensor
- Communications
- Aircraft
- Other (e.g., generator)

Aircrew

Linguist

Communication

Clerk/Typist

Medical

Driver

Sample Handler

#### Safety

- Mine Safety
- Radiation

## INSPECTOR SPECIALTIES AND RELATED FUNCTIONS

The purpose of this paper is to identify inspector specialties that might be required to successfully perform an On-Site Inspection (OSI) under the Comprehensive Test Ban Treaty (CTBT). No attempt was made, at this time, to eliminate any specialty. As a result, the list of Potential OSI Team Members shown on the next page is meant to be all inclusive.

This list of potential team members was generated by identifying potential inspector functions from:

- work done on previous arms control treaties;
- work done on the CTBT by various contractors for DSWA; and
- work done by various government organizations to include the Verification and Monitoring Task Force.

These lists were then merged with any duplicate specialties being eliminated. Previously identified inspector functions were then assigned to each of the specialties. The inspector specialties with their assigned functions constitute the remainder of this paper. Functions common to all specialties were identified and listed separately.

The next step in the process will be to validate the list of potential inspector specialties to insure that no critical specialty or function has been omitted. Having completed this step, one would next pare down the number of specialties by combining specialties with similar functions. The ultimate goal of this process is to determine the inspector specialties necessary to perform an OSI; the hiring qualifications for these inspectors and any additional training they need to receive to be certified as inspectors.

## POTENTIAL SITE TEAM MEMBERS

### OPERATIONAL

Team Chief

Deputy Team Chief

#### Functional Team Leader

- Overflight
- Ground Survey
- Underground Survey
- Radiation
- Drilling

Driller

Drill Helpers

Geologist/Geophysicist/Geotechnical Eng

Interviewer

Mining Engineer

Photographer (still and video)

Photographic Interpreter

Radiation Sampler

Sample Analysis Expert

Records Reviewer

Surveyor

#### Sensor Technician

- Seismic
- Radiation
- Magnetic Field Mapping
- Ground Penetrating Radar
- Gravitational Field Mapping
- Electrical Conductivity
- Other multispectral

#### Data Reduction Technician

- Seismic
- Magnetic Field Mapping
- Ground Penetrating Radar
- Gravitational Field Mapping
- Electrical Conductivity

### ADMINISTRATION/LOGISTICS

Administration Team Leader

Logistics Team Leader

Aircrew

Clerk/Typist

Communication

Driver

Linguist

#### Maintenance (Repair) Technician

- Vehicle
- Computer
- Sensor
- Communications
- Radiation
- Multispectral
- Aircraft
- Other (e.g., generator)

Medical

#### Safety

- Mine Safety
- Radiation

Sample Handler

## Operational Team

### Team Chief

- Assist the Director-General in determining the size of the inspection team.
- Clarify ambiguities with the ISP during exit briefing.
- Communicate with the Technical Secretariat, and with the Executive Council.
- Conduct inspection in-briefing.
- Conduct the OSI and place equipment, as required, up to the boundaries of a restricted area.
- Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).
- Conduct negotiations with ISP on specifics of the inspection (i.e., additional overflights, access to restricted area etc.).
- Coordinate with the ISP for additional overflights.
- Coordinate with the International Data Center.
- Coordinate, if necessary, with the ISP to obtain drilling equipment.
- Develop and modify (as needed) an overall inspection plan.
- Develop site specific and event specific information prior to arrival at POE.
- Establish inspection priorities; update as required.
- Inform observer of inspection activities.
- Liaise with the ISP.
- Liaise with observer.
- Manage and direct inspection team efforts.
- Modify inspection plan.
- Provide copies of information and data collected to the ISP.
- Provide inspection mandate and initial inspection plan to ISP.
- Provide the ISP with preliminary findings in written form during exit briefing.
- Provide the ISP with a list of samples taken during the exit briefing.
- Provide the ISP duplicate copies of all photographs and measurements.
- Receive data from the ISP.
- Receive recommendations from observer.
- Request permission to conduct drilling.
- Request inspection extension, if required.
- Request the ISP provide assistance with sample analysis, if required.

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Request permission from the EC to conduct drilling.  
Review findings of inspection team with the ISP during exit briefing.  
Select the location of a basecamp.  
Select inspectors and inspection assistants  
Submit an inspection progress report within 25 days to the EC.

### **Deputy Team Chief**

Communicate with the Technical Secretariat, and with Executive Council.  
Conduct portions of the inspection in-briefing (as required).  
Conduct the OSI and place equipment, as required, up to the boundaries of a restricted area.  
• Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).  
Conduct negotiations.  
Coordinate with the ISP.  
Coordinate with Team Chief on the location of a basecamp.  
Coordinate with Team Chief on the selection of inspectors and inspection assistants.  
Coordinate with the International Data Center.  
Coordinate, if necessary, with the ISP to obtain drilling equipment.  
Develop and modify (as needed) an overall inspection plan.  
Develop site specific and event specific information prior to arrival at POE.  
Establish inspection priorities; update as required.  
Inform observer of inspection activities.  
Liaise with the ISP.  
Liaise with observer.  
Manage inspection team in Team Chief's absence.  
Provide copies of information and data collected to the ISP.  
Receive data from the ISP.  
Receive recommendations from observer.

### **Overflight Team Leader**

Communicate air to ground.  
Conduct portions of the inspection in-briefing (as required).  
Conduct overflight observing restrictions imposed by ISP.

Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).

Conduct initial overflight to narrow inspection area and collect factual data.

Conduct visual observation and photography using treaty mandated equipment.

Coordinate with Team Chief on the location of a basecamp.

Coordinate with the ISP for additional overflights.

Coordinate visual inspection activities with radioactivity survey.

Coordinate with the ISP.

Coordinate with the International Data Center.

Develop site specific and event specific information prior to arrival at POE.

Document features that may indicate occurrence of a nuclear test.

Document key surface features (man made and natural - initial overflight).

Establish priorities; update as required.

Liaise with observer.

Manage and direct overflight team efforts.

Negotiate with ISP for additional overflights when directed to do so by Team Chief..

Observe (visually) activities within restricted area from the area boundary.

Plan an initial overflight.

Plan additional overflight(s).

Provide the ISP duplicate copies of all photographs and measurements.

Receive data from the ISP.

Receive recommendations from observer.

Reduce size of search area.

Supervise the ISP in taking video/still photography (see Para 61 (e)).

Use field glasses as an aerial observer.

Utilize aerial observer techniques.

### **Ground Survey Team Leader**

Collect ground survey data.

Collect recorded data from seismic sensors.

Conduct portions of the inspection in-briefing (as required).

Conduct geological and geophysical surveys.

Conduct the ground survey portion of the OSI and place equipment, as required, up to the boundaries of a restricted area.

Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).

Conduct magnetic field mapping measurements.

Conduct seismic survey.

Conduct visual inspection from the ground.

Coordinate visual inspection activities with radioactivity survey.

Coordinate with Team Chief on the location of a basecamp.

Coordinate with the ISP.

Coordinate with the International Data Center.

Develop a ground survey plan and modify, as necessary.

Develop site specific and event specific information prior to arrival at POE.

Document features that may indicate occurrence of a nuclear test (ground visual inspection).

Establish priorities; update as required.

Evaluate seismic data.

Identify anomalies or artifacts using magnetic/gravitational field mapping, ground penetrating radar and/or electrical conductivity measurements.

Liaise with observer.

Manage and direct ground survey team efforts.

Observe (visually) activities within restricted area from the area boundary.

Receive data from the ISP.

Receive recommendations from observer.

Reduce size of search area.

### **Underground Survey Team Leader**

Conduct portions of inspection in-briefing (as required).

Conduct the OSI and place equipment, as required, up to the boundaries of a restricted area.

Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).

Coordinate with Team Chief on the location of a basecamp.

Coordinate with the ISP.

Coordinate with the International Data Center.

Develop a underground survey plan and modify, as necessary.

Develop site specific and event specific information prior to arrival at POE.

Establish priorities; update as required.

Evaluate seismic data.

Identify anomalies or artifacts using magnetic/gravitational field mapping, ground penetrating radar and/or electrical conductivity measurements.

Identify underground anomalies to include cavities and rubble zones.

Liaise with observer.

Manage and direct underground survey team efforts.

Receive data from the ISP.

Receive recommendations from observer.

Reduce size of search area.

### **Radiation Team Leader**

Conduct portions of inspection in-briefing (as required).

Conduct the OSI and place equipment, as required, up to the boundaries of a restricted area.

Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).

Conduct radiological survey.

Coordinate radionuclide survey with ground survey and underground survey team.

Coordinate with the ISP.

Coordinate with the International Data Center.

Determine background levels of radiation.

Development a radiation monitoring plan and modify, as necessary.

Develop a radiation sample collection plan and modify, as necessary.

Develop site specific and event specific information, if available, prior to arrival at POE.

Establish priorities; update as required.

Evaluate radiation data.

Identify radiation anomalies.

Liaise with observer.

Manage and direct radiation team efforts.

Pack, seal, tag, and maintain chain of custody for samples.

Perform gamma radiation monitoring on the ground and as an aerial observer.

Receive data from the ISP.

Receive recommendations from observer.

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Request the ISP provide assistance with sample analysis, if required.

Use film badge/personnel radiation monitor in accordance with radiation safety requirements of an OSI.

### **Drilling Team Leader**

Conduct the OSI and place equipment, as required, up to the boundaries of a restricted area.

Conduct inspection using a phased approach for inspection activities (speediest and least intrusive to slowest and most intrusive).

Coordinate with the ISP.

Coordinate with the International Data Center.

Coordinate, if necessary, with the ISP to obtain drilling equipment.

Deploy a drilling system to the field.

Develop a drilling plan and modify, as necessary.

Develop site specific and event specific information prior to arrival at POE.

Employ safety procedures while drilling to prevent accidental radiation release.

Establish priorities; update as required.

Liaise with observer.

Manage and direct drilling team efforts.

Organize drilling logistics.

Plan drilling operations.

Receive data from the ISP.

Receive recommendations from observer.

Request the Team Chief seek an inspection extension to conduct drilling.

Request the Team Chief seek permission from the EC to conduct drilling.

Utilize film badges?

### **Driller**

Deploy a drilling system to the field.

Drill to locate radioactive residue from a nuclear detonation.

Employ safety procedures while drilling to prevent accidental radiation release.

Use film badge/personnel radiation monitor in accordance with radiation safety requirements of an OSI.

**Drill Helpers**

Drill to locate radioactive residue from a nuclear detonation.

Employ safety procedures while drilling to prevent accidental radiation release.

Use film badge/personnel radiation monitor in accordance with radiation safety requirements of an OSI.

**Geologist/Geophysicist/Geotechnical Engineer**

Conduct geological and geophysical surveys.

Conduct seismic survey.

Develop an active seismic monitoring plan and modify, as required.

Develop a passive seismic monitoring plan and modify, as required.

Develop site specific and event specific information prior to arrival at POE.

Establish priorities; update as required.

Evaluate seismic data.

Receive data from the ISP.

Receive recommendations from observer.

**Interviewer**

Conduct interviews, as permitted.

Develop an interview plan.

**Mining Engineer**

Establish priorities; update as required.

Inspect mines/tunnels in the OSI area.

Receive data from the ISP.

Receive recommendations from observer.

**Photographer (still and video)**

Conduct initial overflight to narrow inspection area and collect factual data.

Conduct visual observation and photography using treaty mandated equipment.

Document key surface features (man made and natural - initial overflight).

Inspect equipment at POE.

Process film?

Provide the ISP duplicate copies of all photographs and measurements.

Scan photography.

Supervise the ISP in taking video/still photography (see Para 61 (e)).

Take video/still photography (utilize digital camera?, 35 mm camera?, Polaroid camera?, videocamera).

Utilize aerial observer techniques.

Verify operation of inspection equipment.

### **Photographic Interpreter**

Conduct initial overflight to narrow inspection area and collect factual data.

Conduct visual observation and photography using treaty mandated equipment (if required).

Document key surface features (man made and natural - initial overflight).

Inspect equipment at POE.

Process film?

Review commercial satellite photography (SPOT) or NTM images prior to OSI.

Scan photography into a computer data base.

Transmit photography in digital form to the Technical Secretariat.

Utilize computer and commercial software to analyze/enhance photography.

Utilize aerial observer techniques.

Verify operation of inspection equipment.

### **Radiation Sampler**

Assist in the development of a radiation sample collection plan and modify, as necessary

Collect air samples.

Collect gas samples from the ground by: 1) drawing from a wellpoint; 2) drawing from the bottom of small augured holes; and 3) collecting from underneath tarps.

Collect solid, liquid and gas samples above, at and below the surface.

Document samples.

Estimate/determine geographic and vertical coordinates.

Evaluate radiation data.

Inspect equipment at POE.

Pack, seal, tag, and maintain chain of custody for samples.

Prepare samples for shipping off-site.

Provide all unused samples or portions thereof to the ISP.

Reduce size of radioactive sample.

Sub-divide samples, as necessary, and share with the ISP.

Transfer (ship/transport) samples to an off-site laboratory while observing hazmat regulations.

Trap (collect) radioactive gases.

Use film badge/personnel radiation monitor in accordance with radiation safety requirements of an OSI.

Verify operation of inspection equipment.

### **Sample Analysis Expert**

Analyze samples on site for radioactivity.

Document evidence that may indicate occurrence of a nuclear test.

Inspect equipment at POE.

Prepare samples for shipping off-site.

Provide all unused samples or portions thereof to the ISP.

Reduce size of radioactive sample by gettering.

Request the ISP provide assistance with sample analysis, if required.

Sub-divide samples, as necessary, and share with the ISP.

Transfer (ship/transport) samples to an off-site laboratory while observing hazmat regulations.

Use film badge/personnel radiation monitor in accordance with radiation safety requirements of an OSI.

Verify operation of inspection equipment.

### **Records Reviewer**

Copy ISP records, as permitted.

Develop a records review plan.

Document evidence that may indicate occurrence of a nuclear test.

Examine ISP records, as permitted.

### **Surveyor**

Precisely locate (survey), as required, any evidence collected/identified.

Use surveying equipment.

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### **Seismic Sensor Technician**

Assist in the development of an active seismic monitoring plan.  
Assist in the development of a passive seismic monitoring plan.  
Calibrate inspection equipment.  
Collect recorded data from seismic sensors.  
Conduct seismic survey.  
Deploy seismic sensors; re-deploy as needed.  
Document evidence that may indicate occurrence of a nuclear test.  
Estimate/determine geographic and vertical coordinates.  
Evaluate seismic data.  
Inspect equipment at POE.  
Perform measurements using active seismic instruments.  
Transmit seismological data, in digital form, to the Technical Secretariat for analysis.  
Verify operation of inspection equipment.

### **Radiation Technician**

Assist in the development of a radiation monitoring plan.  
Conduct radiological survey.  
Determine background levels of radiation.  
Document evidence that may indicate occurrence of a nuclear test.  
Estimate/determine geographic and vertical coordinates.  
Evaluate radiation data.  
Identify radiation anomalies.  
Inspect equipment at POE.  
Pack, seal, tag, and maintain chain of custody for samples.  
Perform energy resolution analysis (gamma spectroscopy?).  
Perform gamma radiation monitoring on the ground and as an aerial observer.  
Transmit radiation data, in digital form, to the Technical Secretariat for analysis.  
Use hand held radiation detection instruments.  
Use film badge/personnel radiation monitor in accordance with radiation safety requirements of an OSI.  
Verify operation of inspection equipment.

### **Magnetic Field Mapping Technician**

- Calibrate inspection equipment.
- Conduct magnetic field mapping measurements.
- Develop a magnetic field mapping survey plan.
- Document evidence that may indicate occurrence of a nuclear test.
- Estimate/determine geographic and vertical coordinates.
- Identify anomalies or artifacts using magnetic field mapping measurements.
- Inspect equipment at POE.
- Interpret magnetic field data.
- Modify magnetic field mapping plan, when directed.
- Perform measurements at the surface and from the air using magnetic field mapping instruments.
- Transmit magnetic field mapping data in digital format, as required, to the Technical Secretariat.
- Verify operation of inspection equipment.

### **Ground Penetrating Radar Technician**

- Calibrate inspection equipment.
- Develop a ground penetrating radar measurement plan.
- Document evidence that may indicate occurrence of a nuclear test.
- Estimate/determine geographic and vertical coordinates.
- Identify anomalies or artifacts using ground penetrating radar measurements.
- Identify underground anomalies to include cavities and rubble zones.
- Inspect equipment at POE.
- Perform measurements using ground penetrating radar instruments.
- Transmit ground penetrating radar data in digital form, as required, to the Technical Secretariat.
- Verify operation of inspection equipment.

### **Gravitational Field Mapping Technician**

- Calibrate inspection equipment.
- Develop a gravitational field mapping survey plan.
- Document evidence that may indicate occurrence of a nuclear test.
- Estimate/determine geographic and vertical coordinates.

Identify anomalies or artifacts using gravitational field mapping measurements.  
Inspect equipment at POE.  
Perform measurements at the surface and from the air using gravitational field mapping instruments.  
Transmit gravitational field mapping data in digital form, as required, to the Technical Secretariat.  
Verify operation of inspection equipment.

### **Electrical Conductivity Technician**

Calibrate inspection equipment.  
Develop an electrical conductivity measurement plan.  
Document evidence that may indicate occurrence of a nuclear test.  
Estimate/determine geographic and vertical coordinates.  
Identify anomalies (to include cavities and rubble zones) or artifacts using electrical conductivity measurements.  
Inspect equipment at POE.  
Perform measurements using electrical conductivity instruments.  
Transmit electrical conductivity data in digital form, as required, to the Technical Secretariat.  
Verify operation of inspection equipment.

### **“Other Multispectral” Technician**

Calibrate inspection equipment.  
Develop a multispectral image measurement plan.  
Document evidence that may indicate occurrence of a nuclear test.  
Employ multi-spectral imagery (includes infrared - What else do we do here?).  
Estimate/determine geographic and vertical coordinates.  
Inspect equipment at POE.  
Perform multispectral monitoring from the air.  
Transmit other multispectral data in digital form, as required, to the Technical Secretariat for analysis.  
Verify operation of inspection equipment.

### **Seismic Data Reduction Technician**

Assist in the analysis of seismic data.

Collect ground survey data.

Collect recorded data from seismic sensors.

Deploy recording/communication systems for seismic devices.

Document evidence that may indicate occurrence of a nuclear test.

Reduce active seismic data using a computer.

Transmit seismological data, in digital form, to the Technical Secretariat for analysis.

### **Magnetic Field Mapping Data Reduction Technician**

Assist in the analysis of magnetic field mapping data.

Document evidence that may indicate occurrence of a nuclear test.

Identify anomalies or artifacts using magnetic field mapping measurements.

Reduce gravitational field mapping data using a computer and digital terrain maps.

Transmit magnetic field mapping data in digital form, as required, to the Technical Secretariat for analysis.

### **Ground Penetrating Radar Data Reduction Technician**

Assist in the analysis of ground penetrating radar data.

Document evidence that may indicate occurrence of a nuclear test.

Identify anomalies or artifacts using ground penetrating radar measurements.

Identify underground anomalies to include cavities and rubble zones.

Transmit ground penetrating radar data in digital form, as required, to the Technical Secretariat for analysis.

### **Gravitational Field Mapping Data Reduction Technician**

Document evidence that may indicate occurrence of a nuclear test.

Identify anomalies or artifacts using gravitational field mapping measurements.

Transmit gravitational field mapping data in digital, as required, to the Technical Secretariat for analysis.

### **Electrical Conductivity Data Reduction Technician**

Assist in the analysis of electrical conductivity data.

Document evidence that may indicate occurrence of a nuclear test.

Identify anomalies or artifacts using electrical conductivity measurements.

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Identify underground anomalies to include cavities and rubble zones.

Reduce electrical survey data using a computer.

Transmit electrical conductivity data in digital form, as required, to the Technical Secretariat for analysis.

## **Administration/Logistics Team**

### **Administration Team Leader**

Coordinate with the ISP.

Manage and provide administrative support for inspection team.

Provide security for team work areas in base camp.

### **Logistic Team Leader**

Coordinate logistics (meals, lodging etc.) with the ISP.

Coordinate, if necessary, with the ISP to obtain drilling equipment.

Coordinate drilling logistics with Drilling Team Leader.

Coordinate with Team Chief on the location of a basecamp.

Manage and provide logistic support for inspection team.

Plan equipment movement.

Plan logistics.

### **Aircrew**

File flight plan.

Fly/maintain aircraft.

Plan a flight.

Plan an initial overflight.

Plan additional overflight(s).

### **Clerk/Typist**

Achieve proficiency in the use of tape recorders, photocopiers, computers, and cameras.

Copy records, as permitted.

Possess computer literacy and ability to use COTS office products.

Scan photography as required.

**Communication**

Communicate with the Technical Secretariat, and with Executive Council - (radio procedures; antenna dish set up; fax use; e-mail? etc.).

Maintain telecommunications.

Plan, manage, and coordinate inspection team communication equipment.

Transmit magnetic, gravitational, ground penetrating radar and/or electrical conductivity data, as required, to the Technical Secretariat.

Transmit photography to the Technical Secretariat.

Transmit radiation data, in digital form, to the Technical Secretariat for analysis.

Transmit seismological data, in digital form, to the Technical Secretariat for analysis.

Use ISP telecommunications.

**Driver**

Provide transportation (driving, maintenance).

**Linguist**

Be a member of the initial overflight (if required).

Provide interpretation services to inspection team as directed.

**Vehicle Maintenance Technician**

Inspect equipment at POE.

Maintain/repair vehicles

**Computer Maintenance Technician**

Inspect equipment at POE.

Maintain/repair computer equipment.

**Sensor Maintenance Technician**

Calibrate inspection equipment.

Inspect equipment at POE.

Maintain/repair seismic equipment.

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### **Communications Maintenance Technician**

Maintain/repair telecommunications.

Verify operation of inspection equipment.

### **Radiation Equipment Maintenance Technician**

Calibrate inspection equipment.

Inspect equipment at POE.

Maintain/repair radiation detection and analysis equipment.

Verify operation of inspection equipment.

### **Multispectral Equipment (Ground Penetrating Radar, Magnetic Field Mapping etc.) Maintenance Technician**

Calibrate inspection equipment.

Inspect equipment at POE.

Maintain/repair multispectral equipment.

Verify operation of inspection equipment.

### **Aircraft Maintenance Technician**

Maintain/repair aircraft.

### **Other (e.g., generator) Maintenance Technician**

Inspect equipment at POE.

Maintain/repair equipment.

Verify operation of inspection equipment.

### **Medical**

Provide medical support (physician? physician assistant? EMT?).

### **Safety**

Insure that proper safety procedures are observed during inspection.

### **Sample Handler**

Pack, seal, tag, and maintain chain of custody for samples.

Prepare samples for shipping off-site.

Provide all unused samples or portions thereof to the ISP.

Transfer (ship/transport) samples to an off-site laboratory while observing hazmat regulations.

### **Common Skills (Functions)**

Abide by and apply appropriate provisions of the CTBT.

Administer basic first aid.

Apply diplomacy and good judgment.

Apply tags and seals.

Communicate effectively, verbally and in writing, with team members and the ISP.

Communicate intra-team.

Comply with Technical Secretariat guidance on security, integrity and preservation of samples.

Conduct inspection in accordance with CTBT provisions.

Conduct inspection using managed access.

Determine/record location using PLRS.

Document evidence that may indicate the occurrence of a nuclear test.

Effectively utilize working space.

Establish base camp.

Function as a member of an inspection team.

Develop/maintain general knowledge of the CTBT.

Interact with the ISP.

Know legal responsibilities under CTBT.

Maintain personal equipment and inspection equipment, as required.

Move to base camp from point of entry.

Observe hazmat regulations.

Observe hazmat safety.

Observe and abide by ISP measures to protect sensitive installations and locations to prevent disclosure of sensitive information.

Observe personnel safety precautions (mine safety, radiation safety, equipment operation safety, etc.).

Observe rights and obligations of the ISP (See Part II, Para '88).

Off load inspection equipment from transportation.

Operate multi-terrain vehicles.

Perform administrative functions (computer use; keyboarding, communications(?), journal keeping, scheduling, etc.).

Perform equipment inventory.

Practice cultural awareness.

Provide security at work site.

Read a map.

Receive in-briefing.

Undergo equipment inspection (personal and inspection related) at POE.

Understand and operate in accordance with Technical Secretariat administrative/operational guidelines and procedures.

Understand general personal health considerations, precautions, and treatments relevant for the various geographic areas and areas in which inspections may be held (safety of food, water and beverages; endemic diseases; required inoculations; etc.).

Understand rights and privileges under CTBT.

Use equipment associated with inspection specialty.

Use equipment in a safe manner.

Use own telecommunications.

Write (report) (proposal) (request) (recommendation) in format prescribed by Operations Manual.

### **Permanent (Technical Secretariat) Staff**

Alert inspectors and inspection assistants for possible inspection duty.

Arrange/finalize inspection transportation/lodging.

Assist Director-General in determining if inspection request meets requirements of Part II, Para 41 of the Protocol.

Assist the Director-General in determining the size of the inspection team.

Assist the Director-General in obtaining clarification from the challenged State Party.

Begin preparations for On-Site Inspections (logistics - prepare equipment; arrange for transportation etc.; administrative - begin alerting inspectors, etc.) when On-Site Inspection request fulfills requirements (see Article IV, Para 41).

Calibrate inspection equipment.

Conduct calibration activity visits, as necessary, in support of CBM #4.

Conduct visits under CBM #3.

Provide information to the Director-General, as appropriate, to support the consultation and clarification process as well as On-Site Inspection requests.

Provide inspection mandate.

Provide inspection notification.

Provide technical support, as required, to the Executive Council to support the consultation and clarification process as well as On-Site Inspection requests.

Coordinate with Team Chief on the location of a basecamp.

Select inspectors and inspection assistants.

**PRELIMINARY DETERMINATION OF QUALIFICATIONS AND TRAINING FOR INSPECTORS REQUIRED TO CAPTURE SHORT-LIVED PHENOMENOLOGY**

**INTRODUCTION**

During the initial phase of an On-Site Inspection (OSI), emphasis will be placed on capturing short-lived phenomenology and narrowing the search area. Specifically, efforts will be directed toward locating radioactivity on the surface or finding evidence, such as aftershocks or ground cracking, that can be used to narrow the search area. In a 2 May 1997 paper, DOE provided a preliminary estimate of a bare-bones inspection team composition (See below). The purpose of this paper is to identify qualifications and training of this Bare-Bones Team; to identify additional personnel to raise the team strength to the permitted level of 40; and to identify the qualifications and training required for these additional personnel.

**DOE PROPOSED BARE BONES INSPECTION TEAM**

<b>Primary Personnel<sup>1</sup></b>	<b>Auxiliary Personnel</b>
3 Geologists	1 Data Management Specialists
1 Seismologist	1 Mining Engineer
1 Radiochemist	1 Seismologist
3 Equipment Technicians (Seismic & Sampling)	1 Radiochemist
1 Health & Safety	2 Linguists
	2 Equipment Technicians
<b>TOTAL: 9</b>	<b>TOTAL: 8</b>

<sup>1</sup> One of these individuals will be designated as team leader.

**BARE-BONE TEAM QUALIFICATION AND TRAINING**

Qualifications (Selection Criteria) for geologists, seismologists, radiochemists and mining engineers are rather straight forward: A degree in their specific field (masters degree preferred over bachelors degree); some degree of practical experience (prefer field experience over academic or managerial experience); verbal/writing skills and fluency in English. (Using the CWC as a model, there will be a common language used by the inspectors to communicate intra-team and that language will be English. Consequently, fluency in English becomes a selection criteria. An alternate, less acceptable approach would be to require fluency in a CTBT language (English, French, German, Spanish, Russian, Chinese or Arabic) and then conduct the necessary English language training after hiring.)

Selection criteria for the Equipment Technicians will be a high school degree; specialized/technical school training; practical experience working with seismic or radiological equipment; and fluency in English. A similar set of selection criteria would exist for the Data Management Specialist: a high school degree as a minimum (bachelors degree desired); computer proficiency; and fluency in English.

There are three potential solutions for the Health and Safety Inspector: a physician; a physician's assistant; or an occupational safety and health specialist. Given that On-Site Inspections (OSI) will be conducted in harsh environments under potentially hazardous conditions, we believe the Health and Safety Inspector should possess medical skills. However, since it is assumed that the Inspected State Party (ISP) will provide all the necessary infrastructure and logistical support, a physician seems to be "over kill." Consequently, selection criteria for the Health and Safety Inspector are: a practicing physician's assistant; and fluency in English.

Linguists need to be fluent in at least one language other than a CTBT language and must be able to interpret into English (preferred) or into another CTBT language. Besides being fluent in the general terminology of the interpreted language, the linguists needs to demonstrate fluency in the technical terminology used in nuclear testing and nuclear science.

Upon being hired by the CTBTO, all inspectors will undergo extensive training. Module 1 will be a Basic Course. It will allow inspectors to acquire general knowledge about the CTBT and the CTBTO as well as OSI. The Chemical Weapons Convention (CWC) Basic Course training is seven weeks in length. Since the CTBT is not as complex as the CWC, Module 1 for the CTBT will probably be shorter.

Module 2 training will consist of Specialist Application Courses and be tailored to each inspector's specialization. Included in these courses will be training in inspection planning. At the start of Module 2, each inspector will be given training in his specialty to ensure that tasks are performed to CTBT standards. Since, the Bare-Bones approach demands that each inspector perform a myriad of tasks, the remainder of this module will be dedicated to cross training requirements.

All specialized disciplines (e.g., seismologists, radiochemists, geologists, mining engineer etc.) will be trained to perform more general tasks (seismic station installation, gas collection, visual observation, clerical, communications, etc.). All team members will receive training in the identification of nuclear weapon testing related infrastructure. Additionally, the geologists will be taught to performed all functions associated with the initial overflight.

Equipment Technicians will be trained to maintain all inspection equipment. The level of maintenance and repair to be performed by these technicians needs to be addressed. Given the Bare-Bones nature of the inspection team, we believe that maintenance and repair will be rudimentary and limited to replacing "black boxes." This will allow the equipment specialists to support other members of the team and thus they will require training on the general tasks (e.g., seismic station installation, gas collection, visual observation) identified above.

The Health and Safety Specialist will require training in all safety aspects (i.e., radiation safety) of the OSI. If film badges are used, he will be trained to issue, collect and monitor these badges. He will also be responsible for the preparation for shipment of potentially hazardous material. Additionally, he must be aware of the general health concerns for various parts of the world (i.e., food and water hazards, endemic diseases, etc.).

There is one outstanding training issues that relates to the Team Chief. The Bare-Bones Team requires that all inspectors have specific disciplines with one of the inspectors being designated as Team Chief. This approach does not allow the luxury of having a "diplomat" function as Team Chief. However, it is a safe assumption that during any OSI, the Team Chief will be heavily involved in the "diplomatic" side of the inspection (i.e., negotiating with the ISP, caring for the observer, etc.). The ideal solution to our dilemma would be to nominate as Team Chief a "diplomat" with scientific background. Given that personnel with both of these qualifications are few and far between, individuals who are identified as potential Team Chiefs need to receive a crash course in interpersonal/diplomatic skills so they may function effectively in this role.

The CWC allocates 10 weeks to Module 2 training. Given the complexity of the training required for the Bare-Bones Team, this module would be similar in length.

Module 3 would consist of On-Site Mock Inspection Training. Trainees organized as OSI teams would practice their skills in a realistic inspection environment and develop team spirit and cohesiveness. It is estimated that this module would require two - three weeks.

#### **40 MAN TEAM COMPOSITION**

The Bare-Bones Team will be capable of working a one-shift, 12 hour day operation. It is more suited to conducting a scientific investigation rather than a thorough On-Site Inspection. The 40 man inspection team, shown on the next page, was built around the Bare-Bones Team with the goal of having a robust team capable of operating on a two-shift 24 hour basis and effectively conducting an inspection. Additionally, in a phased approach to conducting an OSI, it could be postulated that the Bare-Bones Team would be the first group of inspectors to arrive in country and would be expanded to a 40 person team as required.

The first change to the Bare-Bones Team is a Deputy Team Chief. This addition will allow the Team Chief to become more involved in the "diplomatic" aspects of the inspection while his deputy runs the operational side of the OSI. Three additional geologists were added to augment the team's analytic capability and to increase the teams ability to reduce the size of the inspection area.

The next significant modification is the addition of Seismic Technicians and Radiation Samplers (total of 11) to augment the five Equipment Technicians on the Bare-Bones Team. These personnel will provide additional capability and flexibility to the OSI Team. The addition of one Sample Analysis Expert to augment the radiochemists on the Bare-Bones Team will allow the full-time, on-site analysis of samples collected by the radiation samplers.

In order to reduce reliance on the ISP and make the OSI team more self sufficient, there was a significant and deliberate attempt to increase the capability of the OSI team to sustain itself. A full time Admin/Log Team Leader was added to the OSI Team to manage this effort.

A Communication Specialist was added to allow the team to use its own communications rather than route all communications through the ISP.

#### 40 PERSON OSI TEAM - INITIAL INSPECTION PHASE (DAYS 1 - 25)

OPERATIONAL		ADMIN/LOG	
Position	Number	Position	Number
Team Chief	1	Admin/Log Team Leader	1
Deputy Team Chief	1	Clerk/Typist	2
Geologist	3	Communication Specialist	1
Seismologist	2	Interpreter	2
Ground Survey Team Leader <sup>1</sup>	1	Maintenance Technician	2
Seismic Technician	10	Health and Safety	1
Underground Survey Team Leader <sup>2</sup>	1	Sample Handler	1
Radiation Team Leader <sup>3</sup>	1		
Radiation Sampler	6		
Sample Analysis Expert <sup>3</sup>	2		
<b>Total</b>	<b>30</b>	<b>Total</b>	<b>10</b>

- <sup>1</sup> Geologist/Geophysicist/Geotechnical Engineer
- <sup>2</sup> Mining Engineer
- <sup>3</sup> Radiochemist

Two Maintenance Technician's were added to the Bare-Bones Team. These technicians will have more diagnostic tools; more spare parts and replacement equipment; and, in general, be better prepared to repair and maintain equipment than the technicians who deploy with the Bare-Bones Team.

Two Clerk/Typists and a Sampler Handler, responsible for preparing for shipment all samples that will be returned to the CTBTO, round out the Admin/Log Team. It is envisioned that this team will also provide security for the OSI Base Camp, process inspectors into and out of country, as required, and in an emergency provide support to the operators on the OSI Team.

It must be emphasized that this team can support only those operations required during the first 25 days of an OSI. After day 25, the CTBT allows additional inspection

techniques (e.g., magnetic field mapping, active seismometry, electrical conductivity measurements etc.) to be employed. These techniques require a different set of skills and more than likely new inspectors will be added to the team while other inspectors, whose tasks are completed, will be withdrawn.

#### **40 MAN TEAM QUALIFICATIONS AND TRAINING**

This section addresses the qualifications and training required for the additional personnel added to the Bare-Bones Team. Qualifications for the Deputy Team Chief will closely parallel that of the Team Chief: Masters Degree in an inspection related discipline (i.e., geology, seismology, radiochemistry etc.); practical field experience as opposed to managerial or academic experience; and fluency in English. The additional seismic technicians and radiation handlers would require the same qualifications identified above for the equipment technicians.

Selection Criteria for the Admin/Log Team Leader would include: a college degree (preferably in an inspection related discipline); demonstrated experience in managing field explorations; and a knowledge of English. Qualifications for the Communications Specialist, Clerk Typist and Sampler Handler would be very similar: high school degree; fluency in English; and experience in communications/electronics, computer literacy, or knowledge of sample custody, packing and shipping procedures, respectively.

These new inspectors would undergo Module 1, 2 and 3 training as described earlier with some minor changes in Module 2, Specialist Application Course training. The additional Seismic Technicians and Radiation Samplers provide the 40 man team with a robust capability in their respective areas. Significant cross training between these specialties is probably not required. On the other hand, the Communication Specialist, Clerk Typist and Sample Handler should receive cross training in each others specialty area. This will provide the inspection team with the required redundancy. The Maintenance Technicians will undergo extensive training since they will be required to maintain and repair not only the equipment required for the first 25 days of the inspection but also the additional equipment needed for the remainder of the OSI.

#### **CONCLUSION**

The above is a preliminary estimate of the qualifications and training for inspectors necessary to capture short-lived phenomenology during the first 25 days of an OSI. More analysis is needed to refine the team composition and to “flesh out” the necessary training.

Additionally, the length of any required inspector training could be “the long pole in the tent.” The CWC training program is 20 weeks: Module 1 (Basic Course) - seven weeks; Module 2 (Specialist Application Course) - ten weeks; and Module 3 (OSI Training) - three weeks. While there is some possibility of reducing the length of Module 1 for CTBT training, the cross training requirements demanded of inspectors on the Bare-Bones Team will probably preclude any reduction in the length of Module 2 training. Consequently, a reasonable length for CTBT inspector training would be 17 - 18 weeks. The length of training and its associated costs has major implications on the number of inspectors trained as well as the mix of permanent inspection staff to augmentee staff.

# **APPENDIX J**

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## **1. ISSUES AFFECTING INSPECTOR FUNCTIONS AND SPECIALTIES**

The Comprehensive Test Ban Treaty (CTBT) text provides a fundamental basis for devising inspector functions and specialties. However, in many places it is incomplete or is open to interpretation. This leaves many questions relating to inspector functions unanswered. Several key issues are discussed below. How they are resolved will affect what functions CTBT inspectors will perform and how these inspections are aggregated into inspector specialties and teams. These issues also will help form the framework for addressing inspector qualifications and training discussed later.

### **1.1 Economy of Specialties**

There is a trade-off between the number of separate inspector specialties and the need for flexibility in assignment. At one extreme, one can propose a large number of very specialized positions requiring candidates qualified in one or, at most, two disciplines and requiring less training per individual. At the other extreme, is an inspectorate composed of fewer but more broadly capable specialists, potentially requiring more demanding selection criteria and more post-recruitment training but providing more flexibility in assignments. The nature of this trade-off will have to be addressed by the On-site Inspection (OSI) permanent staff.

### **1.2 Team Functions vs. Host Functions**

The CTBT requires that the inspected State Party (ISP) provide for or arrange the amenities necessary for the inspection team (IT), such as communications means, interpretation services, transportation, working space, lodging, meals, and medical care. However, in discussions with personnel familiar with the CTBT, there was a belief that the IT should have its own capability independent of the ISP in the areas of communications, interpretation services and to a limited extent, medical services.

In the areas of photography and sampling, the CTBT permits some division of labor between the IT and the ISP. In the area of photography, the ISP has the right to

provide its own camera operator to take all still/video photographs requested by the IT and the ISP. Otherwise, the IT will perform these functions. In the area of sampling, the IT has the right to analyze samples on site, but the ISP can provide assistance if requested.

For the areas discussed above, it would be prudent for the OSI staff to plan on IT members performing the expanded functions with minimal reliance on the ISP.

### **1.3 Team Chief Functions**

The Team Chief must have technical background; manage and direct team efforts; and perform potentially difficult coordination with host officials. For the sake of credibility, the Team Chief needs to be technically competent, but the sensitive nature of this inspection (the equivalent of a challenge inspection in the Chemical Weapons Convention regime) requires diplomatic skills. Based on experience from other inspection regimes, it is probably preferable to have a Team Chief with robust technical skills who has demonstrated diplomatic skills rather than a diplomat with some technical skills.

### **1.4 Inspection Team Sophistication**

Various high technology applications could be used during CTBT inspections. OSI literature, workshops etc. currently focus on complex inspection techniques utilizing sophisticated equipment. It must be remembered, however, that inspectors need to be trained on the proper use of this equipment. One can not assume that personnel selected to be inspectors, no matter how high their qualifications, will be familiar with all the specific equipment purchased for inspections. Consequently, equipment must be identified and purchased prior to the commencement of training so inspectors will have the opportunity to train with actual inspection equipment. In those instances where newer model/different equipment is purchased to replace older equipment, refresher training will be required.

## **1.5 Interviewing**

OSIs will be long and inspectors will have numerous opportunities over the course of the inspection to interface with ISP personnel in both formal and/or informal settings. Besides gathering visual information or data from inspection equipment, inspectors need to know how to verbally probe for inconsistent information. This is a learned skill and should be taught during inspector training.

## **1.6 Language and Interpretation.**

This issue has several facets. First, efficiency and safety dictate that all team members have reasonable fluency in a common language. Secondly, for reasons of efficiency and effectiveness, training needs to be conducted in a common language. What will this language be? What fluency level will be required prior to the onset of training? What language training will be offered during inspector training?

The next facet deals with who provides interpreters, and when. The CTBT states that interpretation service is an ISP responsibility. Logic says that total reliance on ISP interpreters might be ill advised. However, the CTBTO will have difficulty identifying interpreters fluent in a wide variety of member state languages. Even interpreters who are fluent in a language might not be fluent in the scientific/technical 'jargon' of the language. This might require that in selecting inspectors for an inspection, several inspectors are chosen because of their fluency in the ISP's language.

## **1.7 Managed Access**

The CTBT includes managed access provisions that permit the ISP to protect sensitive installations and locations. Measures that may be taken include: shrouding, placing certain restrictions on sampling or sample analysis, declaring restricted access sites, etc. If the ISP employs managed access, it also has the requirement to find alternate ways to satisfy the requirements of the inspection. Performing an inspection under the

provisions of managed access is a demanding and a critical part of an OSI consequently, it must be thoroughly taught during inspector training.

### **1.8 Team Safety**

This issue encompasses monitoring or overseeing where inspectors go, what they do, protective equipment, first aid and decontamination. At issue is—does the OSI Team need a safety specialist? It is probably more appropriate for all CTBT personnel to undergo substantial safety training and forego the creation of a separate safety specialty. Making all team members “safety conscious” could ensure that safety conditions are paramount even when sub-teams are operating at large distances from base camp.

## **2. ISSUES AFFECTING INSPECTION TEAM COMPOSITION**

### **2.1 Inspectorate Size**

Current thinking is to limit the size of permanent OSI staff to around 30 personnel. Consequently, the majority of inspectors will be augmentees. There is also discussion of employing these permanent OSI personnel in critical OSI Team positions (i.e., Team Chief, Team Leader). This has training implications since certain members of the permanent staff will need to be trained as inspectors, in addition to receiving staff training.

### **2.2 Flexibility in Team Composition**

Assembling an OSI Team will present challenges. Ideally, one wants to assemble a team that has undergone training together, especially team and mock inspection training. This impacts scheduling of training. Additionally, the size limit of an OSI Team will require extensive cross-training if the concept of inspector rotation (getting the right inspector with the right skill on the inspection at the right time) is not employed.

How much cross-training required is an additional problem that can not be solved until the Concept of Operations for an OSI is finalized. But if the approach is to select a

40 person team and let that team conduct an inspection without much personnel rotation/replacement the amount of cross-training required could be considerable. (See 4.6)

### **3. ISSUES AFFECTING INSPECTOR QUALIFICATIONS**

#### **3.1 Selection Criteria vs. Training**

There are a number of opposing pair concepts that will be addressed here with respect to establishing qualification criteria. The first of these is selection criteria vice training. Up to a point, the more qualified a recruit, the less training required. Some of the requirements placed on OSI inspectors are so complex and OSI demands are so elaborate that training potentially could be lengthy and costly for a proposed inspector with limited qualifications. For this reason, the emphasis should be on relatively robust selection criteria.

#### **3.2 Education vs. Experience in Selection**

A second pair of opposing concepts involves the balance of emphasis between formal education (e.g., advanced degrees) and direct job experience. Technical experts, who have analyzed other arms control treaties, have stressed the necessity of experience over education, with an understanding that both are needed. With this in mind, the value of field experience should be an essential selection criteria for CTBT inspectors.

#### **3.3 Verifying Inspector Background**

The CTBTO will need to decide whether and how to do background checks on prospective inspectors. The IAEA receives feedback of this nature from nations for inspector nominations, and there is a common screening requirement for individuals applying for most U.S. government civil service positions. Some form of background investigation for potential inspectors would help insure the quality of the inspectorate.

### **3.4 Procedural Guideline Implications for Inspector Selection**

Inspectors in the field may operate under only general procedural guidelines and exercise considerable judgment or they may be required to rigidly adhere to established procedural checklists. Relative emphasis on judgment and set procedures can affect inspector selection, performance criteria and training. When checklists are emphasized, less qualified and experienced inspectors may be needed. Again the OSI Inspection Manuals should provide guidance in this area. However, qualifications should not be downgraded on the assumption that the OSI inspectorate would use detailed procedural guidelines. OSI inspectors may face a wide variety of field situations requiring application of considerable judgment.

## **4. ISSUES AFFECTING INSPECTOR TRAINING**

### **4.1 Timing and Resources**

It is currently impossible to determine when the CTBT will be ratified and take effect. However, given the political problems associated with the CTBT, it is unlikely to enter into force in the near future. However, this should not preclude giving serious consideration now to the development of an inspector training program. The Chemical Weapons Convention (CWC) PREPCOM, in a similar situation regarding uncertainty of ratification, started early to define inspector training. It turned out the training planning began 3 1/2 years before entry into force. However, by starting early, the CWC was ready with training when the first inspectors needed to be trained to meet inspection requirements.

Another related issue is the extent the OSI permanent staff may wish to resort to national training programs and facilities for expedient solutions to training requirements. The CWC uses this approach and has their inspector training taught by designated State Parties.

## **4.2 Inspector Certification**

This issue relates to the question of formal certification of inspectors. For an international regime like the CTBT there are some problems associated with a formal certification program including political embarrassment. Currently, the CWC “invites” more people to training than there are open inspectorate positions. After completion of the course, the CWC permanent staff (not the country offering the training) evaluates student performance and offers jobs to successful candidates. This is a “back door” way of certifying inspectors but it prevents the political embarrassment of hiring an inspector only to have him fail training and require dismissal. In order to maintain the quality of the inspectorate, some form of inspector certification is needed.

## **4.3 Language Used in Training**

Language was addressed earlier in this paper but aspects relevant to training require additional discussion. If the instruction were in English (assuming training is given in a single language), some students would have less mastery than others and require a slower pace of instruction. Even if all classes were taught with simultaneous translation (think of the cost and problems associated with this approach), there would be difficulties in practical work and demonstrations. To minimize degradation, it may be necessary to extend instruction periods; video tape training to allow students weak in English to review training; and offer additional English language training.

## **4.4 Classroom vs. Practical Training Balance**

Instructors could effectively teach some inspection aspects by classroom lecture alone. Other material might best be taught through a combination of lecture or demonstration and hands-on training. Practical exercise training is more time-consuming and facility-intensive than classroom presentations but is required for some functions. Certain performance qualifications can be practically met only by permitting students to practice in a realistic environment as possible, providing feedback and confirming performance proficiency. Additionally, team building will require significant out of

classroom training. The type of instruction required is a legitimate area of investigation for the OSI Training Staff.

#### **4.6 Synergy of Tasks (Cross-training)**

There are some sources who feel that each inspector should be able to perform tasks of other team members in order to meet unexpected situations including illnesses. Although this is a logical approach in theory, the CTBT is a complex inspection regime—more complex and technically-based than most other arms control regimes. To what degree should the program emphasize cross-training without sacrificing specialized training? Cross-training requirements impact the length of training. In how many different areas is it realistic to cross-train inspectors? Clearly, the more areas an inspector is crossed-trained in, the easier it will be to select augmentees for an inspection team with confidence that the team possesses a sufficient back up in every required skill. However, the complexity of the various CTBT tasks and the time required to cross-train specialist in skills outside their specialties mitigates against extensive cross-training. Still, the OSI permanent staff should look for opportunities to cross-train potential inspectors.

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## *On-Site Inspection (OSI) Issues Impacting Inspection Team Composition and Specialties*

The ultimate goal of this study is to examine the functions, qualifications and training of inspectors for CTBT on-site inspections. The attached list of Potential OSI Team Members, developed previously in support of this effort, is unconstrained and was generated to ensure that critical skills were not inadvertently eliminated early in the specialty identification process. Clearly, if all these potential OSI team members were included on an OSI team, the number of inspectors would exceed the 40 person limit.

The next step in this study is to identify skills on the list that could be merged/eliminated in order to develop a more manageable list of specialties/team members. Based on this more manageable list, inspector qualifications and training requirements would be developed. However, before merging/eliminating skills, a series of issues that could impact the final composition of the OSI team need to be addressed. The purpose of this paper is to identify these issues, to discuss their impacts on OSIs and to recommend how these issues might be resolved.

One of the major considerations that permeates the following discussion is the need to maximize the “tooth to tail” ratio within the 40 man team size. Specifically, the goal should be to maximize the number of “operators” who collect and analyze data and reduce support personnel to the minimum number necessary.

### **ISSUE 1: “One size” fits all OSI team vs. phasing OSI team members into the ISP**

Under the “one size” fits all concept, the OSI team that deploys to the ISP will remain in country for the duration of the inspection. With the exception of adding drillers (if drilling is authorized) rotation/substitution/addition of personnel will be the exception not the rule. This approach will have profound impact on inspector qualifications and training. Part II of the Protocol specifies those inspection activities that may occur in the

Initial Phase (Day 1-25) of the inspection and those additional activities that may be performed during the Continuation Phase (Day 25-60). In order to avoid idle time, inspectors will have to be cross-trained. This will allow inspectors with skills useful in the Initial Phase to perform tasks in the Continuation Phase and vice versa.

Under the phasing/rotation approach, the inspector with the appropriate skills will be brought into the ISP as needed. The composition of the inspection team will be fluid, changing as the inspection requirements dictate. Besides providing operational advantages, this approach alleviates some inspector training requirements as extensive cross-training will not be required.

There are negative logistic impacts associated with the phasing approach for an inspection. The ISP will have to move OSI team members from the Point of Entry (POE) to the inspection area and from the inspection area to the POE on a routine basis. If the inspection area is in a remote location, this could prove to be time consuming and costly. Additionally, it raises the question of where the 40 man inspection limit applies. Do just the inspectors in the inspection area count against this limit or is it a combination of the inspectors in the inspection area plus those at the POE?

Regardless of the potential negative logistic impacts of the phasing approach (which can be mitigated by proper planning), it appears that this approach is the most beneficial from an operational and training perspective and should be considered the norm for an OSI inspection.

## **ISSUE 2: Equipment Repair and Maintenance Requirements**

OSIs will require a large and diverse set of equipment: vehicles, generators, sensors, radiation detection equipment, computers etc. Maintaining this equipment in potentially harsh environments could likely be a problem. (Maintenance of OSI equipment is not a requirement placed on the ISP.) There are several options for

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maintaining equipment. On the low end, an OSI team would perform no maintenance and rely on spares to maintain capability. On the high end, a multi-skilled maintenance team would deploy and be capable of repairing equipment in country.

Each option entails costs and risks. The low end option requires the purchase of spares which adds to equipment costs. If there are insufficient spares to replace malfunctioning equipment, the OSI team loses capability. However, the reduction in maintenance personnel allows more “operationally oriented” personnel to be deployed within the 40 man team limit. Conversely, the high end option reduces the cost of spares but adds support personnel to the team thereby reducing the number of “operationally oriented” personnel deployed.

A reasonable solution would be to provide the OSI team with a limited capability to perform maintenance as well as a small inventory of spares. If equipment suffered an attrition rate beyond the in-country maintenance capability, replacement items from the equipment set reserved for a concurrent OSI could be utilized. While reducing the number of maintenance personnel, this option could require significant cross-training of personnel.

### **ISSUE 3: Requirement for a Deputy Team Chief**

Given the demands that will be placed on a Team Chief, there is a requirement to have someone function in the role of Deputy Team Chief. An attractive option would be to have one of the Team Leaders dual hatted as the Deputy. However, the Operational Team Leaders (e.g., ground survey) will be heavily committed managing their team as well as collecting and analyzing data. An alternative would be to have either the administrative or logistics team leader function as Deputy. While this is an attractive option, a majority of the issues requiring action by the Team Chief or his Deputy will be operational not administrative in nature, consequently, this alternative seems less than satisfactory.

Recommend that a full time Deputy Team Chief be assigned to the OSI Team.

#### **ISSUE 4: Requirement for dedicated data analysis personnel**

The list of Potential OSI Team Members includes full time team members responsible for data reduction. The rationale behind this concept is that while one group of inspectors is collecting data another group is analyzing it. The dilemma inherent in this approach, given the 40 man inspection limit, is that for every inspector analyzing the data there will be one less inspector collecting data. This is especially critical in the Initial Phase of the OSI when the OSI team is narrowing the size of the inspection area.

Paragraph 98, Part II of the Protocol specifies that, whenever possible, the inspection team shall analyze samples on site. As a minimum, this implies that the OSI team should be prepared to analyze samples for radioactivity on site and that several OSI team members will be dedicated to performing this analysis task. The remainder of the required data analysis can be accomplished by cross-trained individuals. For example, there will be an initial, manpower intensive effort to place passive seismic sensors throughout the inspection area. Once this task has been completed, the seismic team will concentrate on collecting data from these devices. This later task requires significantly less manpower. The inspectors thus "freed up" would be used to analyze the collected seismic data. Scenarios can be developed for other inspection activities (i.e., magnetic field mapping) that would allow the inspectors who collect data to also analyze it.

Recommend that with the exception of sample analysis personnel, there be no dedicated data analysis inspectors assigned to the OSI team. Data analysis and data collection would be performed by the same, cross-trained individual.

#### **ISSUE 5: Team Functions vs. ISP Functions**

The CTBT requires the ISP to provide for or arrange the amenities necessary for the inspection team, such as communication means, interpretation services, transportation, working space, lodging, meals and medical care. The 40 man team limit

would tend to favor less OSI team involvement and more ISP responsibility in these areas. Some exceptions are noted below.

The OSI team would probably want its own dedicated, secure communication link(s) back to the Executive Council. This would require a dedicated communications specialist and appropriate equipment. It is anticipated that most communications would be handled using ISP provide communications means and only limited, sensitive traffic would be handled on dedicated, OSI controlled communication links.

Most observers believe that although the ISP will provide the bulk of the interpretation services, the OSI Team should have its own interpreters (one or two) who owe their loyalty not to the ISP but to the OSI team. It is felt that these interpreters would provide a more nuanced translation.

The final issue is medical support. Is it necessary for the OSI Team to have its own Medical Specialist? Not surprisingly there are two schools of thought on this issue with the major concern being the quality of medical support available in third world countries. Given the potential length of the OSI, the harsh conditions that might be encountered and the remoteness of the likely inspection areas, adding a medical specialist to the team appears prudent. This should not preclude providing OSI Team members with extensive first aid and emergency medical training.

#### **ISSUE 6: Dedicated Safety Specialist**

Mine safety and radiation safety are two major areas of concern on an OSI. In both of these areas, The OSI team will contain inspectors who will be more steeped in mine and radiation safety considerations than others because of their responsibilities. These members can provide the necessary safety guidance to the OSI Team. Consequently, an inspector dedicated to safety is not required.

## POTENTIALOSITEAMMEMBERS

### OPERATIONAL

Team Chief

Deputy Team Chief

#### Functional Team Leader

- Overflight
- Ground Survey
- Underground Survey
- Radiation
- Drilling

Driller

Drill Helpers

Geologist/Geophysicist/Geotechnical Eng

Interviewer

Mining Engineer

Photographer (still and video)

Photographic Interpreter

Radiation Sampler

Sample Analysis Expert

Records Reviewer

Surveyor

#### Sensor Technician

- Seismic
- Radiation
- Magnetic Field Mapping
- Ground Penetrating Radar
- Gravitational Field Mapping
- Electrical Conductivity
- Other multispectral

#### Data Reduction Technician

- Seismic
- Magnetic Field Mapping
- Ground Penetrating Radar
- Gravitational Field Mapping
- Electrical Conductivity

### ADMINISTRATION/LOGISTICS

Administration Team Leader

Logistics Team Leader

Aircrew

Clerk/Typist

Communication

Driver

Linguist

#### Maintenance (Repair) Technician

- Vehicle
- Computer
- Sensor
- Communications
- Radiation
- Multispectral
- Aircraft
- Other (e.g., generator)

Medical

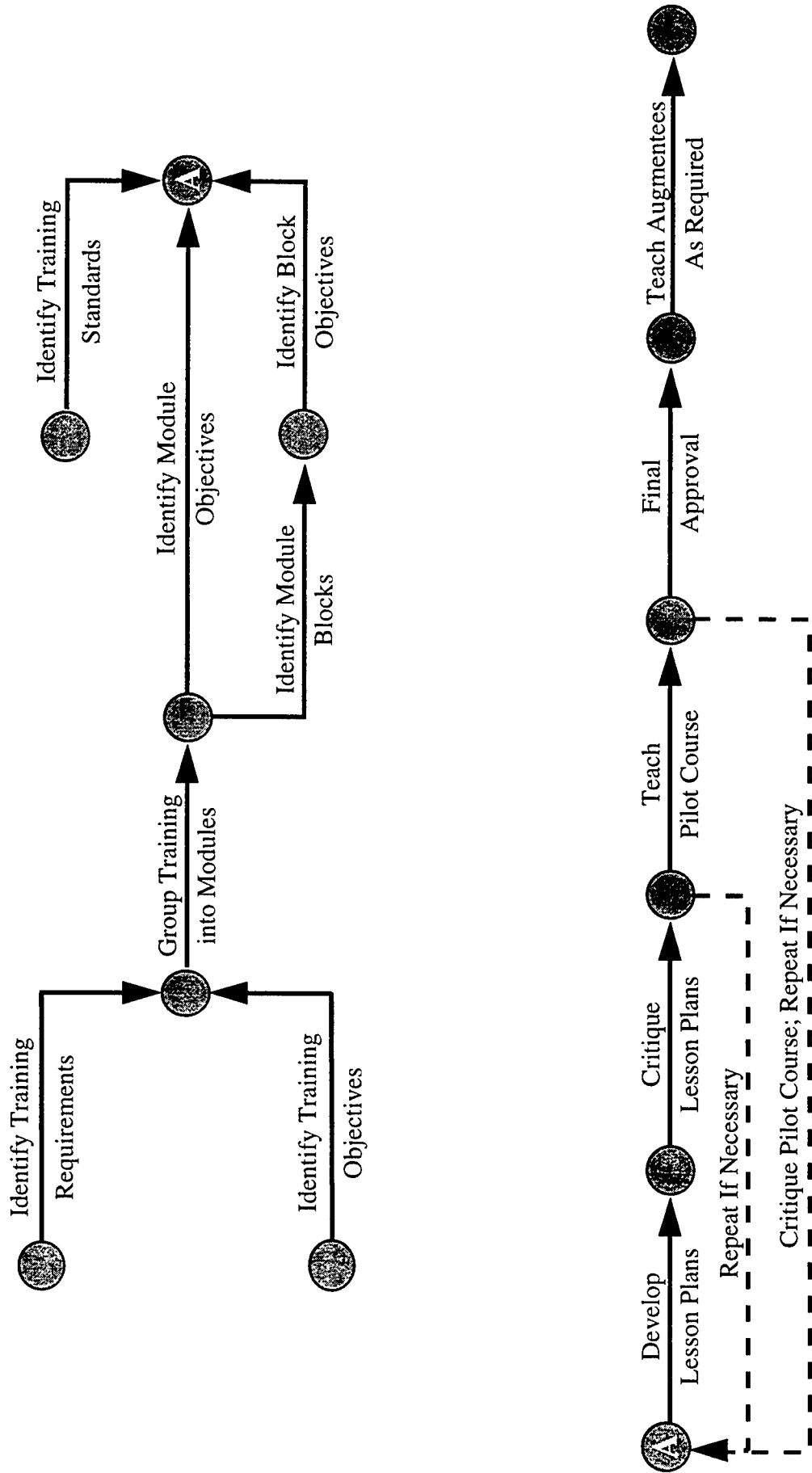
#### Safety

- Mine Safety
- Radiation

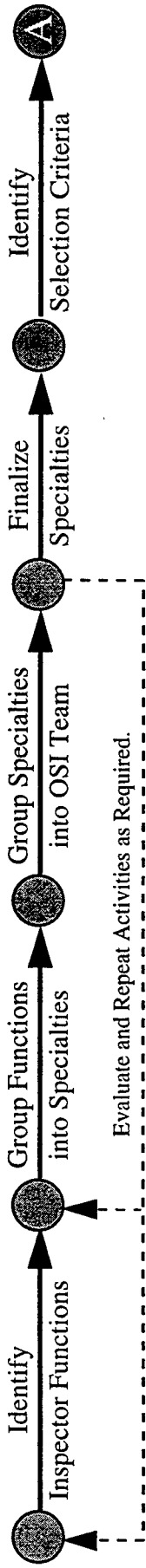
Sample Handler

# APPENDIX K

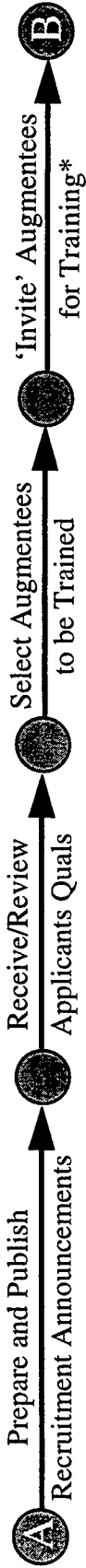
# DEVELOP TRAINING



# IDENTIFY INSPECTORS

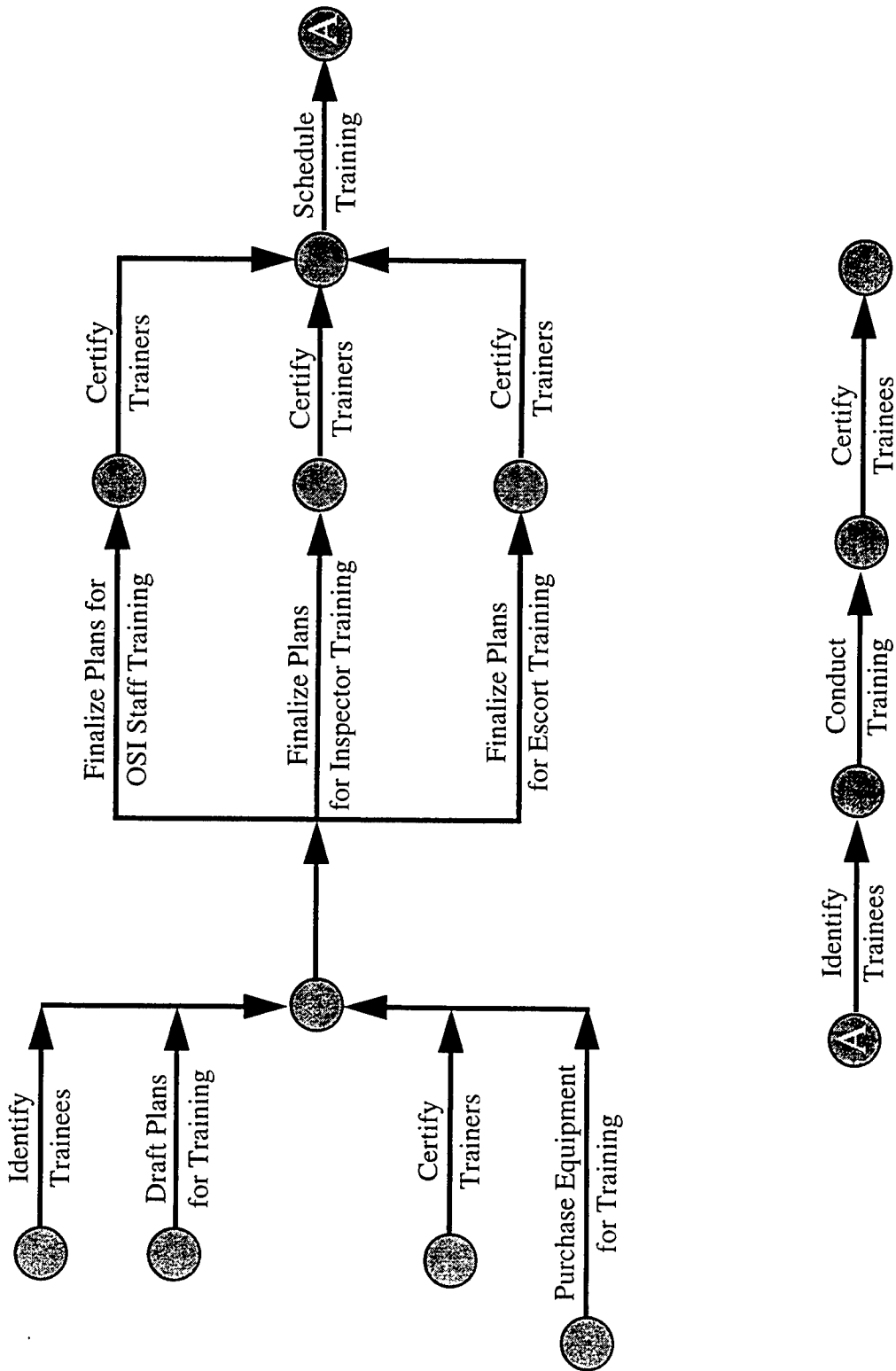


K-3

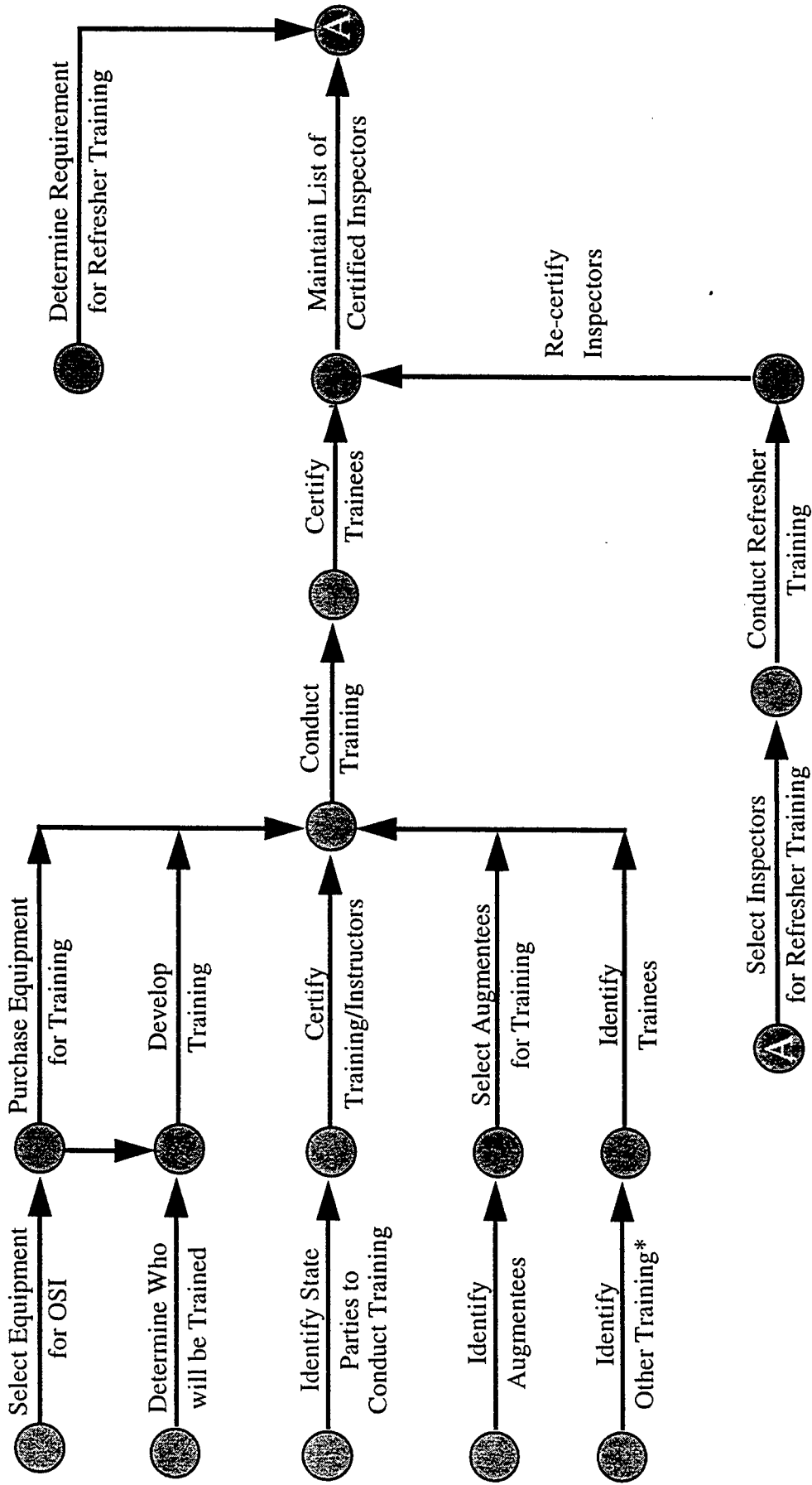


\* Invite 10% - 15% more augmentees than required to account for losses through attrition.

# DRAFT TRAINING GOALS



# INTEGRATED APPROACH



K-5/K-6

\* Permanent OSI Staff, Escorts, National Authority

# **APPENDIX L**

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## ***Concept for Narrowing the Inspection Area on an On-Site Inspection***

### **INTRODUCTION**

Under the aegis of the Comprehensive Test Ban Treaty (CTBT), there are provisions for conducting an On-Site Inspection (OSI) in the territory of a State Party if an anomalous event suspected of being a nuclear explosion has occurred; has been located in the State Party's territory; and can not be resolved by other means. If an OSI is necessary, its objective would be to collect and analyze information relevant to the inspection mandate i.e., data related to an anomalous event "to clarify whether a nuclear weapon test explosion or any other nuclear explosion has been carried out in violation of Article I" of the treaty and, to the extent possible, to gather facts which would aid in identifying any possible violator. An On-Site Inspection (OSI) is essentially divided into three phases: an Initial Phase (Day 1-25); a Continuation Phase (Day 26-60); and an extension Phase (Day 61 to 130). Each of these phases has specific inspection activities associated with it.

One of the principle aims of the Initial Phase of an OSI is to narrow the search area. While the CTBT identifies the activities that are allowed during the Initial Phase of the inspection to accomplish this task, it has left it to the PREPCOM to include the details of the conduct of an OSI in an Operations Manual. The objective of this paper is twofold: a.) to propose a methodology, independent of any specific scenario, that can be utilized to reduce the size of the search area, and b) to explain how inspection activities permitted in the Initial Phase of an inspection fit into the proposed methodology.

### **PRE-INSPECTION ACTIVITIES**

A request for an OSI will probably be triggered by an anomalous seismic event detected by the International Monitoring System (IMS) and supplemented by any relevant technical information obtained from other elements of an IMS and by national technical means of verification. The Executive Council will make a decision on the on-site inspection request no later than 96 hours after it receives the request from the requesting

State Party. If the request is favorably considered, an Inspection Mandate will be generated which will, among other items, contain the location and boundaries of the inspection area. According to the provisions of the CTBT, the inspection area will be continuous and its area shall not exceed 1000 square kilometers with no linear distance exceeding 50 kilometers in any direction. In all probability, this area will encompass the entire seismic error ellipse of the anomalous event. However, in the case of a large, imprecise ellipse that exceeds 1000 square kilometers, the inspection area will include, as a minimum, the central, "most probable" portion of the ellipse.

Members of the CTBT Organization (CTBTO) OSI staff and/or potential members of an OSI team will be active during this time period gathering data relating to the potential OSI area. In addition to information provided by the IMS, other data that might be gathered include: geological information, mining data, population statistics, maps of the area, results of Confidence Building Measures, etc. Additionally satellite photography will be sought that shows the potential inspection area before and after the anomalous event that triggered the request for the OSI. It is likely that any information gathered will be used to assist the Executive Council in defining the inspection area.

A preliminary inspection plan will also be generated during this time period that specifies the activities the inspection team desires to carry out. As a result of this data gathering and planning, the inspection team will arrive at the inspection site with a reasonable knowledge of the area and the challenges that confront them.

#### **PROPOSED OSI METHODOLOGY - INITIAL PHASE**

The Initial Phase of an OSI is the first opportunity to conduct actual "on the ground" inspection activities or techniques. Depending on the availability of the information collected up to this point, the inspection area may be large, up to the Treaty specified maximum size of 1000 square kilometers. Inspection techniques employed during this phase will include: overflight, visual ground survey, passive seismometry, soil gas sampling and radionuclide monitoring.

The first activity undertaken by the inspection team will be the initial overflight. While this overflight will provide the inspection team with a general orientation of the inspection area and facilitate the collection of factual evidence, its primary purpose will be to begin reducing the inspection area by identifying specific sites that have some indications that the anomalous event in question may have originated there. Visual observation, supplemented by visual and still photography, will be the principle activities conducted on the Initial Overflight. Using a set of criteria developed by the CTBTO and defined in the Operations Manual as well as the expert judgment of the OSI Team, the objective of the overflight will be to divide the inspection area into three segments: discrete sites of high interest that may require a ground survey; areas reduced in size (“reduced areas”) that will require a detailed ground survey; and areas that need not be investigated further.

Discrete sites are small areas (no more than four square kilometers) that display some attribute of interest (i.e., a mining site; a subsidence crater etc.) to the overflight team. These sites will be visited by ground survey teams, and prioritized as green, yellow or red using a set of criteria developed by the CTBTO and defined in the Operations Manual, as well as the expert judgment of the OSI Team. Sites designated as green will be explored in greater detail; activity on yellow sites will be deferred until most green sites have been completely studied, and red sites will receive not be investigated further. In prioritizing these sites, survey teams will use visual observation, interviews (if permitted) etc., but will not employ seismic or radiation measurements at this time. For example a mining site that is active might fall in the green category, while an inactive site showing little or no activity might be categorized as yellow or red.

While discrete sites identified by the overflight team are being surveyed and prioritized, other ground survey teams will be exploring the reduced areas identified by the overflight team as worthy of further study. Using such techniques as visual observation, interviews (if permitted), environmental sampling and radiological survey (i.e., gamma radiation monitoring) and using a set of criteria developed by the CTBTO

and defined in the Operations Manual as well as the expert judgment of the OSI Team, the ground survey teams will divide the reduced area into: discrete sites of high interest; areas that will require additional ground survey, time permitting; and areas that need not be investigated further. Discrete sites identified by the ground survey team will be evaluated applying the same criteria that was applied to discrete sites identified during the initial overflight and categorized as green, yellow and red.

At this point the OSI Team has identified two sets of discrete sites (one from the overflight and one from the ground survey) that have been categorized as green, yellow and red. All green sites will now be prioritized for further exploration. Yellow sites will also be prioritized.

The next step in the methodology is to apply passive seismic survey techniques to those discrete sites that have been identified as green. Again, using criteria developed by the CTBTO (e.g., a positive seismic signal from the passive seismic survey) and defined in the Operations Manual as well as the expert judgment of the OSI Team, these sites will either be eliminated or subjected to further evaluation. The number of sites requiring a passive seismic survey may exceed the amount of passive seismic equipment available to the inspection team. This will require the inspection team to move seismic equipment from sites that have been evaluated and eliminated to sites that have not been surveyed. If time permits, and depending on the results from evaluating green sites, yellow sites might also be investigated.

For those sites identified as subject to further evaluation, one would apply the whole suite of inspection techniques permitted during the Initial Phase of an OSI. Additional seismic devices might be employed in an attempt to further localize the source of an seismic disturbance that was detected. Additionally, radionuclide survey techniques would be employed. Air samples will be taken to determine if xenon and argon isotopes have vented. Radionuclide surveys may be conducted using Geiger counters or hand held,

field operable radiological equipment. If radioactive areas are encountered, samples should be taken for immediate analysis.

The inspection team might also consider conducting soil gas sampling. Samples might be collected from: a wellhead (i.e., a metal tube driven several meters into the ground); from underneath tarps; and from the bottom of small augured holes up to 10 meters deep. (This later method might not be permitted if auguring is considered drilling.)

The output from the methodology described above (and shown graphically in the attachment) will be a prioritized list of sites that will be further investigated using techniques (magnetic field mapping, gravitational field mapping, etc.) permitted during the Continuation Phase of the inspection.

#### **ADDITIONAL FACTORS**

Time is of the essence during an On-Site inspection. Additionally, the inspection team is limited in size and will possess a finite amount of inspection equipment. The number of sites for further exploration generated by our methodology could be large and 25 days might prove insufficient for the OSI team to adequately examine all potential sites. Therefore, eliminating sites from consideration becomes as critical as selecting sites for additional investigation. The CTBTO must consider the time factor in generating selection criteria for potential discrete sites and allow the OSI Team Chief sufficient flexibility to balance his assets against the time line dictated by the CTBT.

The inspection techniques that will be most effective during the Initial Phase of the OSI will be determined by the time delay between detection of the anomalous event and the arrival of the OSI team at the inspection site.. For example, if the team arrives in country within two weeks of the actual event, there is a high probability that using passive seismometry, they could detect seismic activity relating to the anomalous event. However, radioactive gases probably would not have migrated to the surface and, consequently, would not be detected. On the other hand, if the OSI Team arrives two months after the actual event, the probability of detecting seismic activity will have

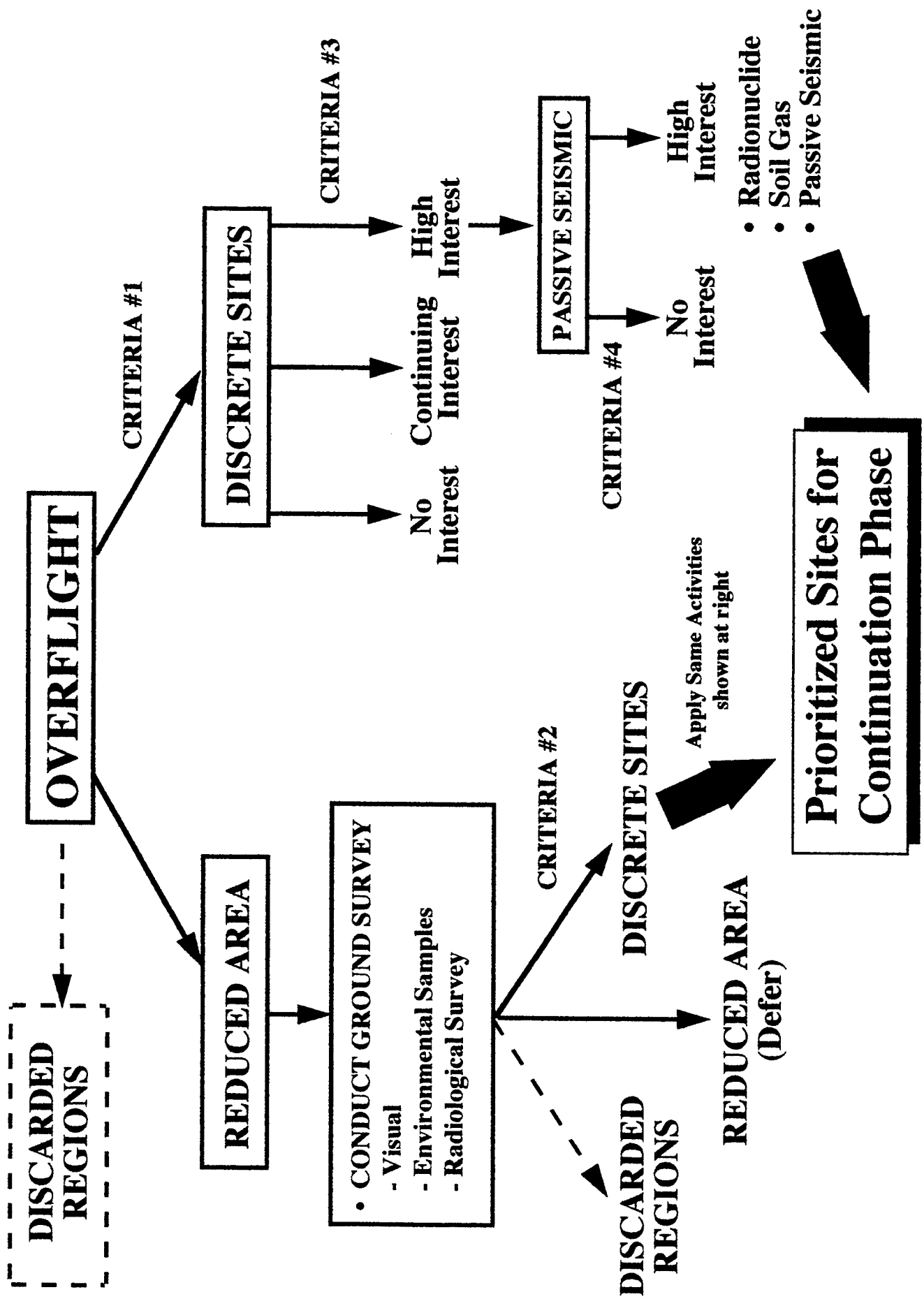
deceased significantly but the probability that radioactive gases have migrated to the surface will have increased. Consequently, selection criteria developed to support the methodology described above needs to be flexible and account for the timing between the start of the OSI and the event that triggered the inspection.

There are many possible situations where OSI Team members' experience and judgment will play a critical role in determining whether a site should be explored in more detail. As an example, locating a subsidence crater combined with other geologic evidence that indicated an unexplained large scale event occurred would most certainly merit further investigation in the immediate area. However, seismic survey and radioactive sampling could be inconclusive or negative. Despite the lack of confirming evidence, the visual evidence may still be so striking that this site should be further explored during the Continuation Phase of the inspection. Again selection criteria must be flexible enough (not mere yes or no answers) to allow an OSI Team member to use his professional/expert judgment in selecting sites for further study.

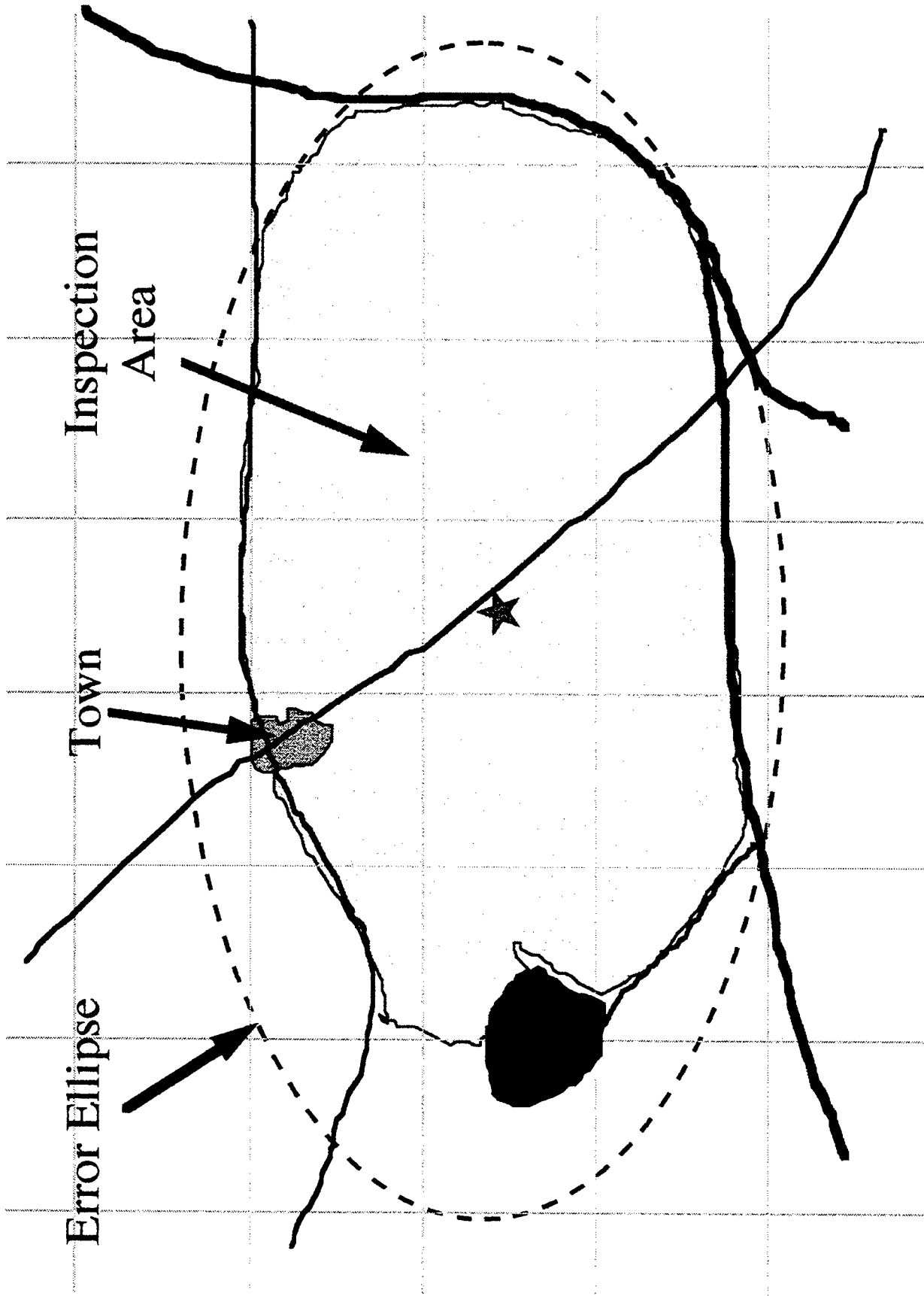
## **CONCLUSION**

Through the use of the methodology described above, which is based on inspection techniques permitted by the CTBT, an OSI inspection team can systematically reduce the inspection area during the Initial Phase of an On-Site Inspection. The output of this methodology, as a minimum, would be a greatly reduced inspection area and a list of sites that needs to be explored in considerable detail using the more sophisticated techniques available during the Continuation Phase of the OSI and, as a maximum, the positive identification of the site of a nuclear event.

# Narrowing the Inspection Area







# OVERFLIGHT

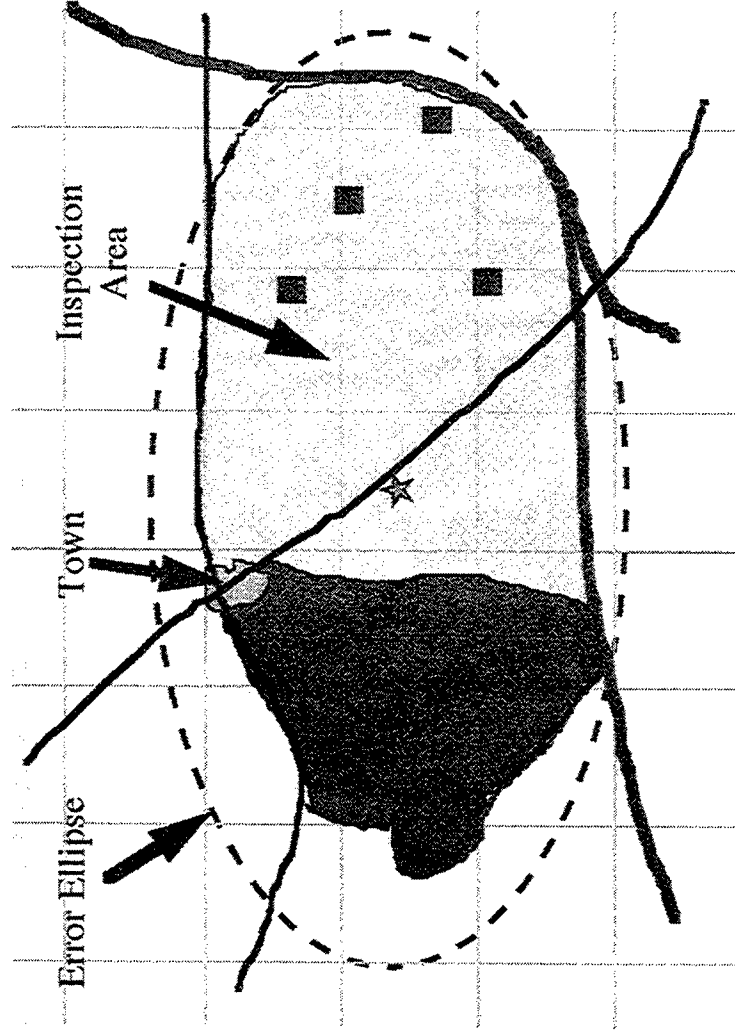
## TOOLS

- Field glasses
- Still camera
- Video camera
- Position locating equipment

## RESULTS IN



Discrete Sites (■)  
Reduced Area (gray)  
Discarded Regions (dark)



# GROUND SURVEY: REDUCED AREA

## TOOLS

- Visual
- Interviews
- Environmental Sampling
- Radiological Survey

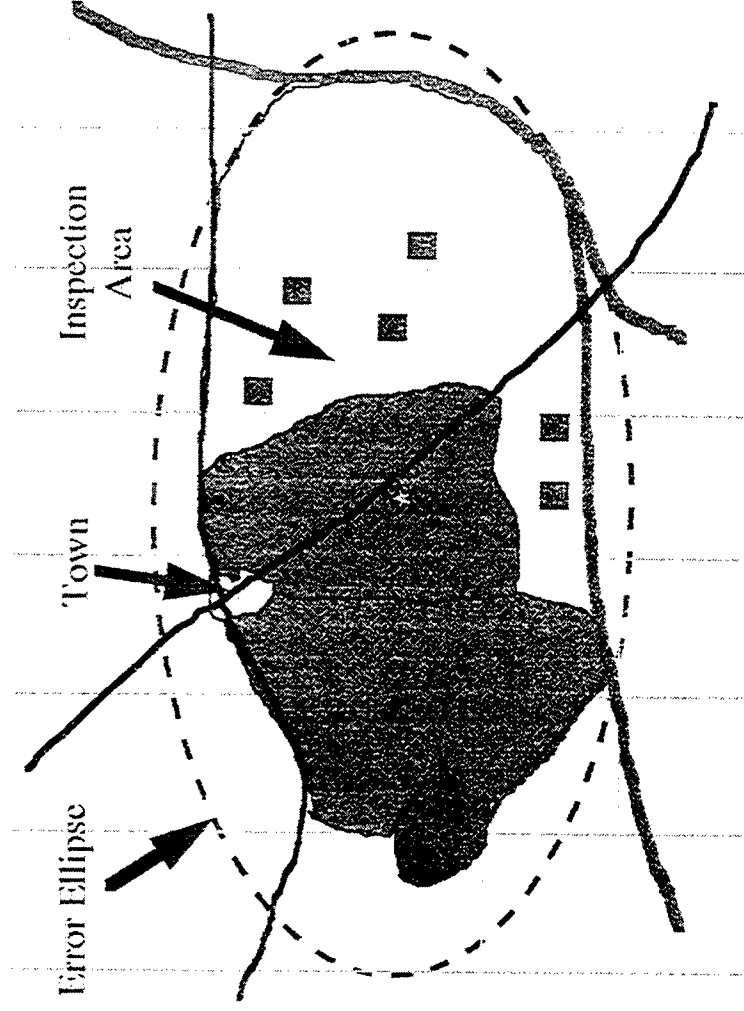
## RESULTS IN



Discrete Sites (■)

Reduced Area (gray)

Discarded Regions (dark)



# DETAILED GROUND SURVEY: DISCRETE SITES

## TOOLS

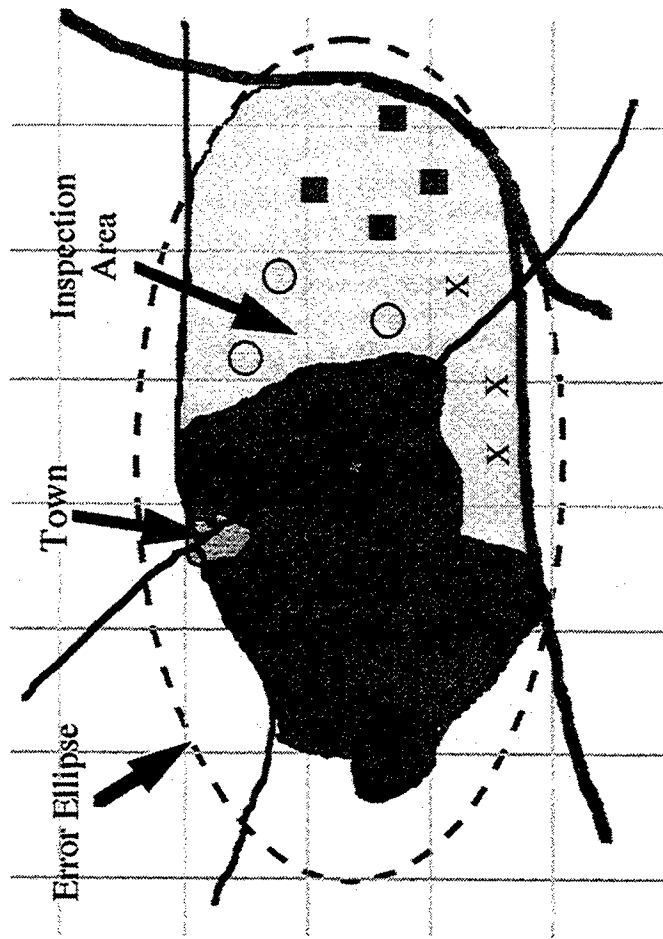
- Visual
- Interviews
- Environmental
- Sampling
- Radiological
- Survey

RESULTS IN



## CATEGORIZED SITES

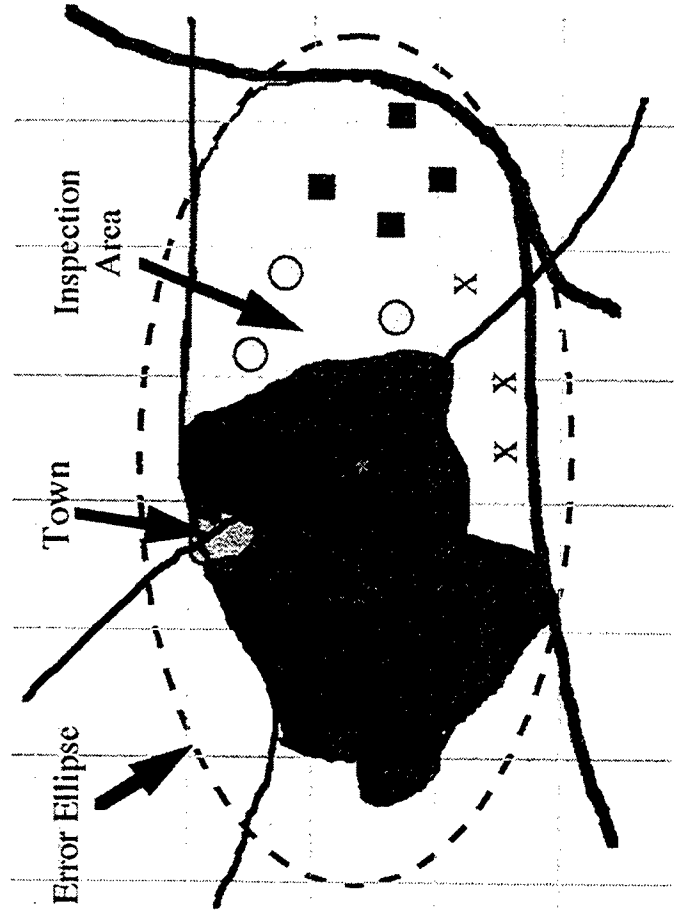
- High Interest (■)
- Continuing Interest (○)
- No Interest (X)



# RESULTS OF OVERFLIGHT AND GROUND SURVEY

- Discrete Sites Categorized as:
  - High Interest (■)
  - Continuing Interest (⊙)
  - No Interest (X)
- Reduced Area
- Discarded Regions

F-14



# PASSIVE SEISMIC SURVEY

## APPLY TO

- High Interest Sites  
(first priority)
- Continuing Interest Sites  
(as available)

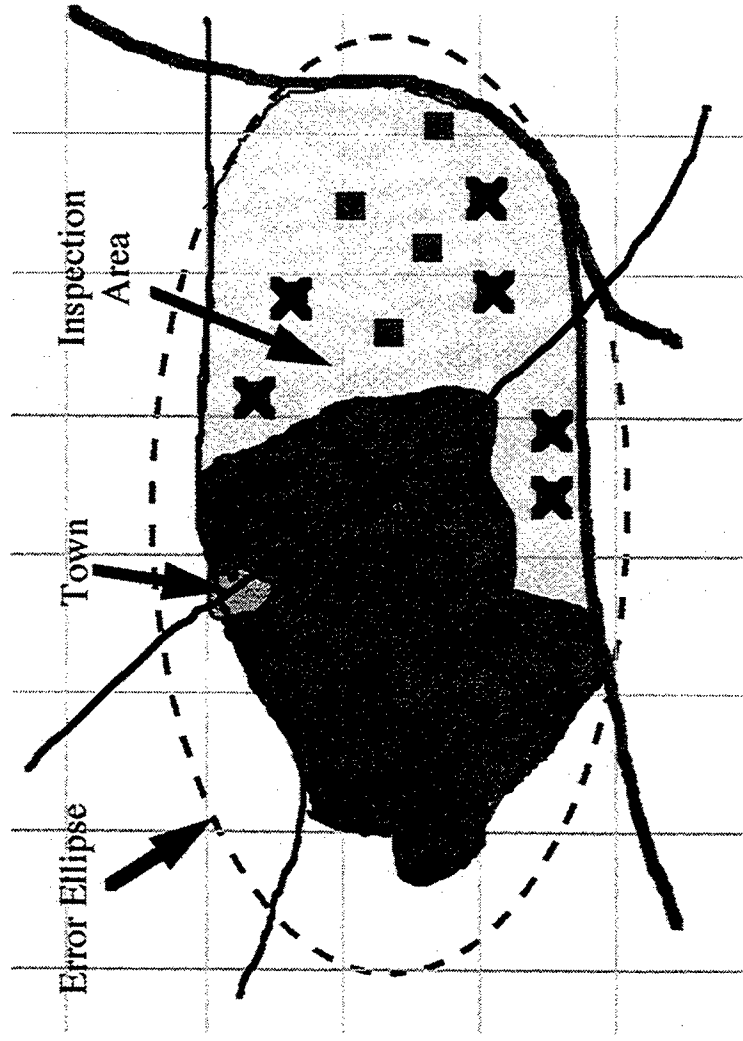
RESULTS IN



## CATEGORIZED SITES

High Interest (■)

No Interest (X)



# DETAILED INVESTIGATION OF HIGH INTEREST SITES

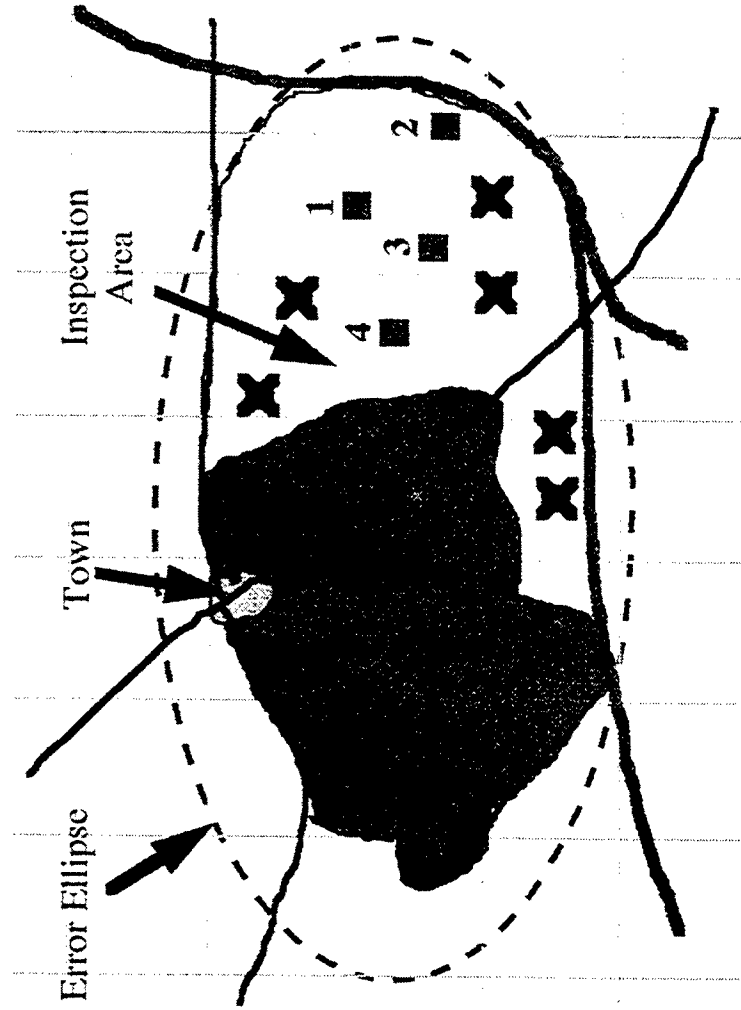
## TOOLS

- Radionuclide Sampling
- Soil Gas Sampling
- Additional Passive Seismic Sampling

RESULTS IN



**PRIORITIZED SITES FOR  
CONTINUATION PHASE**



# APPENDIX M

## ANNUAL BUDGET

### Assumptions

1. There will be 20 full time inspectors on the permanent staff and 200 augmentees.
2. Average loaded cost of a full time employee is \$200,000
3. There will be one OSI in 1998 and two per year in the out years.
4. There will be three sets of OSI equipment purchased.
5. Entry into Force for the CTBT is September 24, 1998
6. There will be 120 inspectors trained at EIF (20 full time and 100 augmentees) and 60 augmentees will be trained annually starting in 1999.
7. Each inspector will undergo 30 days of training. Once trained they will require, on the average, two days per month refresher training.

### Discussion

The objective of this paper is make a first order estimate of a budget to support OSI activities in 1998 and the out years. Costs were allocated to six categories: staff; equipment purchase; equipment maintenance and support; travel; training; and inspection deployment. The chart below reflects the projected budget for CY1998 and ensuing out years. All budget numbers are in current year dollars.

Category	Basic Cost	CY1998	Out Years
<b>Staff</b>	\$4.0M	\$3.0M	\$4.0M
<b>Equipment Purchase</b>	\$3.0M/set	\$9.0M	\$1.0M
<b>Equipment Maintenance &amp; Support</b>	\$0.7M/set	\$1.0M	\$2.1M
<b>Travel</b>	\$1.3M	\$0.9M	\$1.3M
<b>Training</b>	\$4.3M	\$3.2M	\$4.3M
<b>Inspection Deployment</b>	\$10.0M/inspection	\$10.0M	\$20.0M
<b>TOTAL</b>		\$27.1M	\$32.7M

## **Explanations**

Staff: Staff costs are simply the number of full time inspectors times average cost of each inspector. For CY1998 a ramp up was assumed - all inspectors were not on board at the start of the year but were on-board by mid-year.

Equipment Purchase: Equipment was divided into two categories: Inspection equipment (e.g., seismic devices) and support equipment (e.g., trailers). Three sets of equipment were purchased in 1998. In the out years, \$1.0M was spent replacing equipment that was damaged, had become outmoded etc.

Equipment Maintenance and Storage: It was estimated that each set of equipment would require \$0.7M to store and maintain. Since equipment would be purchased throughout CY1998, storage and maintenance costs in this year were reduced by approximately half.

Travel: For CY1998, this category includes travel and per diem associated with the training of 125 inspectors and CBM travel. For out years, it includes travel and per diem associated with training 60 inspectors and CBM travel.

Training: costs associated with training 60 new inspectors and providing refresher training for 120 inspectors per year. This refresher training could include team training and mock inspections. The exception is CY1998, when 120 inspectors will be trained and there will be no refresher training. Additionally, CY1998 includes costs for developing training courses and material.

Inspection Deployment: Includes personnel costs for augmentees, cost to ship inspection and support equipment; host country charges, travel costs and drilling costs. Drilling costs were estimated to be \$4.0M.

## SUMMARY OF EQUIPMENT COSTS

TYPE OF EQUIPMENT	COST (\$K)
Overflight	112
Remotely deployed sensors	1100 - 1400
Geophysical	160
Analytical	300
Special Equipment	320
Support Equipment (Base Camp)	1230
TOTAL	3222 - 3522

## OVERFLIGHT EQUIPMENT

ITEM	NUMBER	UNIT COST (\$K)	TOTAL COST (\$K)
Camera	2+1	5	15
Video Camera	2+1	2	6
Field Glasses	4+1	0.2	1
Radiation Detectors	1+1	10	20
Sampling Equipment	1	20	20
Multi-Spectral Imagery	1	50	50
		Subtotal	112

## REMOTELY DEPLOYED SENSORS

ITEM	NUMBER	UNIT COST (\$K)	TOTAL COST (\$K)
Seismometer (Includes power supply and data link and data storage)	20-40	15	300 - 600
Gas and Particulate Samplers and Detectors with Remote Auto Operation (6+2)	8	100	800
		Subtotal	1100 - 1400

## GEOPHYSICAL EQUIPMENT

ITEM	NUMBER	UNIT COST (\$K)	TOTAL COST (\$K)
Magnetometers	2+1	15	45
Sampling Equipment	1 (lot)	5	5
Gravity Meter	1	50	50
Ground Penetrating Radar	1	30	30
Electrical Resistivity	1	30	30
Vibroseis		*	*
Drilling Rig and Auxillary Equipment		*	*
		Subtotal	160

\*Leased Equipment

### ANALYTICAL EQUIPMENT

ITEM	NUMBER	UNIT COST (\$K)	TOTAL COST (\$K)
Gamma Spec Multi-Channel Analyzer	2	50	100
Sample Preparation Facility	1	200	200
		Subtotal	300

## SPECIAL EQUIPMENT

ITEM	NUMBER	UNIT COST (\$K)	TOTAL COST (\$K)
Computers	20	5	100
Ancillary	6	3	18
Communications			
Secure/Non Secure: w/ data capacity (Team Members)	20	1	20
Internal - Base Camp	1	5	5
External	2 (SAT)	5	10
	1 (HF)	2	2
GPS	1 base, 40 indiv.	8	8
Tools	1 (lot)	5	5
Health and Hygiene	1 (lot)	24	24
Health Physics	1 (lot)	43.5	43.5
Survey Equipment	1	5	5
Mining Safety Equipment	1 (lot)	20	20
Hand Held Survey Meter	6	10	60
		Subtotal	320.5

## SUPPORT EQUIPMENT (BASE CAMP)

ITEM	NUMBER	UNIT COST (\$K)	TOTAL COST (\$K)
Helicopter	**		
All Terrain Vehicle	6	30	180
Housing Trailer	5	50	250
Hygiene Trailer	1	50	50
Food Trailer	1	50	50
Power Trailer (inc. 500 kW generator)	2	100	200
First Aid Trailer	1	50	50
Office Trailer	2	50	100
Maintenance/Spares Storage Trailer	1	50	50
Trucks	6	50	300
		Subtotal	1230

\*\*Provided by host country.

Note:

- 1) Drilling costs are listed in deployment costs.
- 2) This provides a list of equipment that may be required to conduct an OSI should the host country not provide them.

**OTHER ITEMS NOT INCLUDED IN TOTAL**

ITEM	NUMBER	UNIT COST (\$K)	TOTAL COST (\$K)
<u>Consumables</u>			
Food			
Fuel			
Personal Pack	40+40	2	160
Water			
Office Supplies			

# APPENDIX N

## ***ISSUES***

### ***Procedures for Overflights and Use of Inspection Equipment During Overflights***

1. Overflights will be conducted as soon as practically possible to narrow down the size of the inspection area
2. Duration of overflight shall not exceed 12 hours
  - Is the 12 hours continuous or may it be divided over days?
  - Does ground time for landings (staging, refueling, crew or equipment change etc.) count against the 12 hour duration?
  - May overflights forced to terminate because of bad weather or lack of daylight be continued the following day?
  - Recommendation: As a minimum, inspection team should not be penalized for problems beyond its control (i.e., maintenance and/or crew problems with aircraft provided by ISP, lack of daylight, poor weather conditions)
3. ISP vs. TS Aircraft
  - ISP provides aircraft
    - Aircraft, although equipped according to technical requirements, may not be optimized for visual observation for initial overflight
    - Lack of team training between crew and overflight team
    - Potential language problem between aircrew and overflight team
    - Reduces logistic burden for OSI and provides reasonable assurance of early overflight
  - TS provides aircraft
    - With proper selection, can be optimized for various overflight requirements
    - Will permit team training - aircrew and overflight team should function as a cohesive team
    - Potential logistics burden moving aircraft to inspection area - could cause delay in the initial overflight
    - Aircrew counts against 40 man inspection team size limit
  - TS rents aircraft
    - No guarantee that aircraft will completely meet requirements

- Lack of team training and potential language barrier between crew and overflight team remain problems
  - Difficulty in renting aircraft might delay initial overflight
  - Conclusion: From an operational standpoint, TS providing its own aircraft is the preferred option
4. Additional Overflights
- What criteria will be used to request additional overflights?
  - How will the need for additional overflights be documented?
  - Question: Can Open Skies aircraft be utilized in support of additional overflight requirements of an OSI?
5. Overflights - Personnel vs. Equipment
- Maximum of 8 personnel on overflights (four from inspection team, two from ISP, observer, interpreter)
  - Equipment on initial overflight (field glasses, video/still cameras, passive location finding equipment) appears compatible with planned aircraft personnel loading
  - Equipment required for additional overflights (multi-spectral imaging, magnetic/gravitational field mapping etc.) could be incompatible with aircraft provided by ISP and/or the proposed aircraft personnel loading
  - Mismatch might require additional overflights to complete inspection team requirements
  - Less chance of having problems if TS provides its own aircraft. (During training problems with equipment would be resolved, proper techniques developed etc.)
6. Sensor data
- Will the performance parameters for each sensor be defined (i.e., x cm resolution)?
  - What procedures will be use to prohibit use of sensors while aircraft is in transit from its base to inspection area?
  - Will transmittal of sensor data from aircraft to ground be permitted?
  - How much sensor data will be shared with the observer?
7. Emergency Procedures/Deviations from flight plan
- Actions to be taken due to adverse weather conditions, aircraft technical difficulties, medical emergencies etc.
  - Procedures to be followed in the event of in-flight emergencies

8. Inconsistency: Para 80(c), Part II of Protocol allows magnetic field mapping on additional overflights; Para 70, Part II of Protocol allows use of magnetic field mapping after continuation of inspection (25 days). Which takes precedence if additional overflight occurs in first 25 days?
9. The question of using Open Skies aircraft to support overflights should be explored. Even if the decision is made not to utilize these aircraft, the Open Skies Treaty identifies many issues related to the use of sensors aboard aircraft that may have to be addressed in the OSI operation manual.

## ***ISSUES***

### ***On Site Inspection (OSI) Infrastructure***

#### **INTRODUCTION**

There are three infrastructure issues that need to be addressed by the CTBT PREPCOM: permanent OSI team staffing, OSI equipment requirements, and the number of gateways. Decisions on these issues will be dependent on a number of constraints and assumptions. Key constraints include: the cost of maintaining a permanent OSI inspectorate; the amount of meaningful work the permanent OSI staff can perform between inspections; the rapid response required of an OSI team; the effectiveness of augmentees; and the cost of equipment.

Two assumptions will have an impact on OSI infrastructure. The first is the size of the Technical Secretariat (current assumption 250 personnel). The second is the assumption relating to number of yearly inspections and number of concurrent inspections. Current thinking is that while OSIs will be extremely rare (normally no OSI in any given year) two concurrent OSI remain a possibility.

The intent of this paper is to address the size of the permanent OSI staff. An upper and lower bound for the OSI permanent staff will be established. Additionally, functional areas required to be performed by the permanent OSI staff will be identified and a more refined estimate of staff size made.

#### **STAFF SIZE LIMITS**

In determining the upper bound for the permanent OSI staff, a semi-autonomous OSI organization within the permanent Technical Secretariat (TS) was postulated. This organization would consist of an Office of the Director; an Operations Directorate; a Logistics Directorate; and a Personnel and Training Directorate. This organization would maintain its own operations center; be responsible for maintenance and storage of OSI

equipment; conduct deployment planning; and manage training. There would be some “dual hatting” to help reduce staffing requirements. The size of this organization would be in the neighborhood of 100 personnel and would allow two OSIs (fully manned by the permanent staff - no augmentees) to be performed concurrently.

The major drawback of this organization is its cost. Additionally, it is hard to imagine how this staff could be meaningfully employed during the period between inspections.

On the other end of the spectrum is a “Bare Bones” staff. Under this staffing concept, all inspection activities would be performed by augmentees. Additionally, members of the permanent TS would be “dual hatted” and perform OSI related tasks as an additional/secondary duty. Under this concept, the permanent OSI staff would consist of four people: a trainer, who would monitor augmentee training; a logistician, who would monitor equipment maintenance and calibration; a staff coordinator, who would ensure that actions/activities relating to OSI are being addressed by the TS staff; and an OSI Point of Contact.

While this organization would result in minimal cost, it is doubtful that any approach relying totally on augmentees could meet the six day requirement for deploying an inspection team into country. Additionally, one may question the thoroughness and effectiveness of a TS staff who worked OSI issues as an “additional duty.”

## **STAFF FUNCTIONAL AREAS**

Having established that the permanent OSI staff could range between 4 and 100 personnel, the next step is to refine the estimates of staff size. The experience and lessons learned of the Chemical Weapons Convention (CWC) PREPCOM, provide a convenient starting place. Using the design of the CWC Technical Secretariat as a guide, functional areas that might be performed by a permanent OSI staff can be identified

These functional areas, described briefly below, include: Inspection Logistics; Inspection Concepts; Inspector Training; Technical Support; and Health and Safety.

Inspection Logistics encompasses all aspects of deployment planning from maintaining inspector rosters to moving the inspection team and its equipment to the Point of Entry (POE) and on to the inspection site. Inspection Concepts deals with planning the concept of operations for an inspection and identifies activities that must be performed, the sequencing of these activities, skills required and equipment needed. Maintaining the Inspection Operations Manual falls within this functional area.

Inspector training and certification are within Inspector Training's purview. It is envisioned that training will be conducted by States Parties for the TS (current CWC approach) and monitoring this training, approval of lesson plans, establishment of training objectives etc. will fall in this functional area. Technical Support encompasses the maintenance and calibration of inspection equipment. Development of techniques and standard operating procedures to maintain the health and safety of inspector personnel on OSIs falls within the scope of the Health and Safety functional area. Proposed manning for these functional areas is shown below:

Functional Area	Number of People
Inspection Logistics	2 - 4
Inspection Operations	3 - 5
Inspector Training	3 - 5
Technical Support	2
Health and Safety	1

If a two or three man Director's Office is included, the permanent OSI staff, under this option, would range between 13 and 20 persons.

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Several observations need to be made. First, under this proposal, the TS would be required to provide administrative and procurement support to the OSI staff. Secondly, a large number of augmentees will be required to perform an OSI. Finally, limited “dual hatting” might be required of the some members of the TS to ensure that all OSI requirements are met.

This manning level has the advantage of being affordable. Additionally, the OSI staff should be meaningfully employed between inspections. Furthermore, assuming a staffing level of 20, one could form a 10 - 12 person “core” inspection team that could rapidly deploy and meet OSI timelines - augmentees could follow later. Unfortunately, this staffing level does not resolve the difficulty of conducting two concurrent OSI.

## **CONCLUSION**

It is possible to bound the size of the permanent OSI staff and using a rational set of assumptions and constraints develop a reasonable first level estimate a the staff's size. This paper's estimate of a permanent OSI staff size of 20 persons is one such reasonable estimate. While much work still remains in determining an appropriate size of the permanent OSI staff, it is sensible to assume that the final number agreed upon will be closer to 20 rather than 4 or 100.

## ***ISSUES***

### ***Procedures for Certifying Laboratories for Off-Site Sample Analysis***

1. Identify/establish CTBTO requirements:
  - gas analysis
  - spectrometric analysis
  - mass spectrometric analysis (?)
  - wet chemistry analysis
  - low level (radioactivity ) capability
  - high level (radioactivity) capability
  - statement on cost acceptability
2. Establish quantitative evaluation criteria based on:
  - requirements (item 1, above)
  - special considerations such as State Party's political grouping, and ease of transporting samples to the laboratories
3. Request that laboratories claiming above capabilities send qualifications to CTBTO:
  - name, location, physical data, etc.
  - qualifications and experience of the laboratory chief
  - qualifications and experience of key lab personnel
  - limits of current radioactivity licenses
  - the analytical equipment in the laboratory, including capabilities (tech specs)
  - recent experience (emphasis on familiarity with fission products)
  - capability to meet requirements in item No. 1, above
  - unique experiences/capabilities that may be applicable
  - set maximum time for responses
4. Evaluate responses and select top 10 (some number) qualifying laboratories for further evaluation
5. Conduct calibration/proof-of-capability exercise. Send each laboratory identical samples:
  - gas sample
  - mixed fission product sample (perhaps mixed with soil)
  - low-level radioactivity sample
  - request for cost estimate for a specified analysis (example)

6. Laboratories respond to calibration/proof-of-capability exercise by providing:
  - elemental and isotopic species present in samples
  - amount or radioactive material present in dpm, with uncertainty
  - date of formation of the radioisotopes
7. CTBTO evaluate the laboratories' responses using requirements and evaluation criteria established in items 1 and 2 above
8. Select top 4 (some number) laboratories and issue CTBTO certification
9. To maintain certification require certified laboratories to:
  - undergo periodic calibration exercises (perhaps annually)
  - notify CTBTO of changes that may affect their technical capabilities
    - key personnel changes
    - equipment changes
    - physical changes to laboratories
10. Periodic recertification will be required (this will also allow the consideration of new or different laboratories). Basis for recertification:
  - time since last certification (probably a three or five year cycle is reasonable)
  - change in personnel
  - change in equipment at the laboratories
  - physical change in the laboratories (remodel, accident, fire)
  - change in the minimal equipment capabilities required by the Director General and/or the Technical Secretariat
  - establishment of new laboratories with enhanced capabilities

## ***PRELIMINARY CONCEPTS:***

### ***Calibration, Maintenance, and Protection of Inspection Equipment***

1. Approved Inspection Equipment
  - Conference, at its initial session, shall consider and approve a list of equipment for On-Site inspections (OSI)
  - The Technical Secretariat (TS) shall certify that equipment has been calibrated, maintained and protected
  - TS shall provide documentation and attach seals to authenticate the certification
  - TS shall be responsible for maintenance and calibration of permanently held equipment; individual States Parties shall be responsible for the maintenance and calibration of equipment that they provide
2. Inspected State Party (ISP)
  - Has right to check equipment (in the presence of the OSI Team) at the Port of Entry (POE) to insure that it has been approved and certified by the TS
  - Equipment not duly approved and certified by the TS may be excluded
  - Techniques the ISP may use at the POE to check OSI equipment need to be defined
3. Role of the TS
  - Purchase OSI equipment authorized by the Conference
  - Provide each State Party with a list of approved inspection equipment
  - If inspection equipment is formed into kits, provide each State Party with composition of kit
  - For equipment that requires calibration:
    - Develop a calibration plan and schedule
    - Develop a procedure for formally certifying that necessary calibration has been completed
  - For equipment that requires maintenance:
    - Develop a maintenance plan and schedule
    - Develop a procedure for formally certifying that necessary maintenance has been accomplished
  - For equipment/supplies that have a “shelf live” develop procedures to replace out of date items.
  - For all inspection equipment:

- Develop a tagging/sealing plan that will assist in inventorying equipment and will provide protection against tampering
  - The more sensitive the equipment, the more sophisticated the seal should be to prevent tampering.
  - Arrange for equipment to be stored in warehouse space that allows access to be restricted to authorized personnel
  - Develop procedures for:
    - Certifying that equipment has been calibrated, maintained and protected
    - Officially informing States Parties that equipment has been certified
4. During operations at POE, OSI team members should
- Verify that equipment remains functional
  - Allow equipment to be checked by ISP only in their presence
  - Retag/reseal equipment to prevent tampering
5. If equipment is to be stored for short periods of time at POE
- Insure that all equipment has been individually tagged/sealed
  - Store all equipment in a secure area - options for securing equipment storage area include:
    - Physically guard the equipment
    - Store equipment in an area that can be sealed - both the OSI Team and the ISP should apply their own seals to the area (sophistication of the seal used should match the perceived threat)
    - Apply some combination of the above

## *ISSUES:*

### *Procedures Covering OSI Team Safety and Health, and Confidentiality Issues*

*Reference:* CTBT Part II, Paragraph 60 (h) - "During the on-site inspection, the inspection team shall have . . . the obligation to respect the confidentiality and the safety and health regulations of the inspected State Party [ISP]"

- (1) Safety and health regulations of the CTBTO inspectors versus the ISP
  - What will be the basis/standard for the CTBTO safety and health regulations?
  - If any ISP's regulations are more stringent than the CTBTO's, then there is a need to establish procedures for adhering to and/or addressing the ISP's standards (e.g., the ISP provides the inspectors the "authorized" equipment)
  
- (2) Development of CTBTO team safety and health standards in terms of: training, equipment, procedures for inspection activities and areas, and certification
  - Develop standards acceptable and agreed to by all state parties
  
- (3) How does the team deal with a conflict between their desire to conduct a particular activity and the ISP's need to adhere to national regulations?
  - As conflicts arise during an inspection, the team and ISP should identify the applicable "problematic" ISP regulations
  - Attempt to utilize provisions of managed access to resolve concern (e.g., limit the number of personnel inspecting a particular area)
  - Develop procedures/regulations agreed to by all state parties to establish CTBTO health and safety training as acceptable

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(4) Confidentiality issues

- Include a focus on confidentiality as a major issue of team training, and as a part of regulations concerning employment as an inspector (non-disclosure agreements; issues of international law) (increasingly important if CTBTO relies upon inspector augmentees)
- In the event that the ISP raises sensitivity concerns, develop techniques to minimize the team's exposure to sensitive areas during inspections (via managed access)
- Develop procedures to control and protect any sensitive data or samples collected during an inspection (both during the inspection, and afterwards - i.e., in storage)
- Develop mechanisms to punish inspectors if they do not adhere to their non-disclosure agreements

## ***ISSUES:***

### ***Procedures for Storing and Handling the OSI Data and Samples after the Completion of the Inspection***

- (1) Determine the types and forms of data and samples to be stored
  - e.g., finished reports, progress reports, raw data, log books, samples
  - e.g., electronic media, hard copies, soil samples, photographs
  
- (2) Determine the sensitivities and potential special handling requirements for each element
  - e.g., Are particular elements considered CTBTO “sensitive”?
  - e.g., Are original samples potentially radioactive?
  
- (3) Determine the appropriate accountability, control, security, and safety procedures for each element
  - Will certain elements require Secure Data Devices (SDDs)?
  - Tags and Seals?
  
- (4) Determine the appropriate overall system architecture for storing and handling data
  - Data Base Management System (DBMS)
  - Address interoperability / connectivity issues (with other CTBTO systems - e.g., CBM data)
  - Need for secure data transfers? (consider how the data/samples will be received)
  - Need for automated templates etc?

- 
- (5) Determine the appropriate physical security requirements and set-up for sample storage and handling
    - How should the physical samples be stored? (e.g., cabinets, safes, refrigerators)
  
  - (6) Address “Efficiency” issues
    - What OSI elements really “need” to be archived
    - Is there an optimum way to store the data elements? (e.g., scan data into electronic form)
  
  - (7) Develop appropriate procedures for receiving, logging/inventory, storage, tracking, and accessing of data and samples
    - include issue of access procedures (when, how, and by whom might the data be accessed, under what authority?)
    - Who has control over the data and samples? (TS director? representative of Directorate of OSI?)

## ***ISSUES***

### ***Procedures for Training and Qualifications of Inspectors***

1. Hiring (Selection) Criteria vs. Training
  - Many CTBT skills complex and require significant and costly training to fully prepare inspector
  - More qualified the recruit, the less training required
  - Robust selection criteria appear justified
2. Role of Education vs. Experience in the Selection of Inspectors
  - Education shows an individual has the ability to be an inspector
  - Experience shows that prospective inspector has performed in the “real world”
  - Need to determine a balance between experience and education when developing selection criteria
3. Hiring (Selection) Criteria vs. “Geographical Distribution” Requirements for CTBTO
  - Geographical distribution requirements may play a major role in the selection of inspectors
  - Many skills required for CTBT not extensively found in third world
  - Less robust selection criteria with substantial follow-on-training may be required to insure geographical distribution of inspectors
4. Permanent Inspectorate vs. Augmentee Based Inspectorate
  - Permanent Inspectorate Training
    - Travel and per diem training costs reduced; a significant portion of training can be conducted in Vienna
    - Cross training requirements for inspectors can be pinpointed
    - Low turnover reduces training costs
    - Team building training requirements reduced (inspectors in day-to-day contact with each other)
    - Easier to monitor and evaluate effectiveness of training
    - Drawback: high dollar cost associated with maintaining a permanent inspectorate
  - Augmentee Training
    - High travel and per diem costs

- An “excess” of augmentees may need to be trained to insure that a sufficiently large pool of augmentees exists. This will provide enough flexibility to allow inspection teams to be composed of augmentees with the correct technical skills and geographic distribution
  - Significant team building training must be conducted
  - Might be necessary to schedule classes multiple times (results in increased training costs) to allow augmentees some flexibility to free themselves from “real world” jobs to attend training
  - Minimizes the size and costs of a full time inspectorate
  - Conclusion: There are many benefits to training a permanent cadre of inspectors but these benefits must be balanced against the high dollar cost of maintaining full time inspectors, who might have few, if any, inspections to conduct.
5. Impact of “Phasing” an OSI
- Phasing will allow inspector with the required skills to be on the OSI only when needed
  - Reduces cross training; inspector will perform one task and need not be cross trained to perform multiple tasks
  - Reduces training costs
6. Common Skills Training
- Two options: Centralized Training or each State Party conducts its own training
  - Centralized training ensures standardization and quality control, however, cost borne by CTBTO
  - Centralize training will allow CTBTO to “indoctrinate” each inspector with goals and objects of CTBTO
  - Effectiveness of State Party training will vary widely; standardization and quality control lacking; however, costs borne by each State Party
  - Centralized common skills training preferred despite the costs
7. CTBTO’s Role - Trainer vs. Training Management
- CTBTO as Trainer
    - Requires a large, technically qualified, permanent staff
    - Large investment in infrastructure needed - classrooms, equipment etc.
    - Maximizes CTBTO control over curriculum and standards

- CTBTO as Training Manager
  - Individual State Party's conduct training for CTBTO
  - CTBTO approves curriculum, training objectives and standards, and monitors training
  - States Parties make use of their training infrastructure and provide training in lieu of monetary contribution to the CTBTO (Need to determine monetary value of training provided by States Parties)
  - Only a small Training Management Section required at CTBTO
  - Presently the approach being used by the CWC TS
  
- 8. Training Techniques
  - Computer Based Training
    - Effective media for teaching common, non-technical training
    - Ease to update
    - Accessible world wide via internet
    - Might want to consider making operations manuals accessible via the internet
    - Could be used by inspectors to maintain proficiency
  - Formal Classroom Training
    - Bulk of technical subjects taught in the "classroom"
    - Extensive use of hands on training
    - Practical exercises conducted "in the field"
  - Team Training
    - Major element of any training program
    - Extremely critical if OSI relies on augmentees rather than permanent staff
    - Short inspection time lines require that this training be conducted before request for an OSI
    - While team training should be a separate, stand alone module, it could also be integrated, to the extent possible, into all training modules
  - Mock Inspections
    - United States or Russia most likely sites for this type training
    - Individuals learn how to function as a member of a larger team and see how various elements of the team interacts

- Provides opportunity to test out procedures developed for OSI as well as to see how individuals function in the field in a real world environment
- Could lead to revision of Operations manuals

9. Length of Training

- Chemical Weapon Convention Training Schedule - 20 weeks
  - Module 1: Basic Course - Seven weeks
  - Module 2: Specialist Application Course - ten weeks
  - Module 3: On-site Trial Inspection Training - three weeks
- CWC a more complex treaty than CTBT
  - CWC has more “types” of inspections than CTBT: i.e., Former Production Facility; Schedule 1, 2 ,and 3 facilities; Destruction Facilities; Challenge Inspections etc.
  - Less “complex” CTBT treaty might allow reduction in the length of Module 1 and Module 2 training
  - CWC utilizes full time inspectors who perform numerous inspections - reduces the need for refresher training
  - CTBT reliance on augmentees for inspections and the postulated limited number of CTBT inspections might require significant refresher training
- Attached is an initial draft of proposed subjects for Module 1

## **MODULE 1**

### **INSPECTOR TRAINING - BASIC COURSE**

Below is a preliminary draft of the instructional material that might be found in a Basic Course of Instruction for inspectors. It is assumed that this module will be followed by two others: Module 2 - Inspector Specialty Training; and Module 3 - OSI Training (Mock Inspection Training).

#### **CONTENTS OF MODULE 1**

##### **A. GENERAL**

##### **A1 THE COMPREHENSIVE NUCLEAR TEST BAN TREATY (CTBT)**

- A1.1 History of nuclear test ban negotiations
- A1.2 The CTBT background
- A1.3 Scope of the CTBT
- A1.4 Introduction to International Law
- A1.5 Proliferation and Disarmament

##### **A2 THE COMPREHENSIVE TEST BAN TREATY ORGANIZATION (CTBTO)**

- A2.1 CTBTO as prescribed by the CTBT text.
- A2.2 Conference of State Parties and the Executive Council
- A2.3 Technical Secretariat (TS)
- A2.4 Preparatory Commission
- A2.5 Inspection Ethics
- A2.6 National Authorities
- A2.7 Relation with the UN system
- A2.8 Similarity with the Chemical Weapons Convention (CWC)

##### **A3 INTER-PERSONNEL SKILLS**

- A3.1 Organization and handling of contacts at governmental levels
- A3.2 Awareness of cultural and ethnic differences
- A3.3 Introduction to basic negotiating skills

## A4 MANAGEMENT

- A4.1 Organizational and management skills
- A4.2 Logistical support
- A4.3 Administrative support

## A5 COMMUNICATIONS AND NAVIGATION

- A5.1 Data communications
- A5.2 Secure transmissions
- A5.3 Satellite communications
- A5.4 Global Positioning System (GPS)

## A6 DATA HANDLING

- A6.1 Introduction to CTBT databases
- A.6.2 Data handling
- A6.3 Data transmission
- A6.4 Data collection
- A6.5 Chain of custody
- A6.6 Data security and confidentiality

## A7 INTRODUCTION TO INFORMATION COLLECTION

- A7.1 Importance of information collection
- A7.2 Sources of information at an inspection site
- A7.3 Art of asking questions and observation

## A8 LINGUISTIC TRAINING

To be determined

## **B. NUCLEAR TESTING - DETECTION/INSPECTION**

### B1 HISTORY OF NUCLEAR TESTING

- B1.1 History of nuclear testing
- B1.2 The nuclear warfare threat
- B1.3 The present world situation
- B1.4 Significance in conflicts

## B2 INTRODUCTION TO TYPES OF NUCLEAR TESTING

- B2.1 Underground (tunnel/vertical hole)
- B2.2 Underwater
- B2.3 Other (surface, atmospheric, exo-atmospheric)
- B2.4 Hydronuclear tests

## B3 TECHNIQUES FOR CONCEALING TESTS

- B3.1 Decoupling
- B3.2 Masking
- B3.3 Other ???

## B4 INTERNATIONAL MONITORING SYSTEM (IMS) AND INTERNATIONAL DATA CENTER (IDC) FUNCTIONS

- B4.1 General
- B4.2 Seismological Monitoring
- B4.3 Radionuclide Monitoring
- B4.4 Hydroacoustic Monitoring
- B4.5 Infrasound Monitoring
- B4.6 International Data Center functions

## B5 INTRODUCTION TO SAMPLING AND ANALYSIS

- B5.1 Provisions in the CTBT for sampling
- B5.2 Chain-of-custody
- B5.3 Sample handling, sealing, marking, and packing
- B5.4 Storage and transport of samples and toxic materials
- B5.5 Quality assurance/Quality control

## B6 PERSONNEL PROTECTION

- B6.1 Individual radiation monitoring
- B6.2 General safety (Health concerns; equipment safety; etc.)
- B6.3 Mine Safety

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## **C. CONFIDENCE BUILDING MEASURES AND INSPECTIONS**

### **C1 CONFIDENCE BUILDING MEASURES**

- C1.1 Voluntary reporting procedures
- C1.2 Voluntary visits
- C1.3 Calibration experiments

### **C2 ON-SITE INSPECTIONS - RIGHTS, OBLIGATIONS AND PROCEDURES**

- C2.1 CTBT inspection requirements
- C2.2 Administrative/Logistic support to the inspection team
- C2.3 Inspectors rights and obligations
- C2.4 States Party's rights and obligations
- C2.5 Observer's rights and obligations
- C2.6 Inspection team organization
- C2.7 How to use an interpreter
- C2.8 Escort procedures

### **C3 INTRODUCTION TO THE INSPECTION PROCESS**

- C3.1 In-briefing/Orientation to States Parties
- C3.2 General inspection concepts
- C3.3 Inspection equipment orientation
- C3.4 Initial overflight
- C3.5 Inspection techniques (Days 1 - 25)
- C3.6 Inspection techniques (Day 25+)
- C3.7 Drilling
- C3.8 Out-briefing to States Parties
- C3.9 Inspection reports
- C3.10 Lessons learned - UNSCOM, CWC etc.

### **C4 INTRODUCTION TO OPERATIONAL SECURITY**

- C4.1 Team security procedures
- C4.2 Internal team communications
- C4.3 Note taking; team dynamics

## **C5 PLANNING AND ORGANIZATION OF INSPECTIONS**

- C5.1 Personnel and responsibilities**
- C5.2 Work plan**
- C5.3 Phasing equipment and personnel into country**
- C5.4 Safety meetings and inspections**
- C5.5 Planning of response activity in hazardous area**

## **D. MISCELLANEOUS**

### **D1 CASE STUDIES**

- D1.1 Lessons learned from mock inspections/previous inspections**
- D1.2 Classroom exercises**

### **D2 PRACTICAL EXERCISES**

- D2.1 Seismology demonstration**
- D2.2 Multi-spectral imagery demonstration**
- D2.3 Gamma spectroscopy demonstration**
- D2.4 Magnetic field mapping demonstration**
- D2.5 Gravitational field mapping demonstration**
- D2.6 Ground penetrating radar demonstration**
- D2.7 Electrical conductivity measurement demonstration**

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