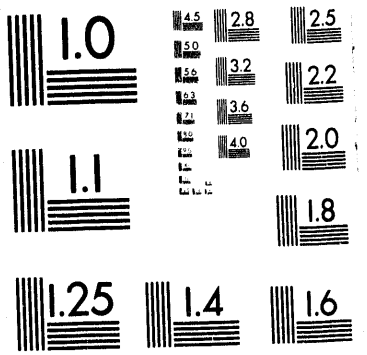
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DEPARTMENT OF STATE
DEPARTMENT OF ENERGY
ARMS CONTROL AND DISARMAMENT AGENCY
NUCLEAR REGULATORY COMMISSION

Concept Paper

Knowledge Acquisition Skills Training for Enhanced IAEA Safeguards Inspections

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EXECUTIVE SUMMARY

This concept paper explores the potential contribution of "Knowledge Acquisition Skills" in enhancing the effectiveness of international safeguards inspections by the International Atomic Energy Agency (IAEA, or Agency) and identifies types of training that could be provided to develop or improve such skills. For purposes of this concept paper, Knowledge Acquisition Skills are defined broadly to include all appropriate techniques that IAEA safeguards inspectors can use to acquire and analyze information relevant to the performance of successful safeguards inspections. These techniques include a range of cognitive, analytic, judgmental, interpersonal, and communications skills that have the potential to help IAEA safeguards inspectors function more effectively.

The need for a high level of Knowledge Acquisition Skills stems from new challenges to the safeguards system, such as that posed by the potential for undeclared nuclear activities in States with a comprehensive safeguards agreement. In combination with relevant technical skills, refinement of Knowledge Acquisition Skills can help the IAEA meet these challenges by enhancing the ability of inspectors to detect undeclared activities and assisting in the effective management of the inspection process that allows such detection. Further development of Knowledge Acquisition Skills can also enhance the Agency's inspection process generally.

Knowledge Acquisition Skills include 10 components addressing the performance of virtually all activities involved in planning and conducting an inspection, collecting, analyzing, and evaluating information, and describing the results in a clear and concise manner (in either written or oral form). A variety of inspection training programs in both the public and private sector provide training in one or more of these components. However, in most cases the skills imparted in these training programs are very closely intertwined with the subject matter domain of the organization. Similarly, in their application to IAEA inspections, Knowledge Acquisition Skills must be employed in tandem with technical safeguards skills and knowledge of the particular types of facilities being inspected. Further,

cultural and language issues also play a role in the conduct of IAEA inspections. As a result, the approaches of other training programs alone are not a complete basis for developing a comprehensive training program for Agency inspectors. While it should be possible to draw upon these other training programs to develop a general structure for providing Knowledge Acquisition Skills training to IAEA inspectors, the approaches in these programs will likely require significant adaptation to support the specific job requirements, policies, and practices that define the IAEA inspector's job. The design and delivery of such training is likely to be best accomplished in close coordination with complementary technical and facility-specific training.

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CONTENTS

1. INTRODUCTION

1.1 PURPOSE

The purpose of this concept paper is to explore the potential contribution of "Knowledge Acquisition Skills" in enhancing the effectiveness of international safeguards inspections by the International Atomic Energy Agency (IAEA or Agency) and to identify types of training that could be provided to develop or enhance such skills. For purposes of this concept paper, Knowledge Acquisition Skills are defined broadly to include all appropriate techniques that IAEA safeguards inspectors can use to acquire and analyze information relevant to the performance of successful safeguards inspections. These techniques include a range of cognitive, analytic, judgmental, interpersonal, and communications skills that have the potential to help IAEA safeguards inspectors function more effectively. This concept paper represents the initial phase of a four-phase task and is intended to lay the groundwork for subsequent phases. In particular, the four phases of this research effort include:

Phase I:	Conduct a scoping study that defines Knowledge Acquisition Skills and discusses how enhanced knowledge acquisition capability will benefit the IAEA. Also, outline the general requirements for IAEA Knowledge acquisition training.
Phase II:	Provide a more detailed identification of the specific skills required for IAEA safeguards inspectors and the training modules that will be required to provide/enhance these skills.
Phase III:	Develop a training curriculum and plan delivery of initial, basic training.
Phase IV:	Deliver additional intermediate and advanced training.

1.2 BACKGROUND

Historically, the IAEA safeguards system has been designed and operated primarily as an auditing system. Agency inspections have been designed to provide assurance that declared nuclear materials have not been diverted from peaceful nuclear activities, in large part by confirming that a nuclear facility's records fairly and accurately account for the nuclear materials used or produced through declared activities. If signs of nuclear materials diversion are detected, this information is subject to further evaluation and follow-up action, as appropriate.

In light of recent experience with undeclared activities in States with a comprehensive safeguards agreement, the traditional approach to international safeguards needs to be enhanced. For example, the implicit assumption that all participants (States) will rely on declared activities and facilities to acquire a nuclear explosives capability no longer holds. In fact, Iraq chose to pursue its nuclear weapons development objectives through clandestine activities in undeclared facilities. Accordingly, the IAEA Director General has stressed the importance of strengthening the safeguards system by "enhancing the Agency's ability to detect and obtain access to any undeclared activities that should have been declared under safeguards agreements" (Report to the 36th Session of the general Conference, GC/XXXVI/1017). Such an ability requires an increasingly observant, inquisitive, and persistent role for Agency inspectors.

To respond to the new challenges, the Agency would like to enhance the ability of inspectors to detect undeclared activities. To address this need, inspectors may have to be more investigative in their approach. Skills in evaluating information on States' nuclear activities, undertaking complex investigations, verifying declarations by making observations and following up on possible anomalies and discrepancies, and dealing with difficult situations involving various forms of resistance from facility operators or State authorities may be required. Inspectors may also need to consult information from a broader range of sources, including open sources (e.g., newspapers, radio, television), governmental proprietary

information (e.g., sensitive material export requests and approval/denials), and other information on a State's nuclear program. Finally, inspectors may need to draw upon enhanced technical expertise in reprocessing, enrichment, and other fuel cycle facilities. To address this new set of requirements and demands on Agency inspectors, the IAEA may modify its current recruiting and selection practices or implement new practices.. It is critical, however, that all inspectors have the requisite skills and knowledge for conducting inspections in these complex and sometimes hostile environments.

1.3 RELATIONSHIP TO OTHER IAEA INITIATIVES

The IAEA has recently launched a number of initiatives to strengthen safeguards. At the request of the Director General, the Standing Advisory Group on Safeguards Implementation (SAGSI) re-examined "how Agency safeguards are implemented in order to advise on ways to reduce costs while meeting new requirements and maintaining effectiveness." SAGSI focused on the problem of undeclared activities revealed through the Iraq experience and urged that the IAEA safeguards system "be strengthened so as to provide confidence that no undeclared activities of proliferation relevance are being carried out in States with comprehensive safeguards agreements." In SAGSI's view, a basis for such a strengthened system is the greater degree of openness and transparency expected by the international community elsewhere in the arms control and disarmament field. SAGSI identified a number of specific measures that could be taken to address both undeclared activities and facilities. It noted that such approaches place "less emphasis on quantitative assessment and more emphasis on qualitative judgments about the declared operation of facilities."

The IAEA Secretariat has been asked to assess in more detail the technical, legal, and financial aspects of SAGSI's proposals and report to the IAEA Board of Governors in December 1993. To manage this and related Agency efforts, the Department of Safeguards has established a program to strengthen and streamline safeguards implementation referred to by the Department as "Program 93+2." This program consists of seven tasks:

1. Cost analysis of present safeguards implementation

2. Increased cooperation with State Systems of Accounting and Control

3. Environmental monitoring techniques for safeguards application

4. Other measures for improving the cost-effectiveness of safeguards

5. Improved analysis of information on States' nuclear activities

6. Enhanced safeguards training

7. Proposals for strengthening and improving the efficiency of the safeguards system

The analysis presented in this concept paper of the potential role of Knowledge Acquisition Skills and the training required to develop these skills is in direct support of Program 93+2, Task 6, Enhanced Safeguards Training. Because needed skills and training are, in large measure, driven by the specific practices and procedures that inspectors must follow, the analysis presented in this paper attempts to anticipate the types of inspection practices likely to emerge from further exploration of SAGSI's proposals and from the other tasks of Program 93+2. As the actual results from Program 93+2 become available, results from the analysis presented in this concept paper could be refined accordingly.

1.4 SCOPE AND ORGANIZATION OF THE CONCEPT PAPER

As we were asked, this concept paper:

- defines knowledge acquisition capability (previously referred to as "observational" capability)
- discusses the advantages and benefits of enhancing the knowledge acquisition capability of Agency inspectors
- describes the applicability of these skills to the detection of undeclared activities

- summarizes the different types of training that fall under the Knowledge Acquisition Skills approach
- includes information on Knowledge Acquisition Skills employed by inspectors and investigators from domains other than arms control
- includes information on Knowledge Acquisition Skills employed in connection with physical security at civilian nuclear and defense facilities

We believe that the following additional elements, not fully addressed in this concept paper, are best completed in Phase II of this task.

- Collect information about lessons learned in the conduct of non-routine inspections
- Identify the core capabilities necessary for a successful inspection
- Identify the core individual and team skills that are necessary to assure these capabilities
- Assess the success of this type of training reported by other agencies
- Identify the training development requirements that must be met in order to provide IAEA inspectors with the team and individual skills

While some lessons from Iraq were factored into the concept paper based on the experience of one project team member, more complete information on non-routine inspections will require interviews with Agency inspectors, as contemplated in Phase II. Similarly, while this concept paper touches on the core capabilities necessary for a successful special inspection and the core individual and team skills that are necessary to assure these capabilities, a full evaluation will benefit from the perspective of active IAEA inspectors. Finally, assessing other agencies' training programs and identifying IAEA training development requirements can be more efficiently performed once additional focus is provided by Agency review of this concept paper.

This concept paper contains four chapters. Following this Introduction (Chapter 1), Chapter 2 explores how Knowledge Acquisition Skills could enhance the ability of IAEA inspectors to detect diversions of nuclear materials as well as clandestine activities and facilities. Chapter 3 summarizes our review of various existing training programs in the public and private sectors that provide training for the development of these categories of skills. Chapter 4 incorporates information presented in Chapters 2 and 3 to provide recommendations for the types of training that could be provided to IAEA safeguards inspectors to enhance Knowledge Acquisition Skills.

2. THE RELEVANCE OF KNOWLEDGE ACQUISITION SKILLS TO IAEA SAFEGUARDS INSPECTIONS

This chapter explores the relevance of Knowledge Acquisition Skills to enhance IAEA safeguards inspections by briefly describing the current approach to inspections, describing potential new inspection practices to meet the new challenges discussed in Chapter 1, and identifying categories of Knowledge Acquisition Skills that could help support such practices. This analysis is based on an informal workshop with several former IAEA inspectors, review of Agency program materials and publications, and the authors' familiarity with the arms control and nonproliferation literature. The discussion of current approach and potential new practices is a brief sketch intended to stimulate thought about the relevance of Knowledge Acquisition Skills for more effective inspections.

2.1 CURRENT APPROACH

The overall purpose of the IAEA safeguards, under both INFCIRC 66/Rev, 2 and INFCIRC 153, has been to verify that nuclear materials have not been diverted from peaceful uses to the manufacture of nuclear weapons or other nuclear explosive devices. Through its safeguards agreement, subsidiary arrangements, and facility attachments, a State declares the facilities and activities where nuclear materials are present that constitute its peaceful nuclear program (or in the case of States that are not subject to full-scope safeguards, the facilities and activities that are subject to safeguards). As an essential element of this process, the State provides the Agency with "design information" concerning the features of each facility subject to safeguards that are relevant to safeguarding nuclear material, including a description of the facility and its layout and the form, quantity, location, and flow of nuclear material being used. The Agency's safeguards are then implemented to provide the timely detection of diversion of significant quantities of nuclear materials from the State's peaceful nuclear activities. "Timely" and "significant quantities" are judged in terms of the weapons potential of the particular type and form of material in question.

Safeguards seek to verify that a diversion has not occurred through the application of nuclear materials accountancy, complemented by containment and surveillance. Accountancy is a means of tracking nuclear materials that move through a State's declared facilities by establishing the quantities of nuclear material present within defined areas and the changes in these quantities that occur over defined time periods. Accounting information is provided by the facility operator, who identifies and inventories the material, maintains records of all transactions, and submits these reports through the State to the Agency. Accountancy is complemented by containment and surveillance. Containment consists of structural features that prevent undetected access to specific materials or items. Surveillance involves monitoring the movement of nuclear material and the detection of interference with containment or tampering with IAEA safeguards devices, samples, or data The most common surveillance device is a time lapse camera.

Safeguards inspections are conducted with reference to the accounting, containment, and surveillance systems. Most generally, the inspector's role is to verify the accuracy of the information provided in the State's accounting reports submitted to the Agency, evaluate quantities of material unaccounted for, and determine reasons for discrepancies. Specific tasks performed by inspectors include:

- comparing the facility's records with the accounting reports submitted to the IAEA
- conducting independent measurements of nuclear materials
- physical verification of declared items
- verifying calibration and operation of Agency equipment
- taking samples for subsequent analysis at the Agency
- attaching, examining, and removing seals
- servicing surveillance equipment, such as removing and replacing film for subsequent review at the Agency

Inspectors may also seek to verify design information regarding a facility which has been provided by the State to the Agency for safeguards purposes.

If results from inspection activities reveal an anomaly (an unusual observable condition which might result from diversion) or a discrepancy (an inconsistency found in auditing records and reports, or found between records and reports and measurements, or found as a result of some other occurrence), the inspector or the Agency attempts to resolve it. Follow-up actions may result in satisfactory explanations, a determination that a significant quantity of a nuclear material is inexplicably missing, a report on other types of noncompliance, or a statement that the Agency is unable to verify that there has been no diversion of nuclear material (IAEA, 1987).

2.2 INSPECTION PRACTICES

To meet the challenge of detecting undeclared activities and facilities, inspection practices directed at the acquisition and analysis of relevant information will require particular emphasis. These practices, many of which are already followed to varying degrees by Agency inspectors, include the following:

Pre-inspection review of facility-specific information. Prior to inspections, inspectors should systematically review pertinent information concerning the facility, including facility design information, recent material balance reports, and the results of previous inspections of the facility, including recent IAEA inspection reports and inspectors' working papers. Review of design information provides a baseline with which the inspector can plan to compare facility features observed during the inspection. Review of previous inspection results can assist in alerting the inspector to past instances of discrepancies, anomalies, delays, obstructions, and the like, as well as how these discrepancies were resolved. In this manner, the inspector (or inspection team) can prepare for similar issues or events that may arise during the inspection.

Pre-inspection review and analysis of information on the State's nuclear activities. Inspectors should supplement briefings from IAEA country or facility officers with comprehensive information on the State's broader nuclear activities. Review and analysis of such information can assist in sensitizing the inspector to potential indicators of undeclared activities or facilities that might be encountered during the course of the inspection.

Pre-inspection generation and analysis of diversion/concealment scenarios. In principle, the Agency takes into account plausible diversion strategies in designing and implementing safeguards approaches and evaluating inspection results. Building on this ground work, inspectors should generate and analyze specific scenarios for the concealment of diversions or undeclared activities or facilities, asking in effect, "what would it take to mislead or fool the inspector?" Such scenario generation and analysis can be helpful in focusing the inspector's efforts.

Pre-inspection team formation. In planning complex inspections, explicit attention should be given to formation of an inspection team that includes members who represent the full range of relevant technical and Knowledge Acquisition Skills, have well-defined assignments, and work well together, consistent with keeping the overall size of the team workable.

Pre-inspection development of an inspection strategy. Inspection planning should include development of an inspection strategy that specifies a sequence of inspection activities most likely to reveal diversions or undeclared activities or facilities, based on review of past inspection results, information on the State's nuclear program, diversion/concealment scenarios, and team formation. Such a strategy could, for example, include changing the manner in which an inspection is performed compared to previous inspections. (If the facility operator does not know precisely what is being inspected, it will be harder to conceal evidence of diversions.)

Attentiveness to physical conditions that may be indicative of undeclared activities or facilities. As currently practiced, inspections primarily focus on anomalies and discrepancies as indicators of possible diversions. It is increasingly recognized that a variety of physical conditions, such as changes in facility features, may indicate possible undeclared activities and facilities. Inspectors should be alert to such conditions. For example under the Agency's authority to verify design information provided by the State to the Agency, inspectors can systematically compare observed attributes of the facility with design information, in order to identify changes in facility design or operation that could be indicative of undeclared activities.

Attentiveness to demeanors and behaviors that may be indicative of concealment. Inspections currently concentrate on objectively measurable or observable physical conditions (including information contained in records and reports). Inspectors and investigators in other domains often observe demeanor and behaviors as potential indicators of concealment. While attentiveness to such behavioral cues cannot substitute for objective data, inspectors should make use of such information in focusing their efforts and in deciding, for example, whether to take at face value, explanations of delays or excuses for denying access.

Attentiveness to volunteered information which may be indicative of undeclared facilities or activities. Facility operators vary greatly in their willingness to talk to inspectors. It is not necessarily the case that those who have the most to hide are also the most circumspect. As with physical conditions, inspectors should be attentive to volunteered information that may indicate possible undeclared facilities or activities, even if that information does not technically fall within the scope of the inspection.

Clarification of declarations. To verify the State's declaration (type of facility operations, types of materials handled, processes performed), the inspector compares what is stated or observed (or what can be reasonably inferred from this information) with the declaration (quantities of materials, types of materials, functions of buildings). If discrepancies are thereby identified, inspectors should ask appropriate questions to clarify

declarations (e.g., am I correct in my understanding that you operated this facility between 1992 and 1993?).

Resolution of apparent anomalies and discrepancies. Inspections can reveal anomalies and discrepancies, such as:

- unreported and significant changes in facility design or operation
- malfunction of containment or surveillance measures
- interference with containment or surveillance measures
- inconsistencies within reporting records and reports
- inconsistencies between records and reports and measurements

Inspectors should be persistent and creative in questioning facility personnel with regard to apparent anomalies and discrepancies on the spot, both to avoid giving the facility the opportunity to establish a false explanation and to potentially catch the operator in further inconsistencies.

Assertiveness in obtaining access to equipment and areas. Facility operators sometimes deny or delay access to facility areas or otherwise attempt to obstruct inspectors in the performance of their work, through excuses, delays, objections, or lack of preparation. The Agency recognizes that such behavior is itself an anomaly (i.e., an objective indicator of possible diversion or misuse). Inspectors should be assertive in their insistence that such obstruction is not permissible (unless a convincing and innocent rationale for the denial or delay is provided) and should describe such incidents fully in their working papers.

Inspector judgment in evaluating inspection results. There has been some tendency in recent years to view safeguards inspectors as careful data collectors, leaving analysis and conclusions to other Agency personnel (e.g., supervisors). Successful inspection will increasingly require the inspector to perform an integrated set of observation, data collection,

analysis, and judgment activities. Accordingly, it may be appropriate for the Agency to consider more emphasis on the exercise of independent professional judgment by inspectors so that the Agency can have the benefit of that judgment in drawing conclusions from safeguards inspections.

Documentation of suspicious physical conditions, behaviors, demeanor, and volunteered information. All of the information gained during the course of the inspection should be captured for use by the Agency in follow-up actions and in future inspections of the same State or facility. Inspectors should include in their working papers documenting the full range of observations made, conclusions drawn based on analyses of this information, and questions raised as a result of the inspection.

Debriefing of inspectors. Even very thorough working papers are unlikely to convey all of the information gained from an inspection, especially findings from a special inspection or a routine inspection that results in significant unresolved anomalies or discrepancies. Debriefing inspectors following these inspections helps to ensure that valuable information is not lost. In addition, questions raised by debriefers sharpen the inspector's skills by suggesting alternate ways of viewing the information or new lines of inquiry in future inspections.

2.3 RELEVANT KNOWLEDGE ACQUISITION SKILLS

Nearly all of the staff of the Safeguards Department, including inspectors, are scientists and engineers. They bring to the job substantial experience in the nuclear field and receive intensive training in the technical aspects of safeguards, particularly nuclear materials accountancy. Through on-the-job experience and additional training, inspectors acquire skills in the practical aspects of conducting safeguards inspections at specific types of facilities, often under difficult conditions. Most also acquire "diplomatic" skills in dealing with State officials and facility operators, who may vary widely in their willingness to cooperate. However, if inspectors are to effectively perform the types of tasks described in the previous

section, they will increasingly need to refine their Knowledge Acquisition Skills. As defined in Section 1.1, these include a broad range of cognitive and behavioral processes designed to enhance an inspector's knowledge and understanding of a given situation.

For purposes of this concept paper, Knowledge Acquisition Skills involve more than simply observing a situation or setting to identify anomalies. Accordingly, Knowledge Acquisition Skills embrace virtually all activities involved in planning and conducting the inspection, collecting information, analyzing and evaluating information, and describing this information in a clear and meaningful manner (either in written or in oral form). To assist in keeping this discussion manageable, ten components of Knowledge Acquisition Skills have been identified and are summarized in Table 1. As indicated in the table, Knowledge Acquisition Skills span all activities included in the inspection. Another important point about the ten Knowledge Acquisition Skills components is that there is some overlap in these components. For example, *Gathering & Corroborating Evidence*, focuses on obtaining information from a variety of sources and identifying alternative sources to substantiate information. This may include conducting interviews. A separate skills component, *Conducting Interviews*, however, provides detailed information about setting up and structuring interviews. Thus, the ten Knowledge Acquisition Skills components may overlap to some degree with other Knowledge Acquisition Skills, but each involves distinct skills or techniques.

Table 1. Knowledge Acquisition Skills Training Components

Training Component	Description of Component
Inspection Planning	This includes all activities related to identifying what is currently known about a setting or situation, and determining the approach used to conduct an investigation.
Team Formation/Team Leadership	When inspections involve a team of inspectors, there are procedures for selecting team members, identifying a team leader, and determining the role that individual members and the team leader play. This training component focuses on the guidelines for establishing teams, assigning work to team members, and assigning roles and activities to the team leaders.
Visual Observation of Physical Surroundings	This training component is used to guide inspectors on procedures for observing the physical surroundings in terms of the physical layout, equipment and systems present, and other techniques for noting anomalies in the physical environment.
Gathering and Corroborating Evidence	This training component addresses the different types of information that can be gathered during an inspection, such as photographic evidence, findings from observations of the environment, and observations of and interviews with facility staff. It also emphasizes the need for corroborating information from other sources.
Interview Techniques (verbal)	This component focuses on specific guidelines for conducting formal and informal interviews and presents guidelines for obtaining information from uncooperative persons.
Interview Techniques (non-verbal)	This training component focuses on interpreting a person's physical demeanor to better evaluate the information he/she is providing.
Conducting Analyses	This training component emphasizes the need for a formal mechanism to combine information from a variety of sources. It can include well-defined models for evaluating, combining, and interpreting information.
Inspection Team Brainstorming	This includes all activities that inspection teams engage in during the inspection to gather and analyze information, determine additional information needs, and generate hypotheses to explain findings.
Agency or Management Briefing/Debriefing	This training element includes the process by which the inspector or team leader provides an oral summary of the information gathered and results from analyses of that information.
Written Report of Observations and Investigations	This training component consists of guidelines for constructing a report that accurately and clearly summarizes findings from an inspection or investigation.

3. REVIEW OF OTHER INSPECTION TRAINING PROGRAMS

To provide guidance in the types of training Knowledge Acquisition Skills that could be used to enhance safeguards inspectors' job performance, we surveyed a number of different training programs and training manuals. This survey included a variety of inspection training programs in both the public and private sector, as well as other training programs that appeared to incorporate Knowledge Acquisition Skills. This section describes the method for conducting this survey and results from the survey of current training programs.

3.1 TRAINING SURVEY METHOD

Procedures for conducting this survey included: (1) gathering information about current training programs provided in the public and private sector, (2) obtaining copies of such training program materials to identify training modules that pertain to Knowledge Acquisition Skills, and (3) reviewing and summarizing training information to ascertain how Knowledge Acquisition Skills are imparted through training. This section describes the findings from obtaining and summarizing programs that include Knowledge Acquisition Skills training modules.

Initially, we used a very broad definition of Knowledge Acquisition Skills that included any activities related to collecting information from visual inspections or interviews with other persons, analyzing or evaluating information to generate explanations or hypotheses, and summarizing information in written or oral form so as to provide a clear, coherent picture of findings and conclusions. Using this broad definition, we began by conducting a computerized search of the published training literature. This produced a few documents from government agencies.

As a next step, we contacted representatives from government agencies who provide training to their staff. This produced a larger number of training program manuals and

handbooks. Finally, we contacted private organizations who also provide some types of inspections training. This produced another set of training program manuals or handbooks. After collecting many training manuals, we reviewed these to identify the types of training provided that could be classified as a component of Knowledge acquisition training.

3.2 SURVEY RESULTS

This section provides a summary and description of the types of training provided to inspectors and investigators employed in public and private organizations. As indicated above, a variety of government agencies were contacted to collect information documenting inspection and investigator training programs. Agencies that would appear to have the most relevant training programs were contacted. In some instances, however, agencies required special procedures or interventions from other government agencies before providing such training information. For example, the Defense Intelligence Agency (DIA) was contacted and offered to provide training curriculum and program information, if such a request were made through another government agency. In addition, some agencies have rather extensive training programs, such that training could not be summarized in a single training manual or handbook. A review of these programs would require site-visits to ensure a thorough understanding of all training programs and modules that relate to Knowledge Acquisition Skills. Therefore, it is recommended that Phase II activities include site-visits to obtain this information from other government agencies (e.g., Occupational Health and Safety Agency, On-site Inspection Agency).

The training programs reviewed for this concept paper were obtained from six government agencies and national laboratories, and from four private organizations. The government agencies and national laboratories represented in this summary are:

- Department of Energy (DOE)
- Environmental Protection Agency (EPA)

- Idaho National Engineering Laboratory (INEL)
- National Institute in Economic Crimes (NIEC)
- Nuclear Regulatory Commission (NRC)
- Swedish Nuclear Inspectorate (SKI)

Private organizations represented in these training program evaluations include:

- Boeing Commercial Airplane (Boeing)
- International Loss Control Institute, Inc. (ILCI)
- Universal Detectives (Patterson)
- Westinghouse Electric Corporation

Descriptive information of each of the training programs reviewed for the concept paper is provided in Table 2. This includes:

- Target Audience: Occupational types who participate in the training program.
- Course Length: The total time for the course. This does not provide specific information about the time spent on specific course modules.
- Type of Training: This is used to identify where the training occurred, such as in the classroom or on-the-job training. This item does not apply to training manuals or handbooks.
- Type of Investigation or Inspection: This refers to the type of inspection or investigation activity, such as fraud or accident investigations or inspections to ensure organizations are complying with regulations.
- Techniques Used in Training: This item is intended to identify the variety of training techniques used to impart knowledge and skills, such as role playing, case studies, laboratory exercises, and simulations.
- Knowledge Acquisition Training included with Technical Training Program: This item was included to determine if Knowledge Acquisition Skills training is provided as a separate training program or in combination with technical skills training. (Yes or No)

According to this information, 12 of the 17 programs consist of training designed for investigators and inspectors. The remaining programs were selected for inclusion because they provide additional information about training for specific components and for assessing the skill level of investigators or inspectors. Nine of the programs involve classroom training, two include classroom training with on-the-job training, three are handbooks which serve as references for inspectors or investigators, one is a self-paced training program, and two provide information about assessing characteristics or skills of investigators or inspectors. Inspection and investigation topics include safety, regulatory compliance, accident, fraud, routine operations, and security surveillance. In addition to classroom lectures, most training programs include other activities to help develop skills, such as (1) case studies, (2) paper simulations, (3) laboratory exercises, (4) role playing, (5) written exercises, (6) group exercises, (7) demonstrations, (8) hands-on simulations, and (9) assessment instruments. Finally, for the majority of training programs or manuals, knowledge acquisition training components are embedded in technical training components (13 of 17).

Each training program is also described in terms of the presence or absence of knowledge acquisition training components. The ten components described in Table 1 also appear in Table 2. To assist in reading Table 2:

- a star (*) indicates that the training component represents a major part of the training,
- a check (✓) indicates that the topic is included in the training, and
- a zero (0) indicates that the topic is not included in the training program.

More detailed descriptions of the variety of training provided within each of the ten knowledge acquisition training components is provided below by skills component.

Table 2. Summary of Observational Skills Components by Training Program

Description of Training							Observation Training Topics									
Training Program/ Manual (Course/Manual, Title & Source)	Target Audience	Course Length	Type of Training (e.g., classroom, OJT, etc.)	Types of Investigation (e.g., fraud, accident)	Training Techniques	Is Observation Training Included with Technical Training?	Inspection Planning	Inspection Team Formulation & Team Leadership	Visual Observation of Physical Surroundings	Gathering & Corroborating Evidence	Interview Techniques (Verbal)	Interview Techniques (Non-verbal)	Conducting Analyses	Inspection Team Brainstorming	Agency Management Debriefing	Writing the Report
Program/Project Managers Handbook (Boeing Commercial Airplanes)	Managers	5 days	Classroom	N/A	Lecture notes, case studies, worksheets	No	✓	★	o	✓	✓	o	✓	✓	✓	✓
Accident Investigation Manual (DOE)	MORT-trained DOE accident investigators & investigative boards	N/A	Manual	Type A & B accidents	Case studies, flowcharts, sample forms	Yes	✓	✓	✓	✓	✓	o	✓	o	✓	✓
Multi-Media Investigation Manual (Environmental Protection Agency)	Investigators who conduct multi-media compliance audits	N/A	Manual	Compliance	Not reported	Yes	✓	o	o	✓	✓	✓	o	✓	✓	✓
Basic Inspector Training Course, Fundamentals of Environmental Compliance Inspections (EPA)	EPA field inspectors	N/A	Classroom	Compliance & enforcement	Lecture, written exercises, role playing	Yes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fundamentals of Modern Safety Management (International Loss Control Institute, Inc.-ILCI)	Investigation team members, managers responsible for investigations, safety professionals	5 days	Classroom	Safety, accident	Case studies, worksheets, lecture notes, chapter summaries/key concepts, motivational ideas, scenarios/role playing	Yes	✓	o	✓	✓	✓	o	✓	o	✓	✓
Professional Accident Investigation (International Loss Control Institute, Inc.-ILCI)	Investigation team members, managers responsible for investigations, safety professionals	3 days	Classroom	Accident	Written exercises, case studies, role playing	Yes	✓	o	✓	✓	✓	✓	✓	o	o	✓

Table 2 (continued)

Description of Training							Observation Training Topics									
Training Program/ Manual (Course/Manual, Title & Source)	Target Audience	Course Length	Type of Training (e.g., classroom, OJT, etc.)	Types of Investigation (e.g., fraud, accident)	Training Techniques	Is Observation Training Included with Technical Training?	Inspection Planning	Inspection Team Formulation & Team Leadership	Visual Observation of Physical Surroundings	Gathering & Corroborating Evidence	Interview Techniques (Verbal)	Interview Techniques (Non-verbal)	Conducting Analyses	Inspection Team Brainstorming	Agency Management Debriefing	Writing the Report
Investigative Techniques in Complex Financial Crimes (National Institute on Economic Crime)	Financial investigators & prosecutors	N/A	Manual	Fraud	Examples, case studies	Yes	✓	O	✓	✓	✓	✓	✓	O	O	✓
MORT Accident/ Incident Investigation Workshop (Idaho National Engineering Laboratory-INEL)	Individuals conducting appraisals, inspections, audits, root cause analysis, & accident investigations	9 1/2 days	Classroom, laboratory	Accident	Case studies, paper simulations	No	✓	✓	O	✓	✓	O	✓	O	✓	✓
Accident/Incident Refresher Training (Idaho National Engineering Laboratory-INEL)	DOE-trained accident investigators	2 1/2 days	Classroom, laboratory	Accident	Laboratory exercises, paper simulations	Yes	O	✓	O	O	✓	O	✓	✓	✓	✓
Instructors' Guide for the Walk-through Examination (Nuclear Regulatory Commission)	NRC examiners for operator qualification & requalification exams	1 day	Classroom, videos	Inspection/ examination of nuclear power plant operators to verify they can perform job	Written exercises, role playing	Yes	O	O	O	O	✓	✓	O	O	O	O
Fitness-for-Duty RuleWorkbook for Preparation of Inspector Training (Nuclear Regulatory Commission)	NRC safeguards & securities inspectors	3 days	Classroom	Compliance with the NRC Fitness for Duty Rule	Lecture, case studies, field trips, role playing	Yes	✓	O	O	✓	✓	O	✓	O	✓	✓
Procedures for a Security Training & Qualification Program (Nuclear Regulatory Commission)	Nuclear security guards	N/A	OJT	Routine, day-to-day job activity	Not reported	Yes	O	O	✓	O	O	O	O	O	O	O

Table 2 (continued)

Description of Training							Observation Training Topics									
Training Program/ Manual (Course/Manual, Title & Source)	Target Audience	Course Length	Type of Training (e.g., classroom, OJT, etc.)	Types of Investigation (e.g., fraud, accident)	Training Techniques	Is Observation Training Included with Technical Training?	Inspection Planning	Inspection Team Formulation & Team Leadership	Visual Observation of Physical Surroundings	Gathering & Corroborating Evidence	Interview Techniques (Verbal)	Interview Techniques (Non-verbal)	Conducting Analyses	Inspection Team Brainstorming	Agency Management Debriefing	Writing the Report
Standards for Psychological Assessment of Nuclear Facility Personnel (Nuclear Regulatory Commission)	Personnel administrators	N/A	N/A	Pre-employment testing	Not reported	N/A	O	O	O	O	✓	✓	✓	O	O	O
Quality Systems Inspections (Swedish Nuclear Power Inspectorate-SKI)	Swedish Nuclear Power Inspectorate inspectors	3 days	Classroom	Compliance with quality regulations	Lecture, case studies, group exercises	Yes	★	O	✓	★	✓	O	★	O	O	✓
Private Investigation Training Manual (Universal Detectives)	People who want to make a career in the field of investigation	Self-paced	Self-taught	Fraud	Manual, self-paced tests, practical assignments	Yes	✓	O	✓	✓	✓	✓	O	O	O	✓
Annual Training Manual for Security Training: Protective Force (Westinghouse Electric Corporation)	Waste Isolation Pilot Plant security inspectors	270 hrs initial training, 168 hrs mandatory training, 232 hrs advanced training, 80 hrs firearms training	Classroom, OJT, field settings	Security surveillance	Lecture, demonstrations, simulated scenarios	Yes	O	O	✓	O	O	O	O	O	O	O
Assessment of Men (Murray & McKinnon)	Candidates applying to a government agency	Not directly applicable, but this was a 3 1/2 day assessment program	N/A	N/A	Role playing, assessment instruments	N/A	O	O	✓	O	✓	O	O	O	O	O

✓ = included
O = not included
★ = significant part of training

Inspection Planning

Of the 17 training programs and manuals examined in this survey, 11 provided training related to Inspection Planning. Training generally consists of (1) defining the investigation requirements and criteria (e.g., codes and standards, and regulations), (2) planning and preparing for accident response (e.g., emergency action, preservation of evidence, notification), (3) planning investigation activation (e.g., identify potential investigation team members who have the necessary capabilities, sufficient motivation, and sufficient objectivity and independence), (4) assembling materials (procedures and guides, hardware and software, and information packages), and (5) establishing procedures geared towards the needs of the organization and types and nature of the incidents that they are likely to investigate (DOE, 1985). Other training manuals for accident investigations also provide participants with flowcharts to demonstrate how the planning component contributes to other parts of the inspection/investigation (INEL, 1992a).

Accident investigation training programs offered by private companies also emphasize the need for inspection planning. For example, one training program provides descriptions and details for conducting a four-step preliminary planning process, including (1) establishing the objectives for investigation with upper management guidance, (2) developing guidance on the activities to include programming priority for steps in the investigation, (3) preparing a detailed course of action - scheduling and budgeting resources, and (4) develop the necessary procedures as tools to implement the selected courses of action (ICLI, 1992b).

Other training manuals indicate that "much of the total time spent on an investigation should be spent on planning and preparing for the investigation." Inspectors are instructed to review all relevant information, such as records, maps of the area, previous reports, and so on (EPA, 1992). In another EPA training course, inspection planning covers two areas: (1) pre-inspection planning and preparation, and (2) administration considerations for inspectors. The pre-inspection planning includes such topics as defining the inspection scope and objectives, reviewing Agency records, and preparing the inspection plan. Administrative

considerations relate to the policies and procedures involved in arranging travel and procuring equipment (EPA, 1991). In training manuals for private sector investigators, a continuous theme appearing throughout the training manual is on planning the investigation and then using the plan throughout the investigation (Patterson, 1978).

In inspecting financial crimes, training program materials instruct investigators to prepare for interviews, prepare documents, and schedule the interview (NIEC, 1989). Government agency inspector training programs also include inspection planning training components. For example, one program dedicates a portion of the training time to planning, including providing a check sheet to assist the inspector (e.g., notifying the appropriate persons in advance, obtain the necessary materials, and review documents prior to the inspection) (Moore, Hunt, Durbin, & Baker [NRC], 1990).

For quality systems inspections, a large portion of the training program emphasizes planning an inspection. For example, inspectors are provided with guidance in how to select information sources, how to plan the actual inspection, and guidance in reviewing documents and information prior to the inspection (Melber, Durbin, Blom, Hunt, Lach, & Forslund [SKI], 1993).

Team Formation/Team Leadership

This particular component was discussed in five of the 17 training programs reviewed. It is important to note that this component is closely linked with Inspection Planning (INEL, 1991, 1992). As demonstrated in the DOE *Accident Investigation Manual*, inspection planning consists of identifying team members who have the necessary capabilities, sufficient motivation, and sufficient independence and objectivity (DOE, 1985).

In one of the more generic training programs reviewed for this paper, *Program/Project Manager's Handbook*, the training program provides extensive guidance on procedures for

organizing an effort, selecting members for the team, developing a productive team, and sustaining effective teams (Boeing Commercial Airplane, 1990).

Other inspection programs also provide information about working together in teams. For example, included in one training program is a discussion of procedures for coordinating team efforts and delegating responsibilities in the inspection planning phase and guidance for effective communications skills for team building and ensuring effective team performance (EPA, 1991).

Visual Observation of Physical Surroundings

Ten of the training and assessment programs reviewed refer to procedures for training inspectors or investigators to be more observant or assess inspectors'/investigators' skills in this area. Programs that focus on training for acquisition of these skills emphasize the need to gather physical evidence related to an accident or incident, such as information about equipment, tools, materials, other hardware, plant facilities, and scattered debris (DOE, 1985). Courses for government inspectors also train participants to observe the physical surroundings and gather physical evidence. Participants are provided with training on drawing and interpreting maps and diagrams (EPA, 1991, 1992)

Training programs for accident/incident investigators provide participants with specific checklists of areas to investigate. In general terms, these include physical layout of the setting and controls set in place to avoid problems. This same program also includes a training component on "seeing" versus "observing," informal observation, planned observations, follow-up observations, and spot observations. This component also provides guidelines for observing (e.g., minimizing distractions, focus attention, stay out of the way), and for providing feedback about the observation, and recording observations (NRC, 1978; ILCI, 1992a).

In a similar training program provided by a private organization, investigators are provided with guidelines for enhancing their Knowledge Acquisition Skills by practicing daily observation of detail in a given situation and answering a list of questions about what he/she has observed (e.g., why doesn't this work better, how could this work better) (ILCI, 1992b). Another training program also emphasizes the need for observation and memory skills and provides guidance for practicing these skills (Patterson, 1978).

In other inspection training programs, observation techniques are described to participants (NRC, 1978). Training sometimes includes providing participants with specific guidance in taking notes and recording information from observations (Melber et al., 1993).

Finally, one government program offers assessment techniques to determine how well a participant can observe and recall information. Two examples of these assessment instruments are provided below.

> Map Memory Test: Provides a map of a given terrain. Participants are asked to study the map for eight minutes. After that they were asked to answer 30 questions about the features of the map. Although this is more of a test, it could be used as a training tool to first determine how well inspectors can observe and then train them on the various features to look for in a situation and to remember them.
>
> Movie Observation: This is a test of observing and reporting. Participants are shown two motion-picture sequences, each of which runs for 2 and 1/2 minutes. They are instructed to observe the situation and features closely because they will be asked to evaluate written information about the situation after the film. Following the film, participants are provided with written statements describing observations from the film. Participants are asked to identify whether or not the statements are true (Murray & McKinnon, 1948).

Gathering and Corroborating Evidence

This training component focuses on two activities performed in most investigations and inspections - gathering information and determining if substantiating information is

required and how it is obtained. Eleven of the 17 programs reviewed provides guidance or training in this area.

Training activities for inspectors include (1) procedures for taking physical samples (e.g., water samples), (2) managing the samples, and (3) taking photographs. Obtaining corroborating evidence for some inspectors involves verifying the authenticity of photographs, especially during the development process (EPA, 1991).

Other inspection training practices focus on collecting information from company records (e.g., written policies and formal systems), reviewing other documents, summarizing information obtained from interviews, observing work practices and meetings, and attending formal presentations presented by company staff. Inspectors are presented with guidance for comparing information from different sources (Boeing Commercial Airplane, 1990; Melber et al., 1993). Other inspection programs include guidance for conducting internal audits and evaluating reports, and assessing an organization's formal policies and procedures for implementing these policies (Moore et al., 1990).

For accident investigations, training includes preparing and interpreting diagrams, maps, and sketches of the location in question. Participants are also encouraged to examine a variety of company records during the investigation (e.g., equipment and materials purchasing) (ILCI, 1992a,b). Another accident investigation program provides training on procedures for collecting testimonial evidence and physical evidence. This training also discusses issues related to the loss and distortion of evidence and provides participants with guidelines for validating and cross-checking information (INEL, 1992). A similar program provides participants with training in (1) using a field protocol to collect physical evidence, (2) preservation of physical evidence, (3) analysis of physical samples, and (4) use of diagrams and sketches (DOE, 1985).

Other investigation training programs, describe the different types of evidence one can collect (verbal - on tape or on paper, film, records, and documents), describe the types of

evidence - direct, indirect, and hearsay, and demonstrate how information from one source can be confirmed with information from another source (Patterson, 1978; NIEC, 1989).

Interview Techniques (verbal)

Fifteen of the 17 training programs reviewed provide guidance for conducting interviews. The definition of interview techniques (verbal) includes conducting both formal interviews with structured interview protocols and conducting informal interviews that may include brief discussions.

Training for inspectors usually includes providing brief instructions for conducting interviews. Sample interview protocols are provided and participants practice modifying these protocols to meet their specific interview needs (Melber et al., 1993). Another inspector training program provides participants with training on interview techniques; course topics include (1) planning and conducting interviews, (2) questioning techniques, (3) conducting and documenting the interview, and (4) creating a productive interview atmosphere (Moore et al., 1990; EPA, 1991).

Another program provides participants with a description of a communication model for asking questions, taking notes, and interpreting these notes at a later time. Training includes (1) potential points of communication breakdown, (2) effective questioning techniques and styles, (3) styles of questioning, (4) effective listening techniques (practiced is provided via a video-tape exercise), (5) efficient and accurate note taking, and (6) proper demeanor. This training program also provides training for dealing with a negative or argumentative person (NRC, 1989).

Accident investigator training provides participants guidance in conducting interviews. For example, one program includes topics, such as (1) finding the witness to interview, (2) controlling distortion of testimony, (3) influence of the interviewer's personality, (4) the interview process, (5) establishing communication with the witness, (6) evaluating the

witness' testimony, and (7) conducting follow-on interviews (ILCI, 1991, 1992). Another accident investigation training program includes interview topics, such as (1) identifying the characteristics of an effective interviewer, (2) identifying where to conduct the interviews, (3) documenting the interview, (4) preparing for the interview, (5) behaviors the interviewer should employ, (6) interviewing methods, (7) conducting the interview, and (8) do's an don'ts of the interviewing process (INEL, 1991; EPA, 1992).

Other investigator training programs provide (1) training on interviewing different types of persons (e.g., helpful and uncooperative), (2) a chart of verbal indicators of deception, and (3) techniques for being assertive and persistent during the interviews (Patterson, 1978; NIEC, 1989).

Finally, two programs provide assessment tools to evaluate a participant's interviewing skills (Murray & McKinnon, 1948; Frank, Lindley, & Cohen, 1981). In one program, the participant is given the opportunity to interview someone who appears to have useful information about a given subject. The person being interviewed has well-rehearsed answers to questions and generally volunteers no additional information. On one or two occasions, the interviewee drops hints of important information to assess the alertness of the interviewer. Following the interview, the interviewer is asked to write a report of his/her findings. The participant is scored on skills in developing rapport, asking productive questions, and following-up on hints and leads (Murray & McKinnon, 1948).

Interview Techniques (Non-Verbal)

A much smaller number of training programs provide information concerning non-verbal interviewing techniques (7 of 17). In general, training programs focus on one of two issues related to interviewing techniques. The first involves the inspector's demeanor and behavior during an interview and ways to create a useful environment. The second type of non-verbal technique involves interpreting the body language of the person being interviewed.

For one inspection training program, participants are instructed to pay attention to creating a productive interview atmosphere and attending to non-verbal communication cues (EPA, 1991). Two other training programs provide participants with a chart of non-verbal indicators of deception (NIEC, 1989; NRC, 1989).

Accident investigation training provides descriptions of non-verbal communications and a list of cues that an interviewer might notice to interpret the information gained from the interview (ILCI, 1992b). In another training manual, participants are given key principles for non-verbal communication for their own behavior (e.g., shake hands, maintain eye contact, etc.) (EPA, 1992). In another program, participants are encouraged to be aware of their own body language and the need for memory and observation skills to assess the demeanor of the person being interviewed (Patterson, 1978).

Conducting Analyses

Nine of the 17 training programs reviewed include guidance for conducting analyses. For some programs a very specific analytical approach is used, whereas for others, participants are given general guidance on procedures for planning and conducting analyses.

For one program, the recommended approach to analyzing information is to conduct analyses as information is collected; this process is directly linked with gathering information (EPA, 1991). For another program, a large part of the training focused on analyzing information. The type of analysis emphasized in this training program focuses on qualitative rather than quantitative data (Melber et al., 1993). A third program discusses the nature of sampling data to ensure that it is a random procedure (Moore et al., 1990). A fourth program provides participants with guidance in organizing and analyzing evidence using filing systems, index systems, chronologies, charting techniques, and summaries from interviews (NIEC, 1989).

Accident investigative training programs, as a rule, train participants to use a particular set of data analytic procedures. For example, the primary focus of most of the accident investigation training programs is to identify the cause of the accident. Therefore, root cause analyses are often recommended and described in detail (DOE, 1985; INEL, 1991, 1992; ILCI, 1992a,b)

Inspection Team Brainstorming

This component was designed to include skills that involve working together as a team and routinely evaluating the data at hand to determine reasons for the current situation and procedures for obtaining additional data, if needed. Four of the 17 training programs provide some guidance for participants working together as a team.

Two of the programs provide guidance for establishing and maintaining effective communication among team members during the investigation (EPA, 1991; ILCI, 1992a). Another program provides guidelines for the team leader to maintain communication with appropriate personnel (team members and others directing the inspection) (EPA, 1992). A final program provides the team leaders with guidance in conducting team-problem solving activities (these may be problems internal and external to the team), developing a productive team, and sustaining effective teams (Boeing Commercial Airplane, 1990).

Agency/Management Debriefing

Eight of the training programs reviewed contained guidance on providing briefings to management based on findings from the investigation or inspection. Accident investigation training programs generally provide guidance to participants indicating that the team leader is responsible for providing a clear and concise summary of the investigation, findings, and action plans to management (ILCI, 1992a). Other programs provide participants with specific details about the content of a briefing/debriefing to management (DOE, 1985). In a third

accident investigation training program, participants are given guidance on preparing a briefing and then are asked to deliver it to other program participants (INEL. 1991).

Inspector training programs also provide detailed information on constructing and delivering a briefing. For example, one program provides guidance on responding to questions and dealing with public relations and the press (EPA, 1991).

Other programs provide guidance for communicating the progress of an investigation, focus on gathering evidence to prepare a legal briefing, and provide information on reporting findings (NIEC, 1989; Boeing Commercial Airplane, 1990; Moore et al., 1990).

Written Report of Observations and Investigations

Twelve of the 17 training programs provide some type of guidance in preparing a written report. In accident investigator training, participants are provided with a report outline to follow in generating a report including (1) report factors, (2) analyses conducted, (3) conclusions drawn, (4) recommendations based on fact, and (5) quality assessment of a written report (EPA, 1992; ILCI, 1992a; INEL, 1992). Other accident programs provide guidance on writing remedial action plans following an investigation and provide examples of well-written reports (DOE, 1985; INEL, 1991; ILCI, 1992b).

Inspection training programs also provide detailed information about preparing written reports. For example, one program provides guidance on how to write a report, elements included in the report, guidance for writing conclusions, suggestions for effective writing, and a report evaluation guide (EPA, 1991). Other programs provide report writing guidance in terms of suggestions for what information is included in the report, organizing the information included in the report, and preparing a variety of reports (factual, chronological, narrative) (Patterson, 1978; NIEC, 1989; Boeing Commercial Airplane, 1990; Moore et al., 1990). In another program, participants are given worksheets to help them move from evidence notes to analysis to a summary of the findings. Participants are instructed on procedures for reporting

problems in a given system and for supporting their analyses and conclusions (Melber et al., 1993).

3.3 SUMMARY DESCRIPTIONS OF TRAINING REQUIREMENTS FOR IAEA INSPECTORS TO ENHANCE KNOWLEDGE ACQUISITION SKILLS

Information and results presented in Chapters 2 and 3 are summarized in Table 3. This table provides a summary of the enhanced inspection practices. The first column, Inspection Practices, lists the practices for conducting safeguard inspections discussed in Section 2.2. The second column, Recommended Skills Training, identifies the types of skills likely to be required for effective implementation of the associated practice. Skills appearing in this column are obtained from the skills list developed in Section 2.3. Finally, the third column, Sources for Training Content, identifies the training program that may be used to guide training development for IAEA inspectors (programs reviewed in the previous section).

In general terms, it is clear that the training programs reviewed in this paper can be used to provide guidance in developing training for each of the ten Knowledge Acquisition Skills components defined in this paper. However, in most cases the skills imparted in these training programs are very closely intertwined with the subject matter domain of the organization (e.g., nature of the inspection or investigation). Therefore, the approaches of these programs will likely require significant adaptation to support the specific job requirements, policies, and practices that define the IAEA inspector job. That is, it is possible to draw upon other training programs to develop a general structure for training IAEA inspectors, but this information is insufficient for a comprehensive training program for IAEA inspectors.

It is also important to note that most of the training programs cited in this paper were developed and conducted in the United States (the exception is one program developed in the U.S., but conducted in Sweden for the Swedish Nuclear Inspectorate). For IAEA purposes, training must be designed for participants from a variety of countries and cultures. It is also

recognized that cultural and language differences between inspectors and facility representatives can influence inspection outcomes. Therefore, cultural and language issues must be considered in the development of training modules for IAEA inspectors.

Table 3. Practices, Recommended Skills Training, and Sources for Training Content for Enhanced Inspection Capability

Inspection Practices	Recommended Skills Training	Sources for Training Content
Pre-inspection review of facility-specific information	Inspection Planning	Accident Investigations, DOE
Pre-inspection review and analysis of information on the State's nuclear activities	Inspection Planning Conduct Analyses	Investigations Techniques in Complex Financial Crimes, NIEC
Pre-inspection generation and analysis of diversion/concealment scenarios	Conduct Analyses	Quality Inspections Systems, SKI
Pre-inspection team formation	Team Formation/Team Leadership	Program/Project Manager's Handbook, Boeing
Pre-inspection development of an inspection strategy	Inspection Planning	Basic Inspection Training, EPA Multi-Media Investigation Manual, EPA
Attentiveness to physical conditions which may be indicative of undeclared activities or facilities	Visual Observation of Physical Surroundings Gathering and Corroborating Evidence	Basic Inspector Training, EPA Fundamentals of Modern Safety Management, EPA
Attentiveness to demeanors and behaviors that may be indicative of concealment	Interview Techniques (non-verbal)	Investigative Techniques in Complex Financial Crimes, NIEC
Attentiveness to volunteered information which may be indicative of undeclared facilities or activities	Interview Techniques (verbal) Gathering and Corroborating Evidence	Instructor's Guide for a Walkthrough Examination, NRC Accident/Incident Investigation Workshop, INEL
Clarification of declarations	Interview Techniques (verbal and non-verbal)	Professional Accident Investigation, ILCI

Table 3 (continued)

Inspection Practices	Recommended Skills Training	Sources for Training Content
Resolution of apparent anomalies and discrepancies	Interview Techniques (verbal and non-verbal) Gathering and Corroborating Evidence	Fundamentals of Modern Safety Management, ILCI Basic Inspector Training, EPA
Assertiveness in obtaining access to equipment and areas	Interview Techniques (verbal and non-verbal)	Investigation Techniques in Complex Financial Crimes, NIEC
Inspector judgment in evaluating inspection results	Conduct Analyses Inspection Team Brainstorming	MORT Accident/Incident Investigation Workshop, INEL Basic Inspector Course, EPA
Documentation of suspicious physical conditions, behaviors, demeanor, and volunteered information	Conduct Analyses Written Report of Observations and Investigation	Quality Systems Inspections, SKI

4. SUMMARY AND CONCLUSIONS

This concept paper has explored the potential contribution of "Knowledge Acquisition Skills" in enhancing the effectiveness of international safeguards inspections by the IAEA and identified types of training that could be provided to develop or enhance such skills. For purposes of this concept paper, Knowledge Acquisition Skills were defined broadly to include all appropriate techniques that IAEA safeguards inspectors can use to acquire and analyze information relevant to the performance of successful safeguards inspections. These techniques include a range of cognitive, analytic, judgmental, interpersonal, or communications skills that have the potential to help IAEA safeguards inspectors function more effectively.

The need for Knowledge Acquisition Skills stems from new challenges to the safeguards system such as that posed by the potential for undeclared nuclear activities in States with a comprehensive safeguards agreement. To meet these challenges, inspection practices directed at the acquisition and analysis of relevant information will require particular emphasis. These practices include :

- Pre-inspection review of facility-specific information
- Pre-inspection review and analysis of information on the State's nuclear activities
- Pre-inspection generation and analysis of diversion/concealment scenarios
- Pre-inspection team formation
- Pre-inspection development of an inspection strategy
- Attentiveness to physical conditions which may be indicative of undeclared activities or facilities
- Attentiveness to demeanors and behaviors that may be indicative of concealment
- Attentiveness to volunteered information which may be indicative of undeclared facilities or activities
- Clarification of declarations

- Resolution of apparent anomalies and discrepancies
- Assertiveness in obtaining access to equipment and areas
- Inspector judgment in evaluating results of inspection
- Documentation of suspicious physical conditions, behaviors, demeanors, and volunteered information
- Debriefing of inspectors

If inspectors are to perform effectively in these types of tasks, they will increasingly need to refine their Knowledge Acquisition Skills. Further development of Knowledge Acquisition Skills can also enhance the Agency's inspection process generally.

Knowledge Acquisition Skills include 10 components addressing the performance of virtually all activities involved in planning and conducting an inspection, collecting, analyzing, and evaluating information, and describing the results in a clear and concise manner (in either written or oral form). A variety of inspection training programs in both the public and private sector provide training in one or more of these components. However, in most cases the skills imparted in these training programs are very closely intertwined with the subject matter domain of the organization. Similarly, in their application to IAEA inspections, Knowledge Acquisition Skills must be employed in tandem with technical safeguards skills and knowledge of the particular types of facilities being inspected. Further, cultural and language issues also play a role in the conduct of IAEA inspections. As a result, the approaches of other training programs alone are not a complete basis for developing a comprehensive training program for Agency inspectors. While it should be possible to draw upon these other training programs to develop a general structure for providing Knowledge Acquisition Skills training to IAEA inspectors, the approaches in these programs will likely require significant adaptation to support the specific job requirements, policies, and practices that define the IAEA inspector's job. The design and delivery of such training is likely to be best accomplished in close coordination with complementary technical and facility-specific training.

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