Improved Information Analysis - Views and Actions

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IMPROVED INFORMATION ANALYSIS -- VIEWS AND ACTIONS

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Abstract
The IAEA continues to assess, develop, and test recommendations for strengthening the cost effectiveness of safeguards. The IAEA's investigation has focused on ways to increase Agency access to data, including access to sites and site data, export/import data, environmental data, open-source data, and other expanded data sources. Although the acquisition of this raw data is essential to strengthening safeguards, the effectiveness of the system is going to be judged by what the Agency does with the data once they have acquired it. Therefore, the IAEA must have the capability to organize, analyze and present the data in a timely manner for internal management evaluation and external dissemination.

The United States Department of Energy has established a Safeguards Information Management Systems (SIMS) Initiative to provide support and equipment which will improve the IAEA's capability to utilize this expanded data to analyze State's nuclear activities. This paper will present views on steps to improve information analysis and discuss the status of actions undertaken by the SIMS initiative.

Introduction
Safeguards Information Management Systems (SIMS) is an ongoing initiative organized by the Department of Energy in support of IAEA safeguards data integration needs.1 Our goal is to assist the Agency with the identification and adoption of innovative approaches for information manipulation in support of safeguards analysis. Four national labs cooperate to carry out the SIMS's mission: Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Pacific Northwest Laboratory, and Sandia National Laboratory. We work with the divisions of the IAEA Safeguards Department and the Action Team to improve safeguards effectiveness by enabling the integration of greater amounts of more diverse information in the safeguards evaluation process. SIMS tools manage information from sources including country declarations, IAEA generated information, and outside sources (including open sources). These data have different forms that create difficulties in their integration in computer based systems. The SIMS initiative provides support to address these areas and addresses the challenges associated with the management of ever increasing amounts of data.

Data Sources
The information used for safeguards evaluation and the detection of undeclared activities can be viewed as originating from three significant "sources". Countries and facilities provide information on their declared nuclear programs. This includes design data and declarations regarding facilities, inventories and exports/imports. The IAEA independently collects its own data on inspections of facilities, this is primarily verification of facility material accounting data, but is being expanded to include chemical and isotopic analyses of samples collected in and around facilities. Additional information is available from outside sources. Industry publications, news gathering organizations and other countries all provide information that bears on country's nuclear programs. These three data sources each have varying degrees of accuracy and different pressures effecting their availability and bias. These features need to be tracked for all data. In addition each source may provide information items in many different physical forms.

Data Forms
Different physical media and basic types of information add to the difficulties associated with integrating data sources in automated systems. Information is provided
on paper, as computer files, as communication streams and structured records within databases. The content of these various physical forms represents a large variety of information types: text, maps, photos, charts, diagrams and lists all need to be accessible for analysis and evaluation by IAEA staff. The evaluation/analysis process can begin when the information from the three sources with its many forms becomes available to analysts.

Analysis Process
The analytic process proceeds by breaking a large problem into smaller elements. These subunits are studied systematically to evaluate the larger concern and the evaluation of the subunits is integrated to reach a conclusion relating to the greater problem. The Agency’s current organizational structure represents this division of the safeguards evaluation process into sub-problems. The culmination of an analysis effort requires that the results of the subdivided evaluations be integrated in support of the evaluation process.

The IAEA is asked to provide a statement as to the absence of undeclared activities in NPT signatory nations. To attempt to provide this negative assurance it is necessary to evaluate the complete body of evidence related to a state’s nuclear program with the hypothesis that the state is engaging in undeclared activities and work to disprove this hypothesis. This is an iterative procedure in which the hypothesis guides the analyst in the search for information that either supports or counters the premise.

Monitoring, the gathering of additional information over time, is guided by this analysis/hypothesis process. Information systems are used to organize data gathered in monitoring inspections and support tools to analyze and compare inspection data for detecting trends and identifying anomalous information.

In some cases when data is unavailable, it is necessary to utilize a model with known or supposed input conditions to extrapolate possible situations and carry the analysis/hypothesis endeavor forward. The supposed conditions and model output are tracked in information management systems.

Most phases of this analysis/case building process require tools for the storage and integration of the IAEA’s gathered data in its many forms. Over time, SIMS has provided a number of tools to address these analysis support needs. The existing tools although each a standalone element are able to exchange data and are hoped to operate as an extended “suite” of tools to support an analysis process operating across the Agency’s safeguards divisions.

Integration Tools
The SIMS effort is guided by a process of user needs evaluation which produced an itemization and prioritization of needs for both the Action Team and the Safeguards department. Since Board decisions and Agency policy changes impact safeguards needs and priorities the evaluation of user needs is an ongoing dynamic process that is not strictly driven by any static document but generally guided by our comprehensive evaluation undertaken in 1994.

With the support and involvement of the IAEA the SIMS initiative has provided and supported a number of information management tools since the initiative began in the spring of 1993.

International Nuclear Safeguards Inspection Support Tool -- INSIST
INSIST is a tool delivered to the Agency in 1993 to geographically store, retrieve and organize inspection data. The INSIST system is used by the Action Team with declarations (from the Iraqi government), inspection data (reports and photos from IAEA inspectors), and background information (maps, documents and open source text) to support Iraq inspection planning and review.

Action Team Database -- OMVSUM
A structured database running on a LAN system has been developed and is undergoing constant improvement to support the Action Team’s need to track Iraqi declarations and data gathered on inspection visits to Iraqi facilities for ongoing monitoring and verification. This system is implemented using commercial software which has allowed the Action Team to quickly grasp the structure and adapt it as necessary to meet changing requirements. The use of commercial software and standard hardware platforms has allowed the straightforward migration of this application to a portable system in the field for inspection support.

Field Portable Unit
A notebook computer based system for storage and annotation of facility plans and inspection documentation is being used by the Action Team in Iraq. This general purpose computer system is also used in the field for retrievals against the OMVSUM
database. Having immediate access to plans, declaration data and prior inspection data in the field is the primary purpose of this system.

Watson
Watson is an information analyst's system for storage, searching and correlation of text, geographic and image information. Watson is built largely from publicly available software and supports a general network retrieval/data storage model. Watson has been undergoing testing by the operation divisions with support of the safeguards Information Treatment division. The trial at the IAEA has so far involved considerable scanning and OCR of source documents for storage in the Watson system. The field trial will be completed shortly and be followed by full deployment if successful.

Open Source Solutions
Open source data presents a serious challenge. The vast amount of material available requires computer based tools and access methods to manage. SIMS has worked with the Agency in this area by providing reports on approaches to open source acquisition and management. With guidance and initial software systems from the SIMS, the Agency has acquired the Topic textual management, indexing and retrieval system to provide access to a developing collection of documents screened and reviewed by the Information Treatment division.

Future Efforts
Combined collections of information will be presented through a single interface by networked systems with interfaces similar to the Watson and OMVSUM systems. We are also exploring Pathfinder, an existing system supported by the U.S. National Ground Intelligence Center. The Pathfinder system is a suite of tools in use by many organizations to review, process and analyze textual data items. It provides a number of innovative graphical methods to view the relationships between textual data elements.

Summary
The SIMS initiative is moving forward with providing loosely coupled tools that smoothly exchange data but are tailored for specific tasks within the IAEA. This broad "suite" of tools will complement specific skills of members of the IAEA analysis team.

Acknowledgment
The SIMS initiative is a DOE coordinated multilab effort with participation from Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Pacific Northwest Laboratory, and Sandia National Laboratory. The dedication and expertise of the individuals at the national labs and the IAEA make this effort successful.

References