Computer-Based Safeguards Information and Accounting System

Acquiring, processing and analysing information about inventories and flow of nuclear materials are essential parts of IAEA safeguards. Safeguards information originates from several sources. The information to be provided is specified in the various safeguards agreements between the States and the IAEA, including both NPT agreements and safeguards trilateral agreements.

Most of the safeguards information currently received by the IAEA is contained in accounting reports from the States party to the NPT. Within the frame of the material balance concept of NPT, three types of reports are provided to the IAEA by the States: Physical Inventory Listings (PIL); Inventory Change Reports (ICR); Material Balance Reports (MBR).

In addition, facility design information is reported when NPT safeguards are applied and whenever there is a change in the facility or its operation. Based on this data, an accounting system is used to make available such information as the book inventories of nuclear material as a function of time, material balance evaluations, and analysis of shipments versus receipts of nuclear material.

A second source of NPT safeguards information is the inspection activities carried out in the field as a necessary counterpart for verification of the data presented by the States in their accounting reports. The processing of inspection reports and other inspection data is carried out by the present system in a provisional manner until a new system, which is under development is available. The major effort currently is directed not to computer processing but toward developing and applying uniform inspection procedures and information requirements.

A third source of NPT safeguards information is advanced notifications and notifications of transfer of source materials before the starting point of safeguards. Since, however, the States are not completely aware of the need and requirement to provide these data, this is a point to be emphasized in future workshops and seminars for States' personnel.

For the safeguards trilateral agreements under INFCIRC/66 [1], the Agency operates a semi-automated system to handle data arising from the joint notification, inventory reports and advance notifications. Although a considerable amount of nuclear material is safeguarded under these agreements, the reporting of information is less standardized and less timely than under NPT agreements. The Department of Safeguards is working with Member States toward the use of a new subsidiary arrangement model containing more standardized reporting procedures. The IAEA is also sponsoring workshops and seminars to train the States' personnel in reporting procedures and to explain and correct existing problems of reporting.

THE INFORMATION SYSTEM

The amount and complexity of safeguards information now being reviewed by the Agency makes manual processing and manual accounting of information impossible. Therefore, it has been necessary for the Department of Safeguards to devote considerable effort to develop an automatic data processing capability. The Agency has evolved computer programmes and operating procedures to handle the current influx averaging about 150–200 reports per month, containing about 3000 separate records. As of 1 August 1977, the total number of accounting reports received and processed by the IAEA safeguards information system exceeded 6000, containing over 150,000 separate records. The influx is steadily increasing and in the next three years it is expected to grow to four to five times the current volume. An especially big increase is connected with reporting under NPT agreements by Japan and Euratom. Reporting by the USA under terms of the USA/IAEA agreement will also considerably increase the inflow of data. The length of the processing cycle within the IAEA is at present two to five working days, and no backlog of processing has been encountered recently. The inspectors can choose between some 30 types of routine print-outs and a large number of special queries according to their individual needs.

Training seminars or workshops are sponsored by the Department of Safeguards once a year for personnel responsible for preparing safeguards accounting reports from the States to IAEA. The purpose of these meetings is to aquaint personnel from these States with the IAEA safeguards information system and to discuss specific input requirements, output characteristics and standardization required to render the system efficient and as error-free as possible. Experts from many countries have actively participated in such seminars held in December 1975, December 1976 and September 1977.

Special attention in developing and in operating the IAEA safeguards information system is directed to assuring security and privacy of data reported by the States and that arising from inspection activities. The system itself is designed in such a way as to fulfil this requirement, and access to the system is restricted to authorized persons with valid and changing access codes. Besides these built-in features, the usual procedures for treatment of confidential data, as established by the Department of Safeguards, are fully applied and carefully followed.

INFORMATION SYSTEM DEVELOPMENT

The anticipated rapid growth in the volume of safeguards data, the expansion of the scope of data processing to cover a wider variety of types and sources of data, the growing needs for more complex analysis, and the evolution of international awareness of the importance of safeguards information has necessitated a continuing review of the long-range needs of the IAEA for processing safeguards information. Factors involved in this review include:

1. The volume of accounting data expected on the basis of anticipated growth in all parts of the nuclear fuel cycle under IAEA safeguards (in the order of 200,000 records per year by 1980);

2. The volume of data which should be expected as a result of IAEA inspection activities;

3. The individual data elements and their characteristics;

4. The computer hardware capacity and software characteristics required to process and evaluate the resulting information. (It has been apparent that the anticipated growth in volume and complexity of safeguards data processing required expansion of IAEA computer capacity);

5. The information needs of inspectors, of safeguards staff responsible for evaluation of effectiveness of safeguards, and of management.

Provision must be made not only for growth but also for adaptability to technical changes and for changing needs for information and analysis. On this basis, an enhanced version of the IAEA safeguards information system is being developed to meet the needs of the 1980's.

The computerized part of the information system under development consists of four main sections: data base system, input processor, post-load processor, and report processor.

The major parts of the data base system are:

1. The **data base** itself, consisting of all data arising from official reports of States to the IAEA, design data for all facilities, data of many types gathered through the IAEA inspection efforts, and information generated through internal IAEA safeguards functions;

2. The **data base management system** (ADABAS), a specialized software system providing all the necessary functions for efficiently maintaining the data files and providing controlled access to the data for use in analysis and reports;

3. The **data base co-ordinator** function – a small group of specialists headed by the data base co-ordinator for safeguards, responsible for all aspects of maintenance of the data base and the data base management system – including providing for the integrity and security of the data for both normal and abnormal operating conditions.

The input processor section of the information system must provide for all functions of transforming data from the various forms and formats in which it reaches the computerized part of the system into a standard form for loading into the data base. Data is expected to arrive, in the future, on a variety of carriers including hard copy, punched cards, paper tape and magnetic tape. The information system is designed in a modular fashion so that new structures and forms of data can be accommodated with minimum effort.

The post-load processor section of the information system is comprised of modules for performing operations on the data after it is loaded into the data base. Essentially all data is initially stored in the data base as reported – even if it contains syntactical or logical errors. The functions of error analysis, correction processing, and maintenance of a historical trace of errors and corrections is a major function of this part of the system. It also includes such routine operations as dimensional units conversion and conversion of numbers from character representation into binary numbers for use internally by the computer.

The report processor includes the modules which produce summaries or detailed reports for use by the safeguards staff. Some modules consist of operations for selecting, sorting, and printing summaries of data elements from the data base as specified by users of the data. Other modules carry out operations on specified sets of data to derive results for use in evaluation of various aspects of safeguards functions.

The future development effort will involve extending the information system in a modular fashion to incorporate the growing needs for processing, storing and analysing safeguards data.

ORGANIZATION

The growth of safeguards information has required the Department of Safeguards to devote a growing effort to handle it. In 1977 the Division of Safeguards Information Treatment was created within the Department of Safeguards. This division is responsible for the handling of all safeguards data, including input, analysis, storage and output. In accordance with its main functions, the division consists of three sections:

Data Processing Operations Section with responsiblity for actual processing of all relevant safeguards data (e.g. design information, accounting reports, inspection reports, inspection working papers, results of sample analysis, etc.). This section also makes data from the data base available to the inspectors and other users and makes the necessary analysis of correctness of input and output data.

Data Processing Development Section is designing the advanced safeguards information system, including software for input modules, data base and application programmes.

Data Evaluation Services Section has as its principal functions:

(a) the evaluation of data quality, trends in safeguards indicators such as book inventories, shipper/receiver differences, MUF, etc.;

(b) provision of assistance to inspectors in the preparation of the detailed conduct of specific inspections (e.g. preparation of sampling plans, etc.);

(c) provision of assistance to inspectors in the preparation of inspection reports and in evaluating the results of inspections; and

(d) performance of correlation and cross-checks on data and of statistical analysis.

Through the organization and activities described above, the Department of Safeguards is effectively using information and data from many sources as an essential aid in meeting the obligations of the IAEA for applying international safeguards, both currently and in anticipation of the needs of the 1980's.

Reference

[1] INFCIRC/66 "The Agency's Safeguards System", IAEA, September 1968.