Transport Activity in Canada: 1992

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INTRODUCTION

For regulators of nuclear transport, it is more important than ever before that regulatory programs have a sound planning basis. In times of mounting deficits, safety programs are subjected to rigorous cost-benefit examination. These pressures are combined with the rising expectations of the public for assurances of perfect safety and zero risk.

The practical foundation for the justification of a transport safety program is a useful description of the transport activity. To know the number and type of packages and shipments, the volume in the different modes of transport and the distances that the material is transported can be critical information for the regulatory authority.

Some significant efforts have been made to provide international transport data. In both 1980 and 1989, the International Atomic Energy Agency (IAEA) requested that surveys be conducted in member states and that the results be reported and assembled for public use. The data would be used to:

- serve as a regulatory aid to national competent authorities;
- foster the exchange of information among member states as well as international organizations;
- support the continuous review of the IAEA regulations; and
- assist in answering public concern.

Of particular interest to the IAEA is that analysis of the activity data together with events data would complete the basis for assessing the radiological impact of transporting radioactive material[1].

The IAEA found, however, that the collection of shipment activity data from member states is sometimes very difficult. There are several good reasons for this. The most important reason seems to be that the timing and required resources for the surveys are difficult to coordinate with the national priorities of all member states. Some members states may also be concerned about the way that the information may affect a competitive commercial advantage. The IAEA is attempting to resolve these and other issues with the member states.

In this context, the efforts of the Atomic Energy Control Board of Canada, to survey transport activity are discussed. A short historical overview, the methods used and the benefits and lessons learned are described. In the Canadian experience, the benefits of a national survey can justify the overall costs.

CANADA'S NUCLEAR INDUSTRY: EARLY TRANSPORT ACTIVITY

Canada is one of the world's leading producers, users and exporters of uranium fuel cycle products and radioisotopes for medical, industrial and research purposes. Large quantities of radioactive materials are transported long distances by all modes of transport including underground pipelines. Consequently, it is important for a regulator like Canada's Atomic Energy Control Board (AECB) to have a very good understanding of the complexity of radioactive material transport to properly regulate, to allocate resources and to establish a basis for emergency response planning.

In the past, several surveys of transport activity have been undertaken[2 3 4 5 6 7 8]. These surveys have historical interest and help to frame the situation today.

In 1948, the number of shipments for medical products and instrument use totalled only 20. At the time of the Cold War, information on the transport of uranium products was considered a matter of high security. Public data for these shipments are available in terms of tonnages.

By the 1950s and 1960s, the number of package shipments started to increase substantially. Although the available data covers only shipments of medical products and some instruments, there were 1,350 shipments in 1955, 8,220 in 1965, 33,350 in 1970 and 54,750 in 1975.

The first comprehensive survey in Canada happened in 1977. At that time, information was collected on all types of materials. Figure 1 shows that about 440,000 packages were transported in Canada in that year.

THE 1981 SURVEY

In 1980, the IAEA initiated a program to gather global statistics on transport activity. The IAEA requested that member states provide information on the number of shipments and packages, the modes of transport and the distances involved. This was a very significant initiative and the results were quite useful.

FIGURE 1: Canadian Transport Activity in 1977

Type of Radioactive Material	Package Total
Medical Products	84,800
Instruments and Devices	351,900
Industrial	3,040
TOTAL	**439,740**

Over 20 major transporting states responded. Of the totals for the reporting countries, some 99% of all transport activity occurred among 16 nations. As shown in Figure 2, Canada was identified as the second largest transporter of radioactive material with some 613,000 packages shipped[9]. That figure was further enhanced with supporting statistics on mode of transport, types of packages and distances travelled.

There are limitations to these data. It does not include excepted packages. In Canada, this represents some 3.7 million additional shipped packages. Canadian national data was also not broken down or categorized in ways that could be linked to other data bases. Nevertheless, the AECB has used this statistic as well as the supporting data for several regulatory initiatives and in much educational and explanatory material. The 1981 data have proven to be an important point of reference.

In 1989, the IAEA made another request for information on transport activity[10]. The timing was not right for the AECB. There were other priorities and resources were limited. Beyond an extrapolation from the 1981 data, it was not possible to provide new information.

FIGURE 2: 1981 Summary Survey of Largest Shippers of Radioactive Materials Excluding Excepted Packages

Country	Number of Packages Consigned
United States of America	2,402,429
Canada	612,632
Japan	353,054
United Kingdom	242,268
Italy	205,679
Federal Republic of Germany[excludes German Democratic Republic]	155,408
France	99,617
Belgium	78,422
Spain	49,425
Australia	45,208
Poland	32,171
Sweden	21,751
Hungary	18,423
Finland	17,753
Norway	16,604
South Africa	11,418

THE 1992 SURVEY

The AECB decided to begin a new survey in 1992 to cover shipment activity for the 1992 year. The purpose was to update the information from 1981 and to provide data to the IAEA. In setting up the 1992 survey project, the files for the 1981 survey were reviewed to glean the lessons learned. The single most important point was that

the industry in Canada did not form a single sampling base. In 1981, a stratified sampling approach had been taken. However, due to regional fluctuations in industrial activity during the survey period, the concentration of certain industries in various regions and the great disparity of size within an industrial activity, even stratified sampling had serious limits. Awareness of the 1981 experience, helped to set the approaches in 1992.

The Survey

Consequently, AECB conducted the survey in a manner that was tailored to the industry and closely involved the licensing officers for the use group.

The AECB licenses companies on the basis of the authorized use. Licensed activities are divided into about 75 authorized uses including power reactors, laboratories, industrial gauging and various medical uses. Some 2,600 licensees hold over 3,900 individual use licenses.

The scope of the survey included material identification and activity, package and shipment types and numbers, transport index, mode of transport and transport distances, origin of shipment and import and export information.

The survey was conducted by collecting data on shipments from a variety of sources. In contrast to the 1981 survey, no single sampling or survey approach was taken. Shippers were grouped according to their licensed use type and sampled in a variety of ways to ensure that the maximum value could be extracted from the data. In some cases, the sampling was 100%; in others, it was as low as 1% for a particular use like fixed industrial gauges. An attempt was made to cover representation by geographic area as well as size of company and use. It was noted that for some industries, 1992 was a period of low or stagnant economic activity. A number of users reported that their transport activity was much lower than in previous years. In some cases, it was not possible to sample a true representation of the group. AECB licensing officers who are familiar with the operations of that particular licensing group assisted in evaluating the data.

In some cases, the data were obtained electronically on floppy disks. Other information was obtained from telephone inquiries, survey forms, export permit data and reports from licensees. In several situations, there were overlapping or duplicate sources of data. These proved helpful in ensuring a good degree of confidence in the final result.

Over 350 licensees out of 2,600 representing some 3900 individual licenses were surveyed. The refusals or inability to participate in the survey were less than 5%. In most cases, this was due to a change in business status or employee turnover with record loss or failure to complete the information satisfactorily. Less than 1% of the refusals or inability to provide the information was due to deliberate non-cooperation. In several cases, businesses requested and received assurances of confidentiality for their information. This affects the treatment of the data and its final public format.

Data Entry

Data entry, as distinct from data collection, was a major effort because of the inconsistency of the information received. Much effort was required to decipher the information on many of the entry forms and to ensure that the information appeared plausible. Some licensees were contacted several times to verify the data.

The information collected was entered into a computer data base and totals obtained using different filters. The system is written as a relational database with "Clipper 5.2" and the dbase III+ file format. There are up to 14 separate tables for the names of the shipper, carrier, package information, shipment information and comments.

In order to simplify the programming for the analysis, the data base was designed to adjust the numbers depending on the ratio of those surveyed to the total population for each use type. In only a few cases were additional adjustments made because those industries surveyed were felt to be atypical. The involvement of AECB licensing staff and compliance inspectors was important in judging the appropriate factors.

Summary spread sheets were constructed to produce the final values using selected parameters. For example, since mass and activity used the same field, a slightly modified program was written to extract the mass data. This was possible because either mass or activity was recorded. Unit conversions were also done by computer so a mix of units could be entered by the clerk. The import, export and in-transit data were extracted separately using basic dbase III+ commands in a small program.

Each different type of package in a shipment consisted of one record. Care had to be taken not to double count the shipments when there was more than one package type to a shipment or when the shipment involved different modes of transport. Shipments were identified by their primary or secondary role in the consignment. Only a few of the shipments had more than one package type. Computer routines were developed to print the various tables for checking and revision of the data.

An important approach taken in the design of the system was to ensure that the data could be amended in future by a mini-survey for a specific use. This will allow the data base to remain a dynamic one instead of a fixed historical point of reference. Although it will mean that parts of the database may be older than more recent data, segments can be updated as needed with less effort and without invalidating the rest of the information. Over time, the data will improve, the range of error will narrow and the effort required to assemble new information can be spread more evenly. The purpose is to ensure that information needs can be met with the most up to date information available.

Perhaps the most important reason for the success of the survey was the persistence of staff. The staff were chosen for the assignment on the basis of personal characteristics. The abilities of part-time professional and clerical staff to be persuasive and persistent in the conduct of the survey and the checking of data made a significant difference to the quality of the final results. Exclusive of office overhead, the cost of the project on the basis of salary is estimated at $80,000 (CDN). No cost data is available for the industry. However, AECB staff estimate about $90,000 (CDN).

THE RESULTS

The summary results shown in Figures 3 and 4 are comparable with the statistics and trends of the past. The data indicate that in 1992 some 885,000 packages were transported in 740,000 consignments. Canada remains a world leader in the transport of large quantities of radioactive material over vast distances. Our estimates of accuracy for this data are plus or minus 25% although we consider that these figures are more likely to be low on the basis of our very conservative approach in data collection and assessment.

VALUE OF THE SURVEY

By itself, any survey is just a group of numbers. Their value lies in the use to which they are put. As the data from this survey were entered into the program and as summaries for the different industries were developed and refined, they have proven to be very valuable for use by the AECB and the industry.

FIGURE 3: 1992 Overall Summary

	TOTAL	TYPE A	TYPE B	Industrial
Packages	883,129	678,873	124,665	79,591
Shipments	737,594	614,869	118,502	4,223
Activity (TBq)	4,463,361	49,561	4,374,458	39,342
Mass (kg)	38,065,220	1,932,664	561	36,131,995

Figure 4: 1992 Package Consignments by Mode of Transport

MODE	Percentage	TOTALS	Type A	Type B	Industrial
Road	87.8%	775,908	585,183	124,157	66,568
Rail	0.2%	2,381	753	0*	1,628
Sea	1.8%	14,998	3,307	347	11,344
Air	10.2%	89,842	89,630	161	51
TOTALS	100.0%	883,129	678,873	124,665	79,591

Regulation Development and Program Justification

A very important use for the data has been program justification and the development of regulations. With this data, it has been possible to clearly demonstrate the need for a minimum level and focus for staff resources in the development of regulations. In reviews of the AECB transport program using the 1992 raw data, both an independent advisory committee and the Auditor General of Canada suggested that additional resources are required for the transport program. The data was also very important in defining the scope of application for an Act of the Canadian Parliament dealing with environment impact review. An added benefit is that the data can also be provided to the IAEA at any time to assist in producing global information. Compliance efforts by the AECB have been better focused on the basis of shipment activity. A new compliance program is being developed using the data from the survey.

There will soon be changes to the IAEA Regulations which will require a radiation protection program in some circumstances. The database will allow the AECB to develop and monitor these programs more effectively.

Future projects of the AECB will be to use this data to evaluate the data on accidents and incidents and contribute to the IAEA's EVTRAM database.

Cost efficiencies

The data has been of value in establishing such matters as the volume of publishing and distribution of guides and information notices for licensees. As the database is linked to the AECB's integrated licensing system for some 3,900 licenses, it is possible to carefully tailor the volume and addressing of publication runs.

Emergency response planning

The data revealed some surprises particularly on the volumes and types of radioactive material and their concentrations. Two ports were identified (one air and the other sea) that required an upgrade of the attention paid to their emergency response preparedness. Efforts are now underway to ensure that the resources are comparable to similar locations.

Industry Benefits

Training programs in some industries also benefited. It is a requirement in Canadian law that shippers, handlers and carriers of dangerous goods be trained. Some companies had responded by training all employees - an expensive task with long-term term implications for refresher training and staff turnover. In the course of submitting data, several companies took the knowledge gained to restructure their systems and reduce the numbers of employees requiring training while making their operations more efficient. This was an unforseen benefit to the industry. Some companies changed their transport systems. In one case, several elements of that industry's program were consolidated and made more efficient on the basis of the information gleaned from the process of gathering the data.

Public Consultation and Confidence

Public consultation and notifications of changes to the transport regulations are now on a better footing. Public consultation can be tailored to the specific use types or the products transported in a specific area. The ability of a regulator to demonstrate an information base for the transport activity in a area contributes to the development of public confidence in the quality of the regulator's efforts.

CONCLUSION

A national survey on radioactive material transport activity can provide very significant benefits for the regulator, the industry and the public.

END NOTES

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