The new regulations for the transportation of radioactive materials were prepared by the International Atomic Energy Agency (IAEA) and are being adopted by most nations of the world. The new regulations provide safety and economic advantages because of their rational bases, intermodal and international uniformity, and flexibility. The impact of the new regulations on the general public, shippers, carriers, transport facility operators, packaging designers, and regulatory authorities and the responsibilities of these groups in the application and continuing development of the new regulations are discussed in the context of Canadian experience.

INTRODUCTION

The recent years have seen the completion and the initial application of the new regulations for the transportation of radioactive materials. The new regulations include the International Atomic Energy Agency, "Regulations for the Safe Transport of Radioactive Materials", 1967 Edition, and all other regulations derived from them.

The new regulations are based on radionuclide hazard potential and prescribe packaging performance standards in terms of shielding, containment, criticality, and heat transfer for normal and accident conditions of transportation, as well as operational and administrative
controls by shipper and carrier. The new regulations provide a realistic degree of safety and significant economic potential in the transportation of radioactive materials.

The object of this paper is to discuss the impact of the new regulations on the general public, shippers, carriers, transport facility operators, packaging designers, and regulatory authorities, and the responsibilities of each of these groups toward the proper application and continuing development of the new regulations. This discussion will be presented in the context of Canadian experience.

GENERAL PUBLIC

The general public and radioactive materials may come into proximity during transportation - the general public as passengers, users of transport facilities, and residents of adjacent transport routes; and the radioactive materials as cargo in a rigorous transportation environment in the custody of transport personnel who may be unaware of the potential hazards and procedures for their control.

The general public may rightfully expect from radioactive materials maximum benefits concurrent with minimum risks. The general public is unknowingly the prime beneficiary of the new regulations which fulfill this expectation to a high degree.

The general public's responsibilities include assuring, through their governmental representatives, effective administration of and compliance with the new regulations. The general public must be cognizant of the benefits, regulatory provisions, and excellent safety record in the transportation of radioactive materials; and must recognize
the need for safe transportation of all hazardous materials.

Other groups must recognize their roles in assisting the general public with their responsibilities and in further reducing public apprehensions of the nuclear industry.

SHIPPERS

The shipper has a key role in the new regulations because they assign to him a major responsibility for safety and because he directs the packaging designer and the carrier and works closely with transport facility operators and regulatory authorities. The shipper may also be a private carrier.

The primary impact of the new regulations on the shipper is that their rational bases, uniformity, and flexibility provide greater economic potential with increased safety.

The rational bases of the new regulations assign minimum packaging and shipment requirements consistent with hazard potential. This provides greater scope for utilization of industrial, specification, standardized, and non-returnable packaging.

The international and intermodal uniformity provides a single regulatory basis for all shipments. This uniformity has promoted a consolidation of modal regulatory authorities and in some cases has created a single regulatory contact.

The flexibility of the new regulations gives the shipper increased scope in the use of packaging safety and operational safety in varying degrees to suit high-volume or one-off shipments.
The new regulations may have necessitated retraining of personnel, revision of procedures, and modifications to existing packaging, but in many cases this has produced economic benefits. For example, the modification of existing packaging may have increased its utilization potential and service life.

The shipper's operative and administrative personnel must be knowledgeable of the regulations and their bases in order to fulfill their safety obligations and to take advantage of the potential economic benefits. This knowledge will also be advantageous in planning, directing packaging designers, and dealing with the regulatory authority.

The shipper's compliance performance must consistently fulfill all technical and administrative regulatory requirements. The shipper must submit clear, concise special approval applications. Broad-scope applications may reduce the need for future revisions. The shipper's good compliance performance determines the degree of voluntary compliance which he is capable of assuming.

The role of the shipper in the continuing development of the new regulations includes proposal of regulatory revisions and specification packagings, preparation of standards; documentation of packaging performance, accident and shipment data; and liaison with other groups. The shipper may fill this role as an individual, corporation or member of an industry organization. Insofar as effective assistance to and influence on the regulatory authority is concerned, the third approach is the most desirable. Industry organizations are the best way for shippers to make an input to the regulatory process.
Where the shipper is also a national atomic energy organization, that organization has additional responsibilities in the education of operative groups and general public, co-ordination and execution of research and development, and provision of technical support to the regulatory authority.

CARRIERS

The carrier has an important role in the transportation of radioactive materials because while in his custody, radioactive materials are in the public domain and may be exposed to normal and accident conditions of transport. The carrier is not able to specialize in a single commodity, e.g., radioactive materials, because his business involves many different hazardous materials and thousands of different commodities.

The impact of the new regulations on carriers has been that the simple operational controls of the earlier regulations have remained basically unchanged except for new package labels, fifty transport index units instead of forty radiation units, and vehicle placard and decontamination requirements. The uniformity of the new regulations may facilitate intermodal and international connecting-carrier transfers. The realistic and uniform packaging performance standards minimize special handling and may reduce damage claims.

The prime responsibility of carriers is a good working knowledge of the new regulations. Management and legal personnel must be aware of their responsibilities and must communicate these to operating personnel including drivers and cargo handlers. The carrier also has responsibility for good compliance performance, careful handling of radioactive materials
shipments, and provision of a safe transport environment. He should be able to cope with radioactive materials accidents through familiarity with basic emergency procedures and availability of expert advice and assistance.

Carriers responsibilities in the continuing development of the new regulations include proposal of regulatory revisions and documentation of traffic and accident data. Such data, presented by technical working groups of carrier industry organizations, will be of value to the regulatory authority in his evaluation of regulatory effectiveness.

TRANSPORT FACILITY OPERATORS

"Transport facility operator" includes private and public organizations responsible for fixed facilities such as ports, inland waterways, airports, terminals, warehouses, bridges, tunnels, and turnpikes. Transport facility operators must avail their facility for transport by hazardous materials and at the same time must assure its safety, availability, and financial stability. This situation may be aggravated by apparent risks not being compensated by a significant volume of traffic or in some cases by adequate financial protection.

The new regulations should assure the transport facility operator that he is assuming a very small risk by permitting radioactive materials shipments through his facility. The new regulation's consideration of hazard potential, packaging performance under realistic normal and accident conditions of transport, operational and administrative controls by shipper and carrier, administrative responsibilities of regulatory authorities, and well organized emergency procedures all make the transportation of radioactive materials an excellent example of risk.
management.

The responsibility of the transport facility operator in the application of the new regulations includes being knowledgeable of the regulations and their inherent safety. Consideration of the excellent safety record of radioactive materials transportation under earlier and less-stringent regulations, provision of emergency procedures and sources of expert advice and assistance, and analysis of credible radioactive materials transport accidents on specific facilities and resultant personal liability, property damage, unavailability, and financial consequences would demonstrate that the risks of radioactive materials transport do not justify restriction by transport facility operators.

Another responsibility of the transport facility operator is to provide, in co-operation with carriers, a safe transport environment.

The transport facility operator's clear definition of his problems with the transportation of radioactive materials and their solution in co-operation with shippers, carriers, atomic energy organizations, and regulatory authorities will promote the continuing development of the new regulations.

PACKAGING DESIGNER

The packaging designer designs and supervises the fabrication of packagings which are the prime safety element in the transport of radioactive materials.

The new regulations provide a logical design approach - hazard potential of proposed shipment, general packaging type, and packaging performance standards under prescribed normal and accident conditions
of transport. The definition of the basic packaging types (industrial, Type A, Type B, large source, and missile) facilitates achieving a higher packaging utilization potential. The packaging performance criteria give the designer very broad scope for employing his creative abilities and recent design, materials, and fabrication technology in achieving maximum packaging capacity with minimum weight.

The new regulations are uniform for all modes and for all countries and the designer no longer has to review all relevant regulations and design to the most demanding criteria.

The new regulations utilize the "basic safety equation" where the total safety is the sum of packaging safety and operational safety components. The "basic safety equation" combined with a choice of shipping methods (full-load, less-than-full-load, and special arrangements) gives the packaging designer much flexibility in optimizing functional, economic, and safety requirements. This flexibility may permit continued use of existing packagings which do not meet the new regulatory criteria and may facilitate "one-off" shipments.

Proper application of the new regulations requires that the designer be very knowledgeable of regulatory requirements and interpretations, that he demonstrate the compliance of packagings fabricated to the approved design, and that he prepare operational and maintenance procedures for his packaging design.

The demonstration of regulatory compliance of a packaging design (and in some cases, shipping procedures) requires the designer's documentation of engineering evidence in the form of test results, theoretical analysis, relevant references, or any combination of these
methods. The roles of designer and regulatory authority in compliance evaluation must be clearly understood - the designer submits the evidence and the regulatory authority judges compliance on the basis of that evidence.

Continuing development of the new regulations involves the packaging designer in review of packaging performance criteria and consideration of specification packagings. The packaging designer may also co-operate with industry organizations in the preparation of design guides and in standardization of packaging details.

REGULATORY AUTHORITIES

The regulatory authority's role includes recognizing the need for and scope of the new regulations, participating in their development, co-operating in achieving their international and intermodal uniformity, adapting them to his national context, publishing them as a proposed rule making, and promulgating them as national regulations. He then must administer them efficiently and effectively.

The rational basis of the new regulations requires the regulatory authority to have competence in radiation health physics, radioactive materials, packaging design and fabrication, shipper capabilities and procedures, carrier equipment and operations, and emergency procedures. The uniformity of the new regulations may have broadened the regulatory authorities' responsibility to include all modes and will have necessitated greater international co-operation with other regulatory authorities.

The flexibility of the new regulations requires the regulatory authority to judge the safety of "special arrangements" shipments for
which detailed regulations are not prescribed.

The prime responsibilities of the regulatory authority in the application of the new regulations include the efficient and effective administration of the regulations, the provision of educational assistance to shippers and carriers, and the organization of adequate emergency procedures for radioactive materials transport accidents.

Efficient and effective administration of regulations includes prompt and thorough consideration of requests for information and applications for packaging and shipment approval. The regulatory authority's distribution of application guidelines and checklists may further improve the efficiency of special approval administration.

Efficient and effective administration of the new regulations also includes minimizing the number of modal and sub-national regulatory authorities. Modal authorities may be unified by reorganization or by providing a single expert adviser. Sub-national authorities should be encouraged to enforce national rather than their own regulations.

The provision of educational assistance to shippers, carriers, transport facility operators, and packaging designers deserves greater attention. Throughout this paper, I have mentioned the importance of each group being knowledgeable of the regulations and their bases. A necessary pre-requisite to this objective is the publication by the regulatory authority of an authoritative and definitive companion guide outlining the basis for and factors considered in formulating each section of the regulations. This guide would also serve as a basis for considering future regulatory revisions. Handbooks describing national regulatory requirements and their administration may also be
useful if distributed on an international basis.

The responsibilities of the regulatory authority in the continuing development of the new regulations include periodic updating of technical and administrative aspects, maintenance of international and intermodal uniformity, publication of specification packagings, evaluation of regulatory effectiveness, promotion of voluntary compliance, and close liaison with all regulated groups.

The technical and administrative aspects of the new regulations must be updated to serve the needs of the nuclear and transportation industries, to incorporate new knowledge and experience, and to achieve simplification and a higher degree of uniformity. A two-year revision period coordinated with the revision of the master (IAEA) regulations may be desirable.

The maintenance of international and intermodal uniformity is an important responsibility of the regulatory authority. Uniformity of the IAEA Regulations was the result of negotiation and compromise. As a result, these regulations may not appear optimum in the context of a single mode or nation. Thus, regulatory authorities may desire to depart from the IAEA Regulations in their own national or modal regulations. Such departures mean reduction of uniformity. Therefore, a guideline for adaptation of the IAEA Regulations to a national or modal context may be desirable. Such a guideline is that national and modal modifications may be less but not more restrictive than the IAEA Regulations and that all departures from the IAEA Regulations should be identified in the respective national and modal regulations. This guideline maintains basic uniformity while providing flexibility in adoption and accumulation
of experience which may result in subsequent revisions to the IAEA Regulations.

The regulatory authority should encourage new specification packagings since he is aware of industry packaging needs through his special permit program. The regulatory authority should co-operate with industry organisations to develop suitable specifications. It is important that design details and regulatory compliance evaluation of a specification packaging be published and a utility review be performed prior to promulgation in the regulations.

The regulatory authority must continually evaluate regulatory effectiveness by investigating the causes and consequences of each accident and by reviewing relevant traffic and accident statistics. National effectiveness evaluations should be correlated on an international basis.

The regulatory authority must consider the long-term roles of himself and of the regulated groups in the context of increased voluntary compliance. I believe that industry is capable of assuming an increasing self-compliance role which will eventually result in voluntary compliance by the nuclear and transportation industries instead of compliance enforcement by the regulatory authority. The route to voluntary compliance is good compliance performance by the regulated groups.

The key to the regulatory authority's degree of success with the new regulations is his effective communication with regulated groups, other regulatory authorities, and international transport organizations. Each group must have a representative, authoritative organization to formulate and present its collective views. There must also be a forum where such
organizations may exchange views with the regulatory authority and propose regulatory revisions. Such organizations are a great advantage to the regulatory authority and he should encourage their formation and their growth.

In April, 1968, a number of national regulatory authorities and an IAEA representative met informally to discuss administrative procedures and differences among national regulations. Such meetings will be continued on an annual basis; hopefully with broader representation.

It is well recognised that the IAEA has played the primary role in establishing the basic technical and administrative aspects of the new regulations. The IAEA has a continuing role in the uniform adoption, administration, and continuing development of the regulations. The IAEA should be active in liaison with regulatory authorities, promotion of regulatory uniformity, definition of national regulatory situations, promotion of international specification packaging, provision of educational assistance, and co-ordination of proposed revisions. It is important that IAEA Regulations be revised on a periodic basis so that the other regulatory authorities may co-ordinate the revision of their own regulations with the master (IAEA) regulations.

It was recently suggested that an international convention for the transportation of radioactive materials may be worthy of study. Such a convention may develop from close liaison among national regulatory authorities and from co-operation between continental transport organizations.
CONCLUSION

The impact of the new regulations has been to bring increased advantages and responsibilities to all groups including the general public, shippers, carriers, transport facility operators, packaging designers, and regulatory authorities.

The advantages appear as improved safety and economic potential in packaging shipment and are derived from the rational basis, international and intermodal uniformity, and flexibility of the new regulations.

The responsibilities involve the proper application of the new regulations and their continuing development. The fulfillment of these responsibilities by all groups may best be achieved by knowledge-ability of the new regulations, by a greater regulatory input, and by increasing voluntary compliance by the regulated groups. The regulatory authorities must promote a closer international liaison with their counterparts and with international transport organizations. Such liaison may eventually lead to an international convention for the transportation of radioactive materials.

The key to the achievement of the advantages and the responsibilities of the new regulations is improved communication both within and between the various groups involved. International symposia such as this one and its predecessor in Albuquerque are outstanding examples of how this communication may be achieved.