Physical Protection of Radioactive Material in Transport

Safety in the transport of radioactive material is ensured by enclosing the material, when necessary, in packaging which prevents its dispersal and which absorbs to any adequate extent any radiation emitted by the material. Transport workers, the general public and the environment are thus protected against the harmful effects of the radioactive material. The packaging also serves the purpose of protecting its contents against the effects of rough handling and mishaps under normal transport conditions, and against the severe stresses and high temperatures that could be encountered in accidents accompanied by fires. If the radioactive material is also fissile, special design features are incorporated to prevent any possibility of criticality under normal transport conditions and in accidents.

The safe transport requirements are designed to afford protection against unintentional opening of packages in normal handling and transport conditions and against damage in severe accident conditions; whereas the physical protection requirements are designed to prevent intentional opening of packages and deliberate damage. This clearly illustrates the difference in philosophical approach underlying the requirements for safe transport and for physical protection during transport. This difference in approach is, perhaps, most easily seen in the differing requirements for marking of consignments. While safety considerations dictate that packages be clearly labelled, physical protection considerations urge restraint in the use of special labels. Careful consideration must be given to such differences in approach in any attempt to harmonize the safety and physical protection aspects of transport.

SAFETY IN TRANSPORT

The principle adopted for achieving an acceptable standard of safety in the transport is that the package should provide adequate containment together with sufficient shielding to retain the level of external radiation within prescribed limits. Simple stowage and segregation rules, based on the level of radiation in the surroundings of each package as indicated on the attached label, are then applied to ensure that, even for consignments of large number of packages, the levels of radiation will not exceed acceptable values for persons and for sensitive materials such as undeveloped photographic film in the same conveyance.

The packages must be fitted with a positive fastening device which cannot be opened unintentionally by any action from outside or by any pressure arising within the package. If the package is heavy, a tie-down system is provided which prevents it from moving and possibly damaging its surroundings during transport.

As there is no regulatory upper limit on the activity that can be transported in a package designed to withstand severe accident conditions, the design is subject to review and approval by an independent competent authority in the country of origin of the design. If the design meets all of a series of prescribed criteria, no additional competent authority approval is required for international shipment; if it fails to meet one or more of those criteria, it must also be approved by the competent authorities of all other countries through or into which it is to be transported.

The IAEA was entrusted in 1959 by the Economic and Social Council of the United Nations with the preparation of recommendations which could serve as the basis for international regulations for the safe transport of radioactive materials. These were approved by the Board of Governors and issued in 1961. They have been reviewed a number of times since then and the current version is the 1973 Revised Edition. At this time, the IAEA regulations have been adopted as the basis for the national regulations of many Member States and for the regulations and codes of the international bodies that carry responsibilities for the transport of goods by road, rail, sea and air.

Under these regulations, responsibility for meeting the safety requirements rests with the consignor of the radioactive material.

The feasibility of establishing a convention covering the transport of all dangerous goods has been discussed at a recent meeting of the UN Committee of Experts on the Transport of Dangerous Goods and, at an International Conference organized by the International Air Transport Association in February 1975, the UN Economic and Social Council and the IAEA were invited to consider the need for an International Convention to harmonize on a world-wide basis the regulatory standards for the transport of dangerous goods.

PHYSICAL PROTECTION

The IAEA Regulations for the Safe Transport of Radioactive Material do not in themselves make provision for the physical protection of radioactive material during transport, that is, for protection against the intentional opening of a package by an unauthorized person, the deliberate damage of a package, or against theft or substitution of the whole or part of a consignment.

The Agency has, however, issued recommendations for the physical protection of nuclear material, which is taken to mean plutonium, uranium-233 and uranium enriched in uranium-235. These recommendations cover general and detailed requirements for physical protection in use and storage, and in transit.

Responsibility for the establishment of a physical protection system within a State rests with that State. In the case of international transfer of nuclear material, responsibility is the subject of agreement between the States concerned.

The system should include adequate regulations and compliance assurance and also a recovery system to be put into operation in the event of failure of the preventive measures.

Detailed requirements have been proposed for physical protection in transport, as it is recognized that nuclear material is then particularly vulnerable to theft and deliberate damage. These requirements are additional to these for safe transport, which stem from the radioactive and fissile properties of the material.

The extent of the detailed additional requirements is related to the quantity and nature of the nuclear material.

They include:

- the use of special locks and seals to prevent unauthorized opening of the packages
- advance notification of the consignee to ensure that he is ready to accept delivery
- special routing of the vehicle to avoid areas where disturbances or interception might be foreseen
- planning of the transport to ensure the minimum travel time and the minimum number of transfers
- adoption of full-load conditions, that is sole use of a vehicle or aircraft by the consignor, all initial, intermediate and final loading and unloading being done in accordance with the directions of the consignor or consignee
- the preferential use of aircraft, including helicopters
- arrangements to ensure that a vehicle is never left unattended during transport
- provision of a rapid communication system between consignor and consignee to indicate the precise time of arrival
- continuous communication with the transport vehicle, and reports from checkpoints
- use of escorts or guards in the same vehicle as the consignment and possibly in accompanying vehicles
- use of special tie-down systems to prevent unauthorized removal of a package from the vehicle
- use of vehicle disabling systems to prevent unauthorized diversion of the vehicle from the planned route
- use of alarm systems to draw attention to and locate a vehicle under threat
- provision for the rapid notification and dispatch of trained and equipped teams to recover any consignment under threat.

For international transport, special arrangements would have to be made in advance between the States concerned for ensuring continuity of such of these protective measures both within each State and at the frontier crossing points as are relevant to the particular shipment. Transport by air has obvious advantages from the point of view of reducing the travel time, of identification and monitoring of the location of the consignment, and of facilitating continuous protective supervision.

CONCLUSION

As for the safe transport of consignments, efforts should be made to secure the adoption and enforcement, on national and on world-wide international scales, of uniform regulations for physical protection of nuclear material in transport. The need for enforcing effective international requirements for physical protection is at least as great as that for enforcing safety requirements. If part of the radioactive contents of a package could escape as the result of an accident or because of the use of improper packaging, it has long been recognized that a serious health hazard could arise. It is now being recognized that an even greater hazard could be relatively easily created by the deliberate damage, theft or diversion to improper use of a consignment of nuclear material.

Notwithstanding the differing underlying considerations, there are areas of complementarity between the two approaches: the tie-down requirements for safety can be supplemented

by the tie-down requirements for physical protection; the use of seals to prevent the unintentional opening of packages can be supplemented by the use of seals to prevent unauthorized opening of package. And it might even be possible to make use, in the field of physical protection, of the concept underlying the safety requirement that the design of a package which must withstand severe accident conditions be subject to review and approval of an independent competent authority in the country of origin of the design, with no further competent authority approval being required if the design meets all of a series of prescribed regulatory criteria. Thus if an independent competent authority in the country of origin of the consignment reviewed and approved the physical protection measures to be implemented during the course of transit, a notification of the shipment together with a statement either that physical protection measures appropriate to the shipment are being taken, or of the measures applicable to the shipment, might suffice. This, of course, assumes the existence of internationally accepted physical protection measures and adequate assurance of their effective implementation.

For administrative purposes it may be possible to combine in one authority responsibility for the implementation of safety and physical protection measures.

Although the development of an international convention might well offer a means of securing internationally applied physical protection measures a number of fundamental matters will require serious study and resolution if this end is to be attained.