

An Evaluation of International Legal Protections in Nuclear Air Carriage

*Roy S. Lee**)

I. INTRODUCTION

The special features of nuclear hazard are too well known: (a) radioactivity; (b) multi-dimensional and transnational scope; (c) the causing of radiation injury and genetic effects; and (d) high cost for reparation. A serious nuclear accident could kill 3,400 and injure 43,000 persons; property damage may range from the lowest limit of US \$ 500,000 to \$ 7,000,000 or more. Exposure could extend for more than 15 miles and contaminate land for 100,000 square miles unfit for agriculture, should it be an airborne mishap¹). The delayed effects of radiation injury, such as cancer, leukaemia and genetic mutation, are even more difficult to reckon with than these immediate effects²). Nuclear substance on board the aircraft could thus not only endanger persons and cargo within, but also magnify

*) LL. M., Fellow of the British Institute of International and Comparative Law. References are up to March 1966.

¹) Theoretical Possibilities and Consequences of Major Accidents in Large Nuclear Power Plants, A Report by the USAEC, 1 CCH Atomic Energy Law Report, Sec. 4031 (1957). The seriousness of nuclear accidents can further be seen from the conclusion of the Nordic Mutual Emergency Assistance Agreement between the Nordic countries and IAEA on October 17, 1963. This is designed to deal with a serious radiation accident in which a country may not have sufficient experience or may not possess the resources necessary to deal with all consequences of such an accident. The Agreement prescribes financial provisions, makes provisions for the question of liability, lists authorities and assistance, and sets out the special functions of the Agency. On the other hand, it is possible that the image of nuclear hazard can be overstated in these embryonic days of the nuclear age, as this has been the case whenever a new source of power has been introduced.

²) It is of great importance to note that the total number of consignments of radioactive materials which have been transported in Britain and the United States during the past 15 years (1950-1965) is approximately one and a half million. There have been about 100 accidents to packages. Only 30 of them have been severe (equivalent to the 30 ft. drop test). For reference see Wilson, *Transporting Radioactive Material*, 56 *New Scientist* 1965, p. 523.

damage resulting from surface impact, aerial collision, and as would any collision with spacecraft³). Moreover, polluted cargo could act as a medium in causing further mishap⁴).

It is therefore quite clear that nuclear hazard has introduced certain unconventional factors which have completely altered some basic assumptions of the existing laws, in particular, the preventive and compensative rules.

Yet, on the other hand, the steadily increased demand for civil uses of nuclear energy has resulted in transportation of an enormous amount of nuclear substance all over the world⁵). Air carriage is necessary in the majority of cases in order to save time and money and for the preservation of the energy⁶). Thus, it is conceivable that air accidents involving nuclear material will increase and will result in greater damage than non-nuclear accidents.

Whether or not the law is adequate to cope with the intensified international air carriage of radioactive material has therefore become a most

³) A topical example would be the recent achievement of the US in launching into orbit the Atlas-Agena rocket with a nuclear reactor (known as SNAP—System for Nuclear Auxiliary Power). The entire satellite weighs 970 lb. and has an over-all length of 10 ft. The reactor itself is fueled with enriched uranium-235 combined with zirconium hydride. It will not come down for 3,000 years. *The Times*, London, April 5, 1965, p. 10 first column.

⁴) For a detailed investigation and analysis of nuclear hazards from flight instrumentalities, see the author's *Liability for Nuclear Damage Caused by Flight Instrumentalities*, McGill thesis, Institute of Air and Space Law (1964), pp. 26–32. See also *Stason, Estep and Pierce, Atoms and the Law* (Michigan 1959), pp. 2–44; *Estep, Radiation Injuries and Statistics: the Need for a New Approach to Injury Litigation*, 59 *Michigan Law Review* 1960, p. 259 *et seq.*; *Estep and Allan, Radiation Injuries and Time Limitations in Workmen's Compensation Cases*, 62 *Michigan Law Review* 1963, p. 259 *et seq.*; *Estep and Forgotson, Legal Liability for Genetic Injuries for Radiation*, 24 *Louisiana Law Review* 1963, p. 1 *et seq.*

⁵) According to the statistics, the United States has transferred about 200,000 kgs. of natural uranium, about 150,000 kgs. of enriched uranium containing 5,500 kgs. of uranium-235, some 20 kgs. of plutonium and more than 600 tons of heavy water. See *Atomic Energy Legislation Through 88th Congress, 2nd Session, Joint Committee on Atomic Energy Congress of the United States, December 1964, Washington; Hearings before the Sub-Committee on Agreements for Cooperation of the Joint Committee on Atomic Energy Congress of the United States, 1st and 2nd Sessions, On International Agreements for Cooperation, September 5, 1963, April 22, and June 30, 1964, Washington, 1964. In May 1964 Canada sent a single shipment of radioactive material weighing 28,000 lbs. by air freight to Düsseldorf, Air Canada, no. 270, June 1964, p. 1.*

⁶) Air-borne nuclear carriage also plays an important role even within a country. According to the Report of the U.S. Atomic Energy Commission during the six-months survey period (October 1st, 1960 to March 31st, 1962) the AEC and its contractors made a total of 23,346 shipments of radioactive materials. Twenty-five percent of the shipments was made by air (second only to those by road). See USAEC, *Health and Safety Information*, November 23, 1962.

important current legal problem. Regrettably, no comprehensive study has been done⁷⁾. This paper intends to reveal that the existing solutions at present envisaged are inadequate to the problems posed by the peculiar features of the subject⁸⁾. The examination is devoted to the two more important questions: the applicability and adequacy of the laws regarding (a) preventive measures, and (b) liability, in relation to international air carriage of radioactive materials.

II. GENERAL SURVEY OF THE APPLICABLE LAWS

1. Preventive Measures

Because of the radioactive nature of nuclear materials, normal preventive regulations for dangerous goods and safety rules for air navigation have proved to be inadequate. Measures which have been taken by some international organizations are, however, at present limited to regulations for safety transport mainly⁹⁾.

(1) IAEA Regulations

Having anticipated the increasing movement of radioactive materials within many countries as well as across international frontiers, the International Atomic Energy Agency (IAEA), a world institution for the promotion of the peaceful uses of nuclear energy and for the establishment of safety regulations connected therewith, has recommended a series of safety measures¹⁰⁾. The Regulations for Safe Transports of Radioactive

⁷⁾ As early as 1959, the International Civil Aviation Organization drew attention to this question, but no substantial action has yet been taken. A. Ke an (UK) who was appointed as the Rapporteur made two reports on the Paris and Vienna Conventions (see below) in 1960 and 1963. See ICAO Doc. LC/Working Draft no. 663, 22/5/63; Doc. 8081 A/12-LC/1, 1959, p. 6; LC/Working Draft no. 705, 7/5/64.

⁸⁾ This paper does not deal with any situations with military aspects. Thus, carriages of nuclear weapons or nuclear materials for defence purposes are excluded. Although from the technical point of view, the term "radioactive material" differs from and has a wider meaning than the term "nuclear material", they are used interchangeably in this paper for materials that are radioactive.

⁹⁾ For instance, Euratom made in 1961 a comparative study of the relevant laws of the six countries and the regulations of the IAEA and IATA concerning the transportation of radioactive materials. The survey aims at simplifying the implementations of the basic standards in the transport field and at the same time facilitating the harmonization of the relevant legislation. See *Esame Comparativo delle Disposizioni Applicabili Nell'ambito della Comunità Europea, 1 Trasporti di Materie Radioattive*, Euratom, 1961, 79 pp.

¹⁰⁾ The first ten regulations are: no. 1 Safe Handling of Radioisotopes; no. 2 Safe

Materials are designed to include carriage of radioactive materials by all means of transport¹¹). They have been incorporated to a certain extent in the national and international transport regulations.

(2) IATA Regulations

Since 1956, the International Air Transport Association (IATA), a non-governmental organization of airlines, has implemented the Regulations on the Carriage of Restricted Articles by Air on behalf of its member airlines in order to meet special circumstances in air transport¹²). These Regulations apply to compressed gases, explosives, corrosive liquids, flammable liquids and solids, magnetic materials, oxidizing materials, poisonous or irritating substances, radioactive materials and other elements which, unless properly packaged, might endanger the aircraft, cargo or passengers. To bring the regulations for radioactive materials up to date, the IATA Permanent Working Group on Restricted Articles recently undertook a complete revision¹³). The present 1966 edition is much more comprehensive and carefully drafted than previous editions.

Handling of Radioisotopes – Health Physics Addendum; no. 3 Safe Handling of Radioisotopes – Medical Addendum; no. 4 Safe Operation of Critical Assemblies and Research Reactors; no. 5 Radioactive Waste Disposal into the Sea; no. 6 Regulations for Safe Transport of Radioactive Materials; no. 7 Regulations for Safe Transport of Radioactive Materials: Notes on Certain Aspects of the Regulations; no. 8 Use of Film Badges for Personnel Monitoring; no. 9 Basic Safety Standards for Radiation Protection; no. 10 Disposal of Radioactive Wastes.

¹¹) This is the result of IAEA 1959 Panels for the study of this question. Participants of the Conference were specialists representing member states of the Agency and several international organizations. All the member states of the Agency were subsequently invited to make comments upon the draft regulations. The Regulations are subject to revision every two years so that they may be kept up to date. The Regulations have been adopted by the UN Committee of Experts for Further Work on the Transport of Dangerous Goods in its recommendations to ECOSOC. They have also been extensively incorporated into the International Regulations Concerning the Carriage of Dangerous Goods. The UK, for example, has always been a leader of national implementation of these regulations. In 1965, a new *révision* (IAEA Safety Series no. 6) has been published. The principles and substances have not been changed, however. Wilson, *op. cit. supra* note 2, pp. 522–523 offers an excellent and brief note on the new edition.

¹²) IATA Regulations Relating to the Carriage of Restricted Articles by Air, 10th Ed., issued by the authority of the Traffic Director, IATA, Montreal, 1965. These Regulations were developed by the IATA Permanent Working Group on Restricted Articles and are subject to annual revision.

¹³) See Report of Special Meeting on Radioactive Materials, IATA Permanent Working Group on Restricted Articles, London, October 1963; Report of Second Special Meeting on Radioactive Materials, New York, April 1964.

2. Liability

Three types of laws are applicable to the question of liability: the international air law conventions, national nuclear liability laws and the international civil liability conventions.

(1) *Air Law Conventions*

The existing international air law conventions do not, and cannot, settle all problems of liability arising from aeronautical activities, but only certain legal relationships. However, a substantial body of rules and principles relevant to the problems under consideration does exist and can be found in the Warsaw (and the Hague Protocol)¹⁴), Guadalajara¹⁵), and Rome Conventions¹⁶). These Conventions regulate, respectively, liability between actual and contractual air carriers and aircraft users, and between aircraft operators and third parties on the surface. Theoretically, most of the cases of international air carriage of radioactive substances primarily fall within the scope of these Conventions.

(2) *National Laws*

As a consequence of partial unification of international air law, four major groups of cases are still governed by national laws:

A. With nearly one hundred ratifications of the Warsaw Convention and possibly, in the near future, the Hague Protocol which may also reach

¹⁴) The Warsaw Convention, the Convention for the Unification of Certain Rules Relating to International Carriage by Air, was signed at Warsaw on October 14, 1929, and came into effect on February 13, 1933. The Hague Protocol was signed in 1955 and came into operation on August 1st, 1963. For a recent and comprehensive study of the question of international air carriage see, B. Cheng, *The Law of "International" and "Non-International" Carriage by Air*, 60 *The Law Society Gazette*, pp. 334, 444, 518, 603, 665, 747, 871; and 61 *The Law Society Gazette*, pp. 37, 115, 192, 261, 336, June 63-May 1964.

¹⁵) The Convention Supplementary to the Warsaw Convention for the Unification of Certain Rules Relating to International Carriage by Air Performed by a Person Other Than the Contracting Carrier, signed at Guadalajara on September 18, 1961, came into force on May 1, 1964. Cf. Mankiewicz, *Charter and Interchange of Aircraft and the Warsaw Convention*, 10 *International and Comparative Law Quarterly* 1961, p. 707.

¹⁶) The Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface, signed at Rome on October 7, 1952. For further reference see E. G. Brown, *The Rome Conventions of 1933 and 1952: Do they Point to a Moral?* 28 *Journal of Air Law and Commerce* 1961, p. 418; Drion, *Limitation of Liability in International Air Law* (Paris 1954); Sand *et al.*, *An Historical Survey of the Law of Flight* (Montreal 1961).

this stage, the law of liability between the air carrier and the air transport users has been almost universally unified. Still, there are countries which have not yet ratified the conventions. Moreover, there are international air carriages in substances which do not fall within the definition or application of the conventions¹⁷).

B. Liability between air transport users and other parties (such as the shipper, the manufacturer, air traffic control agency and the wrongdoer) is not subject to international regulation. If therefore, an air transport user wishes to claim compensation from the person other than the air carrier, he has to do so according to applicable national laws.

C. In so far as the law between the air operator and third parties on the ground is concerned, international unification of laws has as yet a very limited scope. The Rome Convention has so far been ratified by only twenty countries and none of the major air transport states, except Canada, has accepted it. Most of the cases, therefore, are governed by national laws.

D. Subject to national laws is also the question of liability between the operators of aircraft (*e.g.* aerial collision or interference) or possibly between operators of aircraft and spacecraft (*e.g.* collision or interference).

(3) Nuclear Civil Liability Conventions

Within a period of three and a half years (July 1960 to January 1964), six international conventions and protocols have been concluded for liability arising from the operation of ground nuclear installations and nuclear ships. Though none of them is yet in force, they are all relevant¹⁸):

(a) The Convention on Third Party Liability in the Field of Nuclear Energy of the Organization for Economic Cooperation and Development, 1960, as amended by the Additional Protocol of January 28, 1964 (hereinafter referred to as the Paris Convention);

(b) the 1963 Convention Supplementary to the Paris Convention of July 29, 1960, as amended by the Additional Protocol of January 28, 1964 (hereinafter referred to as the Supplementary Convention);

(c) the International Convention on Civil Liability for Nuclear Damage, 1963 (hereinafter referred to as the Vienna Convention); and

¹⁷ See Cheng, *op. cit. supra* note 14, pp. 448-449 and diagrams 1 and 2 therein. Ten non-Warsaw carriage cases are given; many of them are of carriage to, from or between foreign countries.

¹⁸ The Organization of American States is however preparing a regional convention of this type. For further information see Final Report, Inter-American Nuclear Energy Commission, 5th Meeting, Chile, March 1964.

(d) the Brussels Convention on the Liability of Operators of Nuclear Ships, 1962 (hereinafter referred to as the Brussels Convention).

As early as 1957 the problem of nuclear liability had attracted international attention. Two major factors were responsible for this: first, the possibility that damage arising from a nuclear reactor might take place outside a state's territory, including the hazards involved in international carriage of nuclear materials; secondly, the desirability in Europe for the unification of emerging national legislation on the subject. After almost three years' preparation, the first multilateral treaty, the Paris Convention, was produced¹⁹). It soon became the model for subsequent national and international legislation.

After the conclusion of the Paris Convention, it was realized that the financial protection provided therein was too low and a uniform higher limitation was desirable. The Euratom countries took the initiative to amend the convention and subsequently in 1963 concluded the Supplementary Convention²⁰). After the adoption of the IAEA Vienna Convention (see below), in order that the contracting parties of both the Paris and Supplementary Conventions should be able to adhere to it without conflicts, these Conventions were amended in January 1964²¹).

¹⁹) A working group on third parties liability was set up in January 1957 under the Ministerial Council of OEEC, now OECD. Article 11 of the Statute of European Nuclear Energy Agency requires this body to work out uniform rules for nuclear damage to serve as a basis for national laws. The Convention was signed by 16 European countries of OECD: Austria, Belgium, Denmark, France, Germany, Greece, Italy, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. (For the text of the Convention see 27 *Journal of Air Law and Commerce* 1960, p. 376). For references to the Convention see A. Kean, *Aircraft Operator and Nuclear Materials*, 1963 *Journal of Business Law*, p. 21; Kaufmann, *Convention Européenne sur la Responsabilité Civile dans le Domaine de l'Energie Nucléaire*, 13 *Revue Hellénique de Droit International* 1960, p. 25; Arangio-Ruiz, *Some International Legal Problems of the Civil Uses of Nuclear Energy*, 107 *Rec. d. C.* vol. 3 (1962), p. 503. The Convention does not prevent states other than the original signatories from acceding, but the admission requires the unanimous consent of all the contracting states.

²⁰) For the text, see OECD, *European Nuclear Energy Agency publication*, March 18, 1963, or 2 *Current Documents*, p. 685. It has been signed by 13 European countries (see the list above, excluding Greece, Portugal and Turkey). See Fornasier, *Le Droit International face au Risque Nucléaire*, 10 *Annuaire Français de Droit International* 1964, pp. 303-311; Bette, Didier, Fornasier and Stein, *Compensation of Nuclear Damage in Europe (Brussels 1965)*, 95 pp.

²¹) In the Additional Protocols four important amendments were made: the commencement and termination of the period of liability, the operator's exonerations, the extension of the period of limitation for nuclear materials stolen, lost, jettisoned, or abandoned, and the jurisdiction clause.

Problems of liability for nuclear hazards are of universal interest, whereas the Paris and the Supplementary Conventions deal with the problems primarily on a regional level. The IAEA became responsible for a universal solution. The Conference was held, after careful preparation, at Vienna in May 1963 with 58 states participating. It resulted in the Vienna Convention²²⁾.

In the light of the imminent commissioning of nuclear powered ships²³⁾, the conviction that the risks likely to arise from these devices would involve greater danger than ground installations, and that the operation of these mobile reactors would involve complicated relations between operators and (i) ship users, (ii) parties aboard a colliding ship, (iii) third parties on the land, at the 1959 Rijeka Conference of the International Maritime Committee a draft convention based on the major principles of the Paris Convention was drawn up. This was revised in 1960. On the basis of this draft, the Brussels Convention was subsequently concluded in 1962 with the agreement of the majority of participants²⁴⁾. Because of the inclusion of warships, this convention faces objections from both contemporary nuclear ship owners, the United States and the Soviet Union. As

²²⁾ In early 1961, immediately after the establishment of the Inter-Governmental Committee on Civil Liability, the Board of Governors of IAEA requested the Committee to work out a draft on minimum international standards regarding civil liability for nuclear damage. Accordingly, a draft was produced at the 1961 meeting and later was revised in the light of the governments' comments. For the text, see Final Act of the International Conference on Civil Liability for Nuclear Damage, IAEA CN/12/48, May 20, 1963. The Convention has been signed by China, Colombia, the Philippines and Yugoslavia at the time the Convention was opened for signature, and later on by Spain, the United Kingdom, and Cuba. The Republic of Cameroon has deposited an instrument of acceptance. For the minutes and documents of the Conference see, *Civil Liability for Nuclear Damage*, Official Records, Legal series no. 2, IAEA, Vienna, 1964 522 pp. For reference see S. C i g o j, *International Regulation for Civil Liability for Nuclear Risk*, 14 *International and Comparative Law Quarterly* 1965, p. 809.

²³⁾ There are more than thirty naval reactors, either land-based prototypes or sea-going units, for ships and submarines. The United States operates at least twenty nuclear powered submarines, excluding the nuclear powered carriers. The USSR possesses, it is said, a minimum of twelve nuclear submarines. The United Kingdom operates two. Currently two nuclear powered merchant ships are in service, the "Savannah" of the United States and the ice-breaker "Lenin" of the USSR.

²⁴⁾ The Conference was attended by 42 states and a few observers. 28 states voted in favour of the Convention, with ten objections which included the USA, USSR and Eastern European countries, and four abstentions from the Scandinavian countries. See K ö n z, *The 1962 Brussels Convention on the Liability of Operators of Nuclear Ships*, 57 *American Journal of International Law* 1963, p. 100; H a r d y, *Liability of Operators of Nuclear Ships*, 12 *International and Comparative Law Quarterly* 1963, p. 778. For the text, see 57 *American Journal of International Law* 1963, p. 268. The Convention has been signed by Belgium, China, Korea, India, Indonesia, Ireland, Liberia, Malaysia, Monaco, Panama, Philippines, Portugal, UAR, and Yugoslavia.

long as both of them refuse to accept, and no third operator is likely to be in favour of the Convention, so it will remain a dead letter. Assuming that it does come into operation, the Brussels Convention might have some bearing on the question under consideration.

III. APPLICABILITY OF THE LAWS

1. An Analysis of Transport Regulations

Both the IAEA and IATA Regulations aim at controlling and limiting the irradiation and contamination hazard of radioactive material. The irradiation risks are controlled by shielding, or by distance, or by limitation of the duration of exposure, or by a combination of these measures; the contamination hazards are regulated by proper packaging, careful storage, and limitation of external contamination of packages. Limitation of the quantity per package and shipment, and specifications for containers are combined in order to avoid accumulation of radioactivity. Particular emphasis needs to be given to the new IATA Regulations wherein more detailed rules can be found.

All radioactive materials are classified according to the degree of hazard and the nature of the substance – radioactivity, level of penetration, radiotoxicity, availability, contaminability and criticality – in order to apply adequate preventive measures respectively²⁵⁾. This classification would be most convenient for the authorities who apply the system, and for carriers and shippers who endeavour to comply with it. Each class is subject to different packaging requirements which increase with the degree of hazard. Since an effective measure for diminishing the risk is the limitation of the quantity of nuclear substances carried, it is imperative to limit the amount of the potentially more destructive types which may be contained in each package. Less destructive materials are allowed to accumulate in greater quantities. Once the material is packaged, minimum danger exists if the material contained is of a type which does not penetrate the package, provided that the package is not broken. A permissible low level external dose rate is prescribed in the regulations for cargo with penetrating effects.

The presence of nuclear material is indicated by a label system. In the case of those materials emitting penetrating radiation, the label is used to prevent the accumulation of an excess number of consignments at one

²⁵⁾ Under these classifications, 260 kinds of radioactive nuclides are enumerated.

location, while also warning those who carry and transport them. Distinctive coloured labels are used to represent the class of the consignment. Fissionable materials have to fulfil certain additional requirements and must be packaged in such a manner that conditions of criticality cannot foreseeably be reached in any transport accident. They are marked with yellow labels bearing cautions. Special regulations exist for handling and loading, in order to avoid the accumulation of packages. These include storage and carriage limitation, and minimum safety distance for passengers, cargo and for other radioactive packages.

Shipping documents must declare the nature, quantity, quality and the packaging of the consignment. In addition, for every shipment containing radioactive materials, the shipper must supply the air carrier with a certificate, issued and signed by the competent governmental authority in the country of origin, declaring that the consignment complies in all respects with safety regulations. Until all the requirements have been observed, the carrier will not accept the consignment.

2. An Analysis of the Liability Systems

(1) *Claims under International Air Law Conventions*

It is necessary to recall some of the basic liability principles of the international air law. They can best be illustrated by a comparison with those of the nuclear energy laws.

Both aviation and the use of nuclear energy are considered ultra-hazardous. From this point of view, a comparative survey reveals that principles such as absolute liability to third parties, extent of liability, limitation of liability and restriction on the number of *fora* are, at least in form, common to both. But nuclear danger is regarded as far more hazardous than aviation. This attitude is manifested in the substance of these common principles and in principles which are peculiar to nuclear liability²⁶⁾.

In air law, liability towards aircraft users is based on presumption of fault, whereas liability towards third parties is absolute. As to nuclear liability, the nuclear operator is absolutely liable to everybody without distinction. The range of persons held liable exhibits further dissimilarity. Thus, in aviation, the carrier (or the operator) is liable only for his own

²⁶⁾ For instance, liability with limitations is accepted in both regimes, but the amount of limitation differs significantly. For the convenience of comparison, all the important liability principles of the two systems are assimilated and listed in the Chart attached to this paper.

acts and the acts of his servants and agents done within the scope of employment²⁷). On the other hand, the nuclear operator is vicariously liable for all, including damage caused by persons (e.g. wrongdoers) who have no legal relations with him. Further, unless the damage was caused with intent, nuclear operators, subject to certain exceptions, are not granted a right of recourse against the wrongdoer²⁸).

Under the nuclear conventions, the onus of proof cast on the claimant is rather light; he is entitled to compensation provided he can prove that damage has been caused by a nuclear accident. In the Warsaw Convention, the carrier is not liable if he can prove that he and his servants and agents had taken all necessary measures or that it was impossible for him or them to take such measures²⁹). By contrast, the nuclear conventions reduce the possibilities of exoneration to specific circumstances such as the result of war, hostilities, or a grave natural disaster of an exceptional character³⁰). These more limited permissible exonerations of liability strengthen the right of the victim in nuclear accidents.

Financial guarantee of liability is considered beneficial to the victims in both cases, but in air law this principle is recommended³¹) or ignored completely (as in the Warsaw Convention and Hague Protocol) and its observance is left to the discretion of the carrier and the operator, whereas it becomes compulsory and indispensable in the case of nuclear liability. Further, because the financial protection required is rather high and beyond the capacity of commercial insurance, it has been found necessary for the state to partially indemnify the operator's financial burden³²). This is not the case in aviation damage.

Lastly, because air transport is widely used today, disputes should be settled without delay and a short limitation period is desirable. Accordingly, all claims are required to be brought within a period of two years. On the other hand, in the case of nuclear liability, where the delayed

²⁷) Article 25 of the Warsaw Convention and Article 14 of the Hague Protocol.

²⁸) Cf. *infra* note 53.

²⁹) Article 20 (1) of the Warsaw Convention. Article 5 of the Rome Convention limits the exonerations to direct consequences of aerial conflict or civil disturbance.

³⁰) Article 9 of the Paris Convention; Article 4.3 (a) and (b) of the Vienna Convention. However, the national legislation of the contracting state in whose territory his installation is situated may exclude the defence "a grave natural disaster of an exceptional character".

³¹) Cf. Article 15 of the Rome Convention which provides that "Any state may require that the operator of an aircraft ... shall be insured in respect of his liability for damage ...".

³²) For state indemnity see Section 13 (b) and (c) of the Swedish Act; Section 18 of the UK Nuclear Installations Act 1965; Article 2 of the Japanese Indemnity Law. (Detailed titles of this national legislation are given in note 34 *infra*).

appearance of radiation injury must also be considered, a longer period of limitation is necessary. Thus, a ten-year limit has been established, although this may not be long enough to cover all possible delayed effects. Moreover, claims may be amended even after the expiry of the period of limitation at any time before the rendering of final judgment³³).

(2) *Claims under National Laws*

Since 1959 about twelve countries have produced special legislation with regard to the question of nuclear liability³⁴), including the main legal systems of the world. Five important characteristics can be found in this legislation: (a) absolute liability for nuclear accident; (b) financially guaranteed limitation of liability for each accident with a range from \$ 5,000,000 to \$ 500,000,000; (c) channelling liability – all liabilities involving the nuclear installation or its nuclear materials are focused on the operator; (d) minimum exonerations of the operator's liability; (e) extended period of limitation, ranging from ten to thirty years, within which claims may be brought; and (f) limited liability³⁵).

Most of these laws apply to large nuclear activities such as reactors, fuel fabrication plants, reprocessing plants, and waste disposal facilities. They also include cases of transportation of nuclear materials connected with such activities within their own territories. Under the Swiss law, an operator who receives nuclear fuels and radioactive substances from a foreign country is responsible for damage caused in Switzerland in the

³³) Article 8(a), (c) and (d) of the Paris Convention; Article 6.1,3 and 4 of the Vienna Convention.

³⁴) For instance, the U.S Price-Anderson Act, the Nuclear Installation (Amendment) Act of 1965 (see below pp. 614–616) and the Nuclear Installations Act 1965 (United Kingdom), the Federal Act on the Peaceful Uses of Atomic Energy and Protection against its Hazards of 1959 (Germany), the Federal Act on the Peaceful Uses of Atomic Energy and Protection against Radiation of 1959 (Switzerland), the Act on Compensation for Damage Caused by the Operator of Nuclear Reactor 1964 (Sweden), the Law Concerning Compensation of Nuclear Damage and the Law Concerning Nuclear Damage Compensation Indemnity Contracts of 1961 (Japan), and the Law Relating to the Civil Responsibility of the Nuclear Energy Study Centre 1962 (Belgium). Other countries such as Italy, Austria, France, the Netherlands and Spain have also passed legislation.

³⁵) See Chart on liability principles in international air law and nuclear energy laws attached to this paper. For further detailed references to the national legislation see Weinstein, *Nuclear Liability*, vol. 3, Law and Administration (New York 1962; hereinafter referred to as Weinstein, *Nuclear Liability*); Third Party Liability in the Field of Nuclear Energy, Pan American Union, General Secretariat, OAS, Washington 1962, pp. 25–36; Cavers, *Improving Financial Protection of the Public against the Hazards of Nuclear Power*, 77 *Harvard Law Review*, 1964, p. 664 *et seq.*; Weinstein, *Nuclear Liability in Western Europe*, *Nuclear Engineering* 1963, p. 433.

course of their carriage to his plant³⁶); the Japanese law makes the consignee liable for damage caused as the result of the conveyance of nuclear fuels between operators³⁷); the United States indemnity coverage applies to public liability arising in the transport of special nuclear materials and the highly radioactive spent fuels to and from reactors³⁸).

Special attention needs to be drawn to the Nuclear Installations (Amendment) Act 1965 of the United Kingdom³⁹). It represents the first, and so far the only, undertaking of this kind by municipal legislation to implement the civil liability conventions for ground nuclear installations, viz. the Vienna, Paris and the Supplementary Conventions. By an extremely complex measure, but with equally admirable techniques, this new Act not only has amended the existing laws but has also achieved the object of enabling the United Kingdom to ratify all the three conventions simultaneously. No doubt, it will serve as a model and provide an impetus for similar legislation elsewhere. The Act will shortly be brought into effect by an Order in Council with different dates fixed for different parts, as and when this is desired.

The material scope of the Act follows that of the Conventions, though with simpler technique and varied terminology⁴⁰). It is thus sufficient to extract certain important features:

(a) Operators' liability, including that of foreign operators, covers incidents on site and to irradiated nuclear fuel in carriage in the United Kingdom (this was the scope under the 1959 Act) and, generally speaking, occurrences anywhere outside the United Kingdom if the operators have an interest in the materials. Compensation is not, however, payable for injury or damage when it takes place in the territories of other countries even if these are the contracting parties. This is so, on the one hand, because it is expected that other countries will enact similar legislation

³⁶) Articles 12 and 13 of the Swiss Act (for the title of the Act see *supra* note 34).

³⁷) Article 3.2 of the Law Concerning Compensation of Nuclear Damage. See H o s h i n o, Nuclear Liability Legislation of Japan, 7 The Japanese Annual of International Law 1963, pp. 38-57.

³⁸) AEC § II. t., 42 U.S.C. § 2014 (y) 1958. For a more comprehensive study of the US nuclear legislation in relation to international transactions, see C a v e r s, *op. cit. supra* note 35.

³⁹) The text of the Act has been published by HM Stationary Office, London. This Act is to make new provision in place of or amend certain provisions of the Nuclear Installations (Licensing and Insurance) Act 1959 so as to give effect to certain international agreements. The Nuclear Installations Act 1965 which was passed by Parliament on August 5, 1965 is an act to consolidate the previous acts. For reference see The Nuclear Installations (Amendment) Act 1965, EuroNuclear, pp. 389-391, August 1965.

⁴⁰) See *infra* p. 616 *et seq.*

making foreign operators, including British, liable for any nuclear incidents they may cause within their territories, and on the other, to prevent other countries from taking advantage of this Act.

(b) The maximum liability of an operator for each incident is fixed at £ 5,000,000. However, claims that cannot be satisfied under this limit are entitled to be compensated out of the funds by means of a foreign contribution (this is anticipated under the Supplementary Convention) and/or out of the funds up to a total amount of £ 43,000,000 provided by Parliament⁴¹). Section 3 of the Act imposes on foreign carriers an absolute and unlimited liability in respect of incidents caused in this country by nuclear materials in transit in the United Kingdom.

(c) Nuclear operators are, subject to certain exceptions, exclusively liable for damage caused under the Act. Any right given by the Carriage of Goods by Sea and the various Carriage of Goods by Air Acts and any future acts of this kind is specifically preserved thereunder⁴²). The Act does not affect the ordinary duty of a nuclear operator at common law in cases where the harm is caused partly by a breach of duty and partly by the emission of radiation but not a breach of the Act. However, a plaintiff cannot recover damages both under the Act and otherwise.

(d) It is possible that someone other than the person who violates the Act may, in fact, be required to pay compensation (a typical example would be an aircraft operator under the Warsaw Convention). This person may claim for what he has paid but not exceeding the limit mentioned above.

(e) Claims by transport operators are subject to certain limitations. No payment for damage to transport will be made so as not to prevent the satisfaction of all other claims up to an aggregate of £ 1,750,000 which have been or may be established against the person responsible for the incident⁴³). The transport operators' ordinary legal rights, apart from this Act, are specially preserved in cases where a foreign operator is not required to pay compensation under this Act.

(f) In cases of transportation, certain particulars must be given to the carrier. These include a document issued by or on behalf of the guarantor for the financial guarantee of nuclear liability, which states appropriate details of the person for whom the nuclear matter is being carried, of the nuclear material and of the funds available. Furthermore, it is specifically

⁴¹) Section 8 of the Nuclear Installations (Amendment) Act.

⁴²) *E.g.* Acts that might be passed to implement the Geneva Convention for international road carriage of goods.

⁴³) Section 10 of the Act.

provided that the guarantor is debarred from disputing any of these particulars in any court. This is to provide maximum protection and security for the victims.

(g) Lastly, to avoid any possible misinterpretation, it is expressly stipulated in the Act that in a question of liability under the law of a country that is not a party to the Supplementary Convention but a party to the other civil liability conventions (*i. e.* the Vienna and Paris Conventions), the compensation payable is limited to £ 5,000,000. This is to prevent claimants of non-Supplementary Convention contracting parties from taking advantage of the higher limit of compensation payable under the Supplementary Convention⁴⁴).

(3) *Claims under Nuclear Civil Liability Conventions*

A. Temporal Scope

The ground nuclear installation liability conventions give priority to the express terms of the contract between the nuclear operators with regard to the temporal scope of their responsibility⁴⁵). In the absence of an express clause, it is the person actually in charge of the substance who is liable⁴⁶). For carriage involving non-contracting states, different rules apply. The shift of responsibility, which differs from that of the Warsaw Convention and might cause some difficulty, is made at the moment when the material has been loaded on or unloaded from the vehicle. The object of this provision is to ensure that an operator of a contracting party will,

⁴⁴) Article 13 of the Vienna Convention provides that "This Convention and the national law applicable thereunder shall be applied without any discrimination based upon nationality, domicile or residence". Thus, it is debatable whether the UK 1965 Act has discriminated against nationals of Non-Supplementary Convention contracting parties. The issue was one of the most controversial ones during the Vienna Conference. The majority viewed this kind of provision as discriminatory. See its proceeding, *op. cit. supra* note 22, p. 443 *et seq.* For the following reasons, the author believes that this is not a discrimination in the meaning of article 13 of the Vienna Convention. It would be unreasonable to require a higher financial compensation to nationals whose right was derived from a different convention. This is not in the real meaning of discrimination, for fair and adequate compensation will be given according to the Vienna Convention which itself stipulates a limit of compensation. From the practical point of view, this interpretation would prevent parties to the Paris and Supplementary Conventions from adhering to the Vienna Convention and thus the objective of universal application would not be achieved.

⁴⁵) Article 3 of the Paris Convention was amended by Article 4 (a) (i) of the Additional Protocol of January 1964 and was thus identical to the Vienna Convention.

⁴⁶) Article 2.1 (b) and (c) of the Vienna Convention; Article 4 of the Paris Convention was amended, making it identical to the Vienna Convention, by Article 4 of the Additional Protocol.

in any given case, be responsible for any damage occurring in the territory of another contracting party during transit.

B. Two Rights of Action

In order not to affect the rights of the claimants under the existing laws in the field of international transport, because of the provision of concentration of liability, the ground nuclear conventions preserve these original rights⁴⁷⁾. An aircraft user or a third party on the surface who has suffered nuclear damage either during the flight or by aircraft in flight⁴⁸⁾ is, therefore, entitled to two bases of recovery. The claimants can theoretically bring an action both under the provisions of the air law conventions involved, because neither the Warsaw nor the Rome Convention prohibits such an exercise⁴⁹⁾, and under one or all of the nuclear conventions as the case may be. Since the national law of some countries prohibits double compensation, in practice these rights may turn out to be simply a matter of choice⁵⁰⁾. On the other hand, if there is no other international convention applicable simultaneously to the case, the nuclear conventions will be applied exclusively.

The Brussels Convention accepts, however, the channelling liability to such an extent that rights granted by international agreements in the field of sea transport are completely absorbed by the nuclear ship operators' liability⁵¹⁾.

C. Right of Recourse

An examination of the relevant articles in the ground nuclear conventions⁵²⁾ reveals that the transport entrepreneur is provided with a right

⁴⁷⁾ Exposé des Motifs, 27 Journal of Air Law and Commerce 1960, p. 387.

⁴⁸⁾ Article 1 of the Warsaw and the Rome Conventions. For literature see notes 14, 15 and 16 *supra*.

⁴⁹⁾ Article 10 of the Rome Convention. Since the Warsaw Convention does not either implicitly or expressly prohibit this right, and furthermore, since the Convention was intended only to "unify certain rules", the victims are not prevented from claiming compensation under other laws. See also relevant discussion below.

⁵⁰⁾ For the issue of double recovery, see Rosevear, Wrongful Death Action under the Canadian Carriage by Air Act, 38 Canadian Bar Review 1960, p. 217; Paterson, Wrongful Death Action under the Canadian Carriage by Air Act, *ibid.*, p. 635; see also Ehrenzweig, Assurance Oblige, A Comparative Study, 15 Law and Contemporary Problems 1950, p. 450. This analysis of right of choice is based on the presumption that the countries involved are parties to at least one of the nuclear conventions and to at least one of the air law conventions. The United Kingdom is a typical example of this kind. Otherwise the conclusion is not valid. Cf. above p. 615.

⁵¹⁾ Articles 2.1 and 3.1 of the Convention.

⁵²⁾ Article 6 (c) of the Paris Convention states, "Any person who is liable for damage caused by nuclear incident under any international agreement ... or under

of recourse against the nuclear operator who entrusted the nuclear consignment to him. He may recover from him the compensation which has been paid for. Since the Conventions exclude the damage to or loss of the means of transport upon which the nuclear substances were loaded⁵³), the entrepreneur will have to claim compensation outside the Conventions. Similar provisions are found in the Brussels Convention⁵⁴).

D. Nuclear Damage

Actually, whether air claimants could take advantage of the nuclear conventions depends on whether or not damage to them was "nuclear damage" caused by a "nuclear incident" within the meaning of the Conventions. All the nuclear conventions define nuclear incident in such a way as to include any occurrence, or series of occurrences having the same origin which cause nuclear damage. Nuclear damage means loss of life and property, personal injury and damage to property which "arises out of or results from radioactive properties" or a combination thereof⁵⁵). Thus, the mere fact that an aircraft carrying nuclear materials crashes on the surface or on a nuclear ship does not make the conventions automatically applicable. It depends on the facts and circumstances of the particular case. If the incident is considered as such, the carrier could recover not only for the radioactivity damage but also for the impact damage to the passengers and cargo⁵⁶), otherwise, only for that damage directly related to the nuclear material aboard. In collision with a nuclear ship, the air operator may claim even for the loss of, and loss of use of, his aircraft⁵⁷). Damage

any legislation of a non-Contracting State shall have a right of recourse, within the limitation of the amount of liability established ... against the operator liable for that damage in accordance with this Convention".

Article 9.2 (a) of the Vienna Convention provides, "If a person who is a national of a Contracting Party, other than the operator, has paid compensation for nuclear damage under an international convention or under the law of non-Contracting States, such a person shall, up to the amount which he has paid, acquire by subrogation the right under this Convention of the person so compensated ...".

⁵³) Articles 3 (a) (ii) 2 and 6 (c) of the Paris Convention; Article 4.5 (b) and 4.7 (b) of the Vienna Convention. Nuclear materials means nuclear fuel, capable of producing energy by a self-sustaining chain process of nuclear fission outside a nuclear reactor, as well as radioactive products or waste. See Article 1 (a) (iii) and (v) of the Paris Convention and Article 1.1 (f) and (h) of the Vienna Convention.

⁵⁴) Articles 2.6 and 11.5 (a) of the Convention.

⁵⁵) Article 1 (a) (i) of the Paris Convention and Article 1 (k), (i) and (l) of the Vienna Convention.

⁵⁶) A complete inclusion of all the damage in these circumstances is a misinterpretation of the intention of the contracting states and is an abuse of the provision of concentration of liability.

⁵⁷) This is a literal interpretation of Article 2. Under the Convention, exception is

to the third parties and nuclear pollution and contamination thereof are, however, nuclear damage. In an ambiguous circumstance, in which it is uncertain whether or not damage is nuclear, it is advantageous that it be deemed nuclear⁵⁸).

E. Concurrent Applications

It is reasonable to foresee that more than one of the nuclear liability conventions, apart from the air law convention concerned, might concurrently be applicable in cases of collision with a nuclear ship, a ground nuclear installation, or a surface transport (land or water) on which nuclear substances are located. The whole case might become even more complicated if there were an aerial collision of two aircraft carrying nuclear material which fell on the previously stated objects. These situations deserve separate consideration.

It is quite simple when the situation does not involve the Brussels Convention, since the ground nuclear conventions have already provided that all nuclear operators involved are liable jointly and severally⁵⁹).

A case of collision between an aircraft and a nuclear ship could in theory result in the simultaneous application of three separate conventions: the nuclear ship convention, the ground nuclear convention and the air law convention. The question arises: (a) how to solve the conflicts arising from the first two separate conventions; and (b) under what situation could the air transport users and the third parties on the surface still have two rights of action: one under the air law conventions and the other under the nuclear conventions.

In any of these case, the damage could be extremely high and the parties involved would be many. It is necessary not to concentrate all the liability on either the nuclear ship operator or the ground nuclear operator alone. Since there is no specific provision and it is suggested that such concentration would not be in accordance with the intention of the contracting states, had they foreseen this possibility, for the benefit of the potential claimants, all nuclear operators involved should be liable jointly and severally⁶⁰).

made only in circumstances wherein the nuclear incident results from a personal act or omission done with intent to cause damage and then a right of recourse is given to the nuclear operator against the wrongdoer. Article 2.6 of the Convention.

⁵⁸) Article 4 of the Vienna Convention.

⁵⁹) Article 2.3 (a) of the Vienna Convention; Article 5(b) of the Paris Convention 1960 as amended by Article 5 (d) of the Additional Protocol.

⁶⁰) Article 16 of the Vienna Convention should, however, be noted. "No person shall be entitled to recover compensation under this Convention to the extent that he has recovered compensation in respect of the same nuclear damage under another international convention on civil liability in the field of nuclear energy".

A possible danger exists, however, in that it may be argued by a literal interpretation that Article 14 will apply to the Paris Convention when it comes into force and that the Brussels Convention will override the Paris Convention⁶¹⁾, because it provides that,

“This Convention shall supersede any International Conventions in force or open for signature, ratification or accession at the date on which this Convention is opened for signature, but only to the extent that such Conventions would be in conflict with it; however, nothing in this Article shall affect the obligations of Contracting States to non-Contracting States arising under such International Conventions”.

True, the Paris Convention was first concluded in 1960 and thus falls literally into the scope of article 14. It is suggested, however, that this was not the intention of the contracting parties. What they had in mind was probably the international conventions in the field of sea transport. The evidence is handicapped by the fact that the preparatory work of the Brussels Convention was not officially published⁶²⁾. But for the reasons given above, it is desirable to make the operators involved liable jointly and severally.

One may recall that the Rome Convention is applicable to collision between aircraft and ships in territorial waters and on the high seas⁶³⁾. A case of collision of the two objects would make both Conventions simultaneously applicable. In view of Article 14 cited above, the Brussels Convention prevails in a conflicting application⁶⁴⁾. The rights of the third parties granted under the Rome Convention are, therefore, absorbed by it and thus they do not have any right against the aircraft operator, if their actions are brought under the Brussels Convention. Similarly, the Brussels Convention shall supersede the Warsaw Convention in an air crash case and thus

⁶¹⁾ The Brussels Convention will not come into operation, unless one of the two minimum required ratifications is that of a state which operates a nuclear ship. The United States has bilaterally approached many countries (about ten) which she intended to visit. Prior to the maiden voyage of the nuclear ship Savannah, the US succeeded in concluding agreements with Greece, Germany and Belgium for admission of the nuclear ship to the ports of these countries. The agreements require the US to ensure the safety of the ship according to the Safety of Life at Sea Convention of 1960. Liability involving the vessel is financially guaranteed by the US governmental indemnity of \$ 500,000,000 per incident.

⁶²⁾ This point was not mentioned in the literature cited above in note 24. Cf. Cigoj, *op. cit. supra* note 22, p. 815.

⁶³⁾ Article 29 of the Rome Convention.

⁶⁴⁾ The unstated assumption is that all the contracting parties involved in the case are identical to both Conventions. Otherwise, it is entirely up to the parties involved to decide the prevailing one. See Schwarzenberger, *A Manual of International Law*, 4th ed. vol. 1, p. 151.

the nuclear ship operator becomes vicariously liable for the air carrier. If, however, their actions are brought under the ground nuclear installation liability conventions, their rights under the air law conventions are still preserved and thus they still have two rights of action.

IV. ADEQUACY OF THE LAWS

1. The Preventive Measures

Safety regulations for carriage of nuclear materials are but one important link in the series of preventive measures. At present, a complete system is lacking. It might be necessary, for instance, to designate special air routes to avoid any conceivable danger or to minimize the possibility of greater damage. It is evident that a nuclear flight incident occurring in a thickly-populated area would cause greater harm. This is equally true of accidents taking place in an industrial area. From this point of view, it may be desirable to prohibit flights in the immediate airspace adjacent to these areas. In certain cases, the assignment of particular airports might be needed for aircraft loaded with large quantities or high qualities of radioactive substances. Regulations are also needed for nuclear pollution, contamination and for de-contamination. These preventive measures have not been undertaken by any international organization.

In addition, the following minor but valuable technical observations may also be propounded on the otherwise adequate regulations for carriage of radioactive materials:

(a) Neither the IAEA nor the IATA regulations require the supply of monitors either by the carrier or the shipper. To provide knowledge of radioactivity during the transport, it would be necessary to require this equipment. Cargo shipped with large radioactive consignments could thus be checked each time after unloading. This would make early discovery of over-exposure or radiation leakage possible so that further damage could be prevented. What is more important from the legal point of view, is that this would result in the supply of evidence. Litigations in radiation injury cases could thus be greatly facilitated.

(b) The IAEA Regulations fail to make different requirements for the loading of nuclear consignments in passenger and cargo aircraft. It seems that varied conditions should be considered, since the environments differ.

(c) International institutions concerned have not taken adequate action on the question of permission usually required for international transit by countries concerned. At present, in order to transport one gramme of ura-

nium from one country to another, it usually takes months to obtain permission due to the complicated procedure. The difficulty is created in part by the numerous documents required, varied standards of condition for packaging and carriage, and the question of insurance. This makes it impossible to cope with the need for rapid transaction for nuclear industry and research. The question of simplification of procedure has been too long neglected. This "by-product" consequence has to be solved, if a system of preventive measures is considered practicable.

2. The Liability System

(1) *Shortcomings of the Air Law Conventions*

The existing private international air law conventions were designed for conventional aircraft involved in non-nuclear accidents. The amount of compensation was expected to meet damage caused by such incidents, and liability principles embodied were adopted in the light of these circumstances. The uses of nuclear energy are highly technical and scientific, and beyond the common knowledge both of the advocate and of the court. It would often be difficult for the plaintiff to produce necessary evidence, even with the assistance of experts. Radiation injury and genetic effects will in many cases only become evident after a long period of time. Even when these effects become manifest, their ultimate consequences cannot be predicted. Moreover, the exceptionally high cost of reparation is another important factor.

It is very unlikely that an accident during nuclear carriage could produce a nuclear explosion or result in nuclear damage as great as that from a reactor. Yet both pollution and contamination of the environment are highly possible. Because of the speed and the force of impact of the aircraft, the consequences are likely to be felt over a much wider area of land. From this point of view, the compensation required will be similar in amount. The financial protection prescribed in international and national nuclear liability legislation⁶⁵⁾ immediately indicates the necessity for reconsideration of the sum of compensation available under the Rome Convention. (At present, the maximum liability is about \$ 1,300,000⁶⁶⁾). The case of Windscale requiring a compensation of more than \$ 6,000,000 also

⁶⁵⁾ See the Chart.

⁶⁶⁾ Under the Rome Convention, Article 12, the over-all liability of the aircraft operator is formulated according to the maximum weight of the aircraft involved. For the commonly used Boeing 707-420 and DC-8-40, the liability accordingly amounts to 19,000,000 frs. (approximately \$ 1,280,000). The liability per person is limited to \$ 33,334.

demonstrates the financial inadequacy of the Rome Convention⁶⁷⁾, if it is to deal with surface damage involving radioactive pollution or contamination.

Both the Warsaw and the Rome Conventions grant a victim only the short period of two years within which to bring his claim⁶⁸⁾. If the plaintiff brings his action immediately without knowing the exact extent of the damage, the compensation may not be commensurate to his actual injury. A judgment obtained by him would usually bar any claim for additional resulting injury⁶⁹⁾. If, however, he were to wait until concrete signs of injury emerged, he might be time-barred. Moreover, under the Rome Convention the claimant has to bring a notification of his claim within a period of six months from the date of the incident. Unless the claimant acts within this time limit, he is entitled only to the amount of compensation left over after all claims made within the period have been met in full⁷⁰⁾. In claims for radiation injury, this provision causes additional difficulty. In short, at present, a victim either receives no compensation whatsoever, if he has no knowledge of the injury or if his injury appears after the period of limitation, or if the danger is recognized, his compensation is inadequate.

In addition, there is the difficult question of proof. The passenger, for example, according to the Warsaw Convention⁷¹⁾, has to prove not only that the injury was sustained during a flight (or flights) but also that it was related to a particular airline or with a particular flight. Clearly, the proof of a causal link with a particular airline or with a particular flight would be difficult, if not impossible. A third party on the surface might also have to face this difficulty, for damaging effects could result, in theory, from the cumulative effects of radiation from other sources such as industry, medicine, fall-out, or nuclear waste.

⁶⁷⁾ The accident took place in England on October 10, 1957. It is one of the most costly nuclear pollution cases. Milk from the surrounding farms in a 200 square mile area had to be destroyed. For details of the case, see Accident at Windscale, Cmnd. 302, November 1957. A comprehensive review of four hundred nuclear incidents (from 1943 to 1960) has been given by S m e t s, Review of Nuclear Incidents, in: W e i n s t e i n, Nuclear Liability, *op. cit. supra* note 35, pp. 89-165.

⁶⁸⁾ The period of limitation is reckoned from the date of arrival at the destination, or from the date on which the carriage ought to have arrived, or from the date on which the transportation stopped. (See Article 29 (1) of the Warsaw Convention). Under the Rome Convention, the time begins from the date of the accident which causes the damage (Article 21.1).

⁶⁹⁾ Cf. *supra* note 50.

⁷⁰⁾ Article 19 of the Rome Convention.

⁷¹⁾ Article 17, see *infra* note 74.

(2) *Shortcomings of the National Nuclear Legislation*

Adopting the highest financial protection 500,000,000 \$ and the longest period of limitation (30 years) among the national nuclear legislation as standards of two important desirable rules, the chief defects of national legislation are either low level financial protection or insufficient temporal safeguards, or in some cases both. The merits of these laws cannot, however, be denied. At least, they do provide a remedy for cases taking place in their own territories.

In view of the limited geographical scope of their application and, thus far, the small number of twelve countries which have enacted such legislation, cases of international air carriage of radioactive materials may still well be left out of protection. Unless the shipper, the consignee or the airline has perchance some assets in a foreign country, these victims will have difficulty in obtaining compensation. It is possible, however, for the victim to sue the shipper, the consignee or the airline in their home state. Before any compensation can be recovered, if there is to be any at all, the claimant is bound first of all to incur great expense.

(3) *Shortcomings of the Nuclear Liability Conventions*

Potential air transport litigants should be able to benefit from the double coverage and a right of recourse granted under the Conventions.

The provisions are, compared with those of international air law, more satisfactory and convenient. Notably, the principle of absolute liability greatly favours potential claimants; the financial protection is far higher and the period of limitation is five times as long. Yet, the following shortcomings should equally be noticed.

First, since their major purpose is designed for risks of an exceptional character and nuclear accidents occurring at or in connection with nuclear installations, their application to the problems under consideration is, therefore, limited. True, at present, most of the major shippers transporting nuclear materials are probably included within the definition of "nuclear operator" or "nuclear installations"⁷²). In the future, nuclear energy will be administered by a greater number of private persons and institutions which may very well not relate to reactors⁷³). The present scope of defini-

⁷²) Nuclear operator means the person designated or recognized by the installation state as the operator of an installation. Nuclear installation includes any factory using nuclear fuel for the production of nuclear material, or any factory for the processing of nuclear material, including any factory for the reprocessing of irradiated nuclear fuel, and any facility where nuclear material is stored, other than storage incidental to the carriage of such material.

tion will not be able to cope with the situation. Even today, the gap does exist. For instance, a large amount of radioisotopes for industrial, agricultural, medical, or scientific purposes is transported by air and yet does not fall within the definitions. Nor is the transport of fissionable material between research laboratories included. Consequently, claims for harm arising in these cases are still governed by existing laws and will continue to be so governed.

Secondly, assuming that these Conventions would eventually be ratified and come into operation, the gap should be noted and, if desirable, be bridged. This gap is created by the different periods of responsibility of the air carrier and of the nuclear operator. The Warsaw Convention requires that the carrier be liable as long as the consignment is in his custody⁷⁴⁾, while the nuclear conventions terminate the operator's responsibility when the substances have been unloaded from the means of transport by which the material was consigned to a destination in a non-contracting state⁷⁵⁾. There is, therefore, one case in which the air carrier only is responsible.

Finally, from the victim's viewpoint, the absence of a remedy for radiation injury appearing after the ten-year period is also a defect in the law⁷⁶⁾.

⁷³⁾ The United States has already passed the law allowing private ownership over special fissionable nuclear materials. The purpose is for commercial reasons to encourage nuclear industry. Governmental control is, however, not decreased. For details see literature cited above in note 3.

⁷⁴⁾ Articles 17 and 18 of the Warsaw Convention, which have not been modified by the Hague Protocol, outline the carrier's liability. Article 17 reads, "The carrier shall be liable for damage resulting in the event of the death or wounding of a passenger or any other bodily injury suffered by a passenger, if the accident which caused the damage so sustained took place on board the aircraft or in the course of any of the operations of embarking and disembarking".

Article 18 reads in part, "(1) The carrier shall be liable for damage sustained in the event of the destruction or loss of, or of damage to, any checked baggage or any goods, . . . (2) The transportation by air within the meaning of the preceding paragraph shall comprise the period during which the baggage or goods are in charge of the carrier, whether in any airport or on board an aircraft, or, in the case of a landing outside an airport, in any place whatsoever".

⁷⁵⁾ Article 1 (b) (iv) and (c) (iv) of the Vienna Convention; Article 4. (a) (iv) and (b) (iv) of the Paris Convention.

⁷⁶⁾ The Conventions do, however, allow national legislation to establish a period longer than ten years if measures have been taken to cover the liability of the operator in respect of any actions for compensation begun after the expiry of the period. (See article 8 (c) of the Paris Convention of 1960). This provision did not appear in the Vienna Convention. The right to do so is certainly within the authority of the contracting states themselves even without this express provision.

V. CONCLUSION

The above examination has showed that the solutions therein envisaged are inadequate to the problems posed by the peculiar features of the subject. The existing preventive measures take effect only in regulations for carriage of radioactive materials. These laws form only part of a complete system. Because of the limited amount, and the restricted geographical application of national nuclear legislation, the municipal framework cannot provide sufficient solution. International air law conventions are also inadequate because of the short period of limitation on the one hand and the insufficient financial protection on the other. Irrespective of the fact that the nuclear liability conventions were not particularly designed for the protection of air victims or to regulate international air carriage of nuclear substances, and regardless of their shortcomings, they are to a certain extent applicable to the question under consideration. Some air victims can be better compensated under these conventions. Occasionally, the air transport entrepreneur might also be protected. However, the operation of these conventions must await sufficient ratifications and wide national implementation.

It may well be argued why the victims of a nuclear accident should be treated differently from other air transport users or third parties on the surface. Does nuclear damage deserve more compensation than an ordinary air crash in which a hundred or more passengers may be killed? From this point of view, the position of the air transport users in a nuclear accident hardly needs more consideration. If, however, their protection as a whole is to be considered, this newly introduced hazard cannot be ignored. The dangers of air transport have been multiplied with the carriage of nuclear substances and have gone far beyond the original conditions⁷⁷).

Certain necessary and effective steps must be taken along the following lines in order to (a) forestal and minimize the occurrence of flight nuclear accidents, and (b) to provide sufficient remedies for the victims, should the preventive system break down.

The existing regulations can be greatly improved by widening their scope. Provided that a nuclear transaction will not be impeded, a complete and systematic preventive measure should include the control of aircraft carrying radioactive materials, and the control of nuclear pollu-

⁷⁷) The revision of the Rome Convention of 1952 has already been proposed by the ICAO Legal Committee. Questionnaires have been distributed to member states and other interested parties, in order to discover the reasons for the delay of ratification. The revision, if necessary, will be prepared and conducted in the light of the findings by the Committee. (See ICAO Doc. LC/SC/Rev. Rome no. 9, 30/3/65).

tion and contamination, in addition to the present safety regulations for the carriage of radioactive materials. To facilitate this system, it is necessary to provide an uniform and simplified procedure for nuclear cargo in transit. Top priority should be given to these matters. The task calls for the urgent attention and co-operation of various international organizations and national governments.

With regard to the question of liability, on the national level, a wide enactment of nuclear legislation is desirable. The countries which are less advanced in nuclear activities should, in order to protect their own nationals, accept the nuclear liability conventions now open for ratification. The more advanced nuclear powers should also accept these conventions for the promotion of their nuclear industries and their protection from unlimited liability which would otherwise be imposed on them⁷⁸). A model legislation has already been enacted by the United Kingdom. It would not thus be unrealistic to expect more like this.

On the international level, it may be said in this respect that the best way to meet such a contingency is to conclude a separate international convention⁷⁹). Future action and need, however, must be based on the evaluation of the practice of the preventive measures and the factual situation of international conveyance of nuclear carriage. A practical result can only be achieved when closer observation between relevant studies, *i.e.* law and science, has been made.

⁷⁸) Their acceptance would accelerate the rate at which other states followed suit, and would provide a more secure market for their nuclear exporters.

⁷⁹) The substances of the proposed convention, which is beyond the scope of this paper, is dealt with elsewhere. (See the author's *Liability for Nuclear Damage ...*, *op. cit. supra* note 4, p. 100 *et seq.*). The inquiry extends to the scope of the convention, the nature, the extent, the period, and the limitation, of liability, the period of limitation, defences, recourse, financial security, and jurisdiction.

**Chart On Liability Principles in
International Air Law and Nuclear Energy Laws**

Title	Pr	NL	CL	LL	PL	FLI	PLi	GI	De	LR	Ju	CI
International Nuclear Liability Conventions	PC	AL	Y	5-15 M	10 yrs		Op		ME	Y	PA/LS	Y
	SC	AL	Y	120 M	10 yrs	Y	Op		ME	Y	PA/LS	Y
	VC	AL	Y	5 M	10 yrs		Op		ME	Y	PA	Y
	BC	AL	Y	100 M	10 yrs		Op		ME	Y	LS/PA	Y
National Nuclear Legislation	US			500 M			Op	Y				Y
	UK	AL	Y	15 M	30 yrs	Y	Li		ME	Y		Y
	Ge	AL	NA	125 M	30 yrs		Op	Y		Y		Y
	Sz	AL	Y	8 M	10 yrs	10 yrs	Op		Y	Y	IS/PA	Y
	Sw	AL	Y	5 M	10 yrs	30 yrs	Op	Y		Y		Y
	Ja	AL	Y	NoL	20 yrs		Op	Y	Y	Y	Y	Y
Air Law Conventions	WC	Ft	NA	\$ 8660 pp	2 yrs		Cr		Y	NA	Mj	
	HP	Ft	NA	\$ 16600 pp	2 yrs		Cr		Y	NA	Mj	
	RC	AL	NA	\$ 33334 pp	2 yrs		Op		Y	NA	PA	Re

(blank means either "no" or "no reference in the provision")

Legend

AL	==	Absolute Liability	NL	==	Nature of Liability
BC	==	Brussels Convention (nuclear)	NoL	==	No Limit
CI	==	Compulsory Insurance	Op	==	Operator (nuclear operator or aircraft operator)
CL	==	Channelling (or Concentration) of Liability	PA	==	Place of Accident
Cr	==	Carrier	PC	==	Paris Convention, 1960 (nuclear)
De	==	Defence	PL	==	Period of Limitation
FLI	==	Fund for Latent Injury	PLi	==	Person who is liable
Ft	==	Fault	pp	==	per passenger or per person
Ge	==	Germany	Pr	==	Principles
GI	==	Governmental Indemnity	RC	==	Rome Convention (air)
HP	==	Hague Protocol (air)	Re	==	Recommended
IS	==	Installation State	SC	==	Supplementary Convention (nuclear)
Ja	==	Japan	Sw	==	Sweden (nuclear)
Ju	==	Jurisdiction	Sz	==	Switzerland (nuclear)
Li	==	Licensee	UK	==	United Kingdom (nuclear)
LL	==	Limitation of Liability	US	==	United States (nuclear)
LR	==	Limited Right of Recourse	VC	==	Vienna Convention (nuclear)
LS	==	Licensing State	WC	==	Warsaw Convention (air)
M	==	Million dollars per accident	Y	==	yes
ME	==	Minimum Exoneration	Yrs	==	years
Mj	==	Multiplicity of Jurisdictions			
NA	==	Not Applicable			