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INTERNATIONAL REGULATIONS FOR THE SAFE TRANSPORT OF DANGEROUS GOODS

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Abstract

The volume of dangerous goods carried by air increases year by year. Most of these are transported with due regard to the applicable international and national regulations and so travel safely. However a small proportion, not in compliance with the rules, have caused accidents in the past and are liable to do so again. The source of these rules is the multi-modal United Nations 'Recommendations On The Transport Of Dangerous Goods'. The development of this document is described, together with its adaptation to the special characteristics of the air mode in the ICAO 'Technical Instructions For The Safe Transport Of Dangerous Goods By Air'. The ICAO requirements, which would ensure the safety of such transport, are sometimes disregarded. The reasons for this are discussed and suggestions made for achieving a higher level of compliance.

Introduction

At the mention of carrying dangerous goods by air, the first reaction usually is: what are these dangerous goods?; followed closely by: if they are dangerous why allow them to be carried? It is the intention of this paper to explain what types of goods are involved and to show that any attempt to ban their carriage would be unwise - indeed unsafe! There are many goods which have a potential for danger, but very few that cannot be carried safely if suitable rules have been devised and these are followed carefully. International regulation and the consequential national legislation are ensuring an ever higher standard of safety in this 'dangerous' aspect of aviation.

What are Dangerous Goods?

The dry definition of dangerous goods is: 'Articles or substances which are capable of posing a significant risk to health, safety or property'. The qualification 'significant' is important as the vast majority of substances will burn in some circumstances or will harm your health if consumed in sufficient quantity. The internationally accepted system of classification divides the hazards into nine classes, with some of the classes further split into divisions. These classes are:

Class 1 - Explosives; such as sporting cartridges, fireworks and oilwell charges.

Class 2 - Gases: compressed, liquefied, dissolved under pressure or deeply refrigerated; such as therapeutic oxygen, industrial acetylene, aerosols and fumigants.

Class 3 - Flammable liquids; for example the higher concentrations of alcohol, thinners and solvents.

Class 4 - Division 4.1 Flammable solids (matches,charcoal, cellulose film).
Division 4.2 Substances liable to spontaneous combustion (yellow phosphorus)
Division 4.3 Substances which in contact with water, emit flammable gases (calcium carbide, barium alloys, zinc phosphide).

Class 5 - Division 5.1 Oxidizing substances (sodium chlorate weedkiller, some ammonium nitrate fertilizers).
Division 5.2 Organic peroxides (for the manufacture of plastics).

Class 6 - Division 6.1 Poisonous substances; substances liable either to cause death or injury or to harm human health if swallowed, inhaled or by skin contact (mercury compounds, pesticides, disinfectants).
Division 6.2 Infectious substances; i.e. substances containing viable micro-organisms or their toxins, known, or suspected, to cause disease in animals or humans (used for preventative or diagnostic purposes).

Class 7 - Radioactive material (radioisotopes for medical or research purposes, pacemakers, smoke detectors).

Class 8 - Corrosives; includes substances which can damage living tissue or metals (caustic soda, battery fluid, paint remover).

Class 9 - Articles and substances which during transport present a danger not covered by other classes; such as dry ice, asbestos and magnetized material.

Why Are They Carried By Air?

They are carried because the need exists. International air transport is often the

most effective way of moving these products from manufacturer to user, particularly as in many cases they will be in small volume, high value packages. An oil rig may be held up for a shaped explosive charge to be able to continue exploration or a highly corrosive liquid to clear a stuck drill, fuel may be needed in a remote spot in the outback, a patient in Australia needs treatment with a radio-pharmaceutical only available in England and which must be used within 48 hours of preparation. The answer has to be by air. But most dangerous goods do not travel on special missions, they travel to satisfy the convenience of the general public and to meet the needs of commerce. As aviation exists on the goodwill of the public and on commercial success, we must try to meet these requirements when it can be done safely.

Do They Cause Accidents?

No, not if handled correctly. There has been no recorded instance of an accident being caused by dangerous goods carried in accordance with the regulations. Alas there have been accidents, but only where the rules have been broken - through ignorance, carelessness or wilful disregard. The best documented case occurred almost exactly 15 years ago, when a Boeing 707 crashed at Boston, U.S.A., killing all on board. It seems certain that fumes, caused by concentrated nitric acid, filled the flight deck resulting in the crew losing control. This would not have happened if:

1) the caps of the containers of the acid had been properly secured (some were later found to be loose);
2) the containers had been packed in non-organic material (they were cushioned in sawdust, which reacts with concentrated acid);
3) the packages had been stowed in the upright position (this was not done in all cases);
4) the crew had been advised of the chemicals on board, they would then have dealt with the emergency in a different way (the list of dangerous goods was found after the accident - unsigned by the captain).

More recently a Boeing 747 combi-aircraft crashed into the sea near the Island of Mauritius. The enquiry has narrowed the cause down to a fire in the cargo stowed on the main deck. It is alleged that the cargo included one ton of fireworks, misdeclared and so quite possibly improperly packed!

But it is not only cargo that can be dangerous, items carried by passengers also have that potential for danger. It is highly probable that such things were the cause of two other accidents in which all on board perished: a Boeing 707 over Saudi Arabia in 1979 and a Lockheed 1011 at Riyadh Airport in 1980.

A passenger was certainly responsible, a few years ago, for the destruction of a Boeing 737 - fortunately with no loss of life. A fire occurred on the ground, caused by four bottles of Methyl ethyl ketone being carried undeclared in a piece of checked baggage.

There are also the many unexplained fires and disappearances over the years. It seems quite possible that some of these might have been due to dangerous goods, particularly when one considers the many incidents that, with a slight change of circumstances, would have been accidents. A few of these are listed in the Annex to this paper.

Legislation - the Distant Past

Society has always had a need to transport potentially hazardous substances. The accidents that have occurred, have been the spur to legislative endeavours to ensure safety for the future. A regulation in England of 1768, required horses pulling gunpowder carts to be leather-booted. In 1831 an agreement was made between the Rhineland States to regulate dangerous substances that were being carried in Rhine traffic. This was followed by an edict from Kaiser Wilhelm in 1840 laying down various penalties for non-compliance and in 1850 the Union of German Railway Administrations produced a set of dangerous goods regulations. Meanwhile in Britain, the Parliamentary Railway Clauses Act of 1845 (8th Vict., Cap. 20, Sect. 105) contained the following:

> "No person shall be entitled to carry, or to require the Company to carry, upon the Railway any aquafortis, oil of vitriol, gunpowder, lucifer matches, or any other goods which may be of a dangerous nature; and if any person send by the Railway any such goods, without distinctly marking their nature on the outside of the package, or otherwise giving notice in writing to the Book-keeper, he shall forfeit to the Company Twenty Pounds for every such offence."

It is interesting to find in this very early rule some of the elements which feature prominently in all subsequent dangerous goods legislation: a list of the more commonly carried dangerous substances disclosure of the nature of the goods offered, appropriate marking of the package and a suitable penalty to deter non-compliance.

Legislation- the Recent Past

When aviation came upon the transport scene some countries, which had already developed a legal code covering surface transport of dangerous goods, extended these to the new mode of travel. The leader in this field was the United States

of America, where early action had been necessary following numerous accidents from explosives (often unstable or carelessly handled) being carried by miners, explorers and railwaymen during the expansion of that country. While the basic principles for transporting dangerous goods safely apply to land, sea or air, some detailed provisions have been inappropriately transferred from the surface to the air. The different requirements in the laws of the United States for passenger trains and for freight trains have unfortunately been perpetuated into a separation of the requirements for passenger aircraft and for cargo aircraft, the latter being largely unjustifiable.

As the volume of air cargo increased, so the airlines became more concerned about the possible threat to safety through the carriage of dangerous goods. Moreover, to expedite international movements, it was very apparent that a uniform set of rules was needed. Thus the association of airlines, the International Air Transport Association (IATA), set up its Restricted Articles Board in 1950 (at that time the airlines coyly preferred the term 'restricted articles' to any mention of danger!). The Board devised appropriate rules and within a few years was able to publish the first IATA Restricted Articles Regulations, to be followed by ever more comprehensive editions at approximately annual intervals. The regulations were well thought out and, when correctly applied, ensured that these goods travelled safely. Though recognized and accepted by many countries, compliance - or often the lack of it - became an increasing problem. In particular, United States law is unable to require compliance with such industry devised requirements. Thus IATA turned for help to the International Civil Aviation Organization (ICAO), the intergovernmental body for aviation affairs.

International Recommendations

In 1953, the Economic and Social Council of the United Nations (ECOSOC) established a Committee of Experts on the Transport of Dangerous Goods, charged with the task of devising basic recommendations for safety in international transport that could be used by all modes of travel. This Committee meets in Geneva every two years, while its subsidiary bodies - the Group of Rapporteurs and the Group of Experts on Explosives - meet approximately every six months. The work of the Committee results in the publication of the United Nations Recommendations on the Transport of Dangerous Goods (the 'orange book'). These are recommendations not regulations, intended to be used as a basis for national or modal rules with a view to attaining a fundamental level of uniformity worldwide. The need for continual development and expansion of the Recommendations is accepted, thus accommodating new packaging methods, new chemical compounds and increased knowledge of the properties of materials. One of the basic tenets of the Recommendations is to facilitate the transport of dangerous substances, as far as is compatible with safety, not to impede it.

While initially the Committee considered all types of dangerous goods, in 1959 ECOSOC requested the International Atomic Energy Agency (IAEA) to take on the task of developing rules for the transport of radioactive material. This resulted in the eventual publication of the IAEA's Regulations for the Safe Transport of Radioactive Material (Safety Series No. 6).

The UN Recommendations and the IAEA Regulations have been adapted by the various international bodies for use by each form of transport: the International Maritime Organization's IMDG Code for the marine mode, ICAO's Technical Instructions for the Safe Transport of Dangerous Goods by Air, the Central Office for International Rail Transport's RID regulations for the railways of Europe, North Africa and the Middle East and the UN Economic Commision for Europe's ADR agreement for road movement in Europe.

ICAO Involvement

The origins of ICAO go back to 1944 when delegates from 52 nations met in Chicago and drew up the Convention on International Civil Aviation. Since then the membership of sovereign States has grown to 157 and thus this Organization represents every nation in the world with a significant involvement in civil aviation. The activities of ICAO are aimed at the development of international agreement on rules, regulations and procedures which will make international aviation as safe as possible and at the same time make commercial air transport regular, reliable and economic. The governing body of ICAO is its Assembly which meets every three years and at which representatives of all member Nations gather to review the work of the organization and to plan its future activities. Between assembly sessions the running of the organization is carried out by the elected Council and its subsidiary bodies, the Air Navigation Commission and other committees.

The aims of the Organization are principally achieved by the publication of internationally agreed specifications which are contained in Annexes to the Chicago Convention. Each of the present eighteen Annexes contains Standards and Recommended Practices on particular subjects. The Contracting States to the Convention are required to incorporate the provisions of the Standards into their national codes or, if they are unable so to do, then a difference must be notified to, and published by, ICAO. It is important to note that ICAO does not have any sort of enforcement body. Moral suasion

and the force of international opinion are the powerful factors which influence nations to comply with these internationally agreed regulations.

For a long time ICAO's involvement in the transport of dangerous goods was limited to a very general regulation in two of its Annexes. Then some ten years ago, an ICAO Divisional Meeting recommended that the Organization become more deeply involved. At the same time an approach had been made by IATA, who felt that an increased level of compliance with its Restricted Articles Regulations was badly needed and this could only be achieved through the world-wide authority of ICAO. Member States soon endorsed these views. Thus the Council of ICAO decided that twelve international experts in this field should be called together to form the Dangerous Goods Panel.

The Panel held its first meeting in January 1977. Its initial task was to consider existing national and international schemes for regulating the air transport of dangerous goods and, using the best parts of these as a basis, to develop appropriate regulatory documents that would be suitable for world-wide use and furthermore would be capable of receiving world-wide acceptance. It was agreed from the outset that full account should be taken of the United Nations Recommendations and of the Regulations of the International Atomic Energy Agency. This recognized the standing and expertize of these bodies and was seen as essential to enable goods to move smoothly between one form of transport and another. However, these multi-modal recommendations needed to be adapted for the use of aviation. Particular account must be taken of the range of pressure, temperature and vibration that may be encountered during flight. The Panel's proposals were further refined by suggestions from States and by work of the Air Navigation Commission. Then in June 1981, the Council of ICAO adopted Annex 18 to the Convention on International Civil Aviation. This Annex, entitled "The Safe Transport of Dangerous Goods by Air", contains the broad Standards and Recommended Practices that need to be followed. The Annex also makes binding the provisions of the associated document known as the "Technical Instructions for the Safe Transport of Dangerous Goods by Air", which contains all the necessary detailed requirements. The Annex and the Technical Instructions both became applicable on the First of January 1984. No government has rejected these documents and most are making efforts to see that they are fully implemented.

The Technical Instructions needs to be updated regularly, and this is now being done every two years. Each new edition is issued under the authority of the Council. Any change to an Annex requires the approval of the membership, which entails a protracted procedure. However, as Annex 18 already requires compliance with the latest edition of the Technical Instructions, this neatly avoids any delay in publishing and implementing desirable changes to the requirements.

National Legislation

The 157 sovereign States that are members of ICAO are obligated to implement the Technical Instructions but obviously the time-scale for this, and indeed the thoroughness with which it is done, will vary from country to country. Particularly in the developing lands, resources are limited and there are many conflicting priorities. However, there has been much progress and appropriate legislation has now been enacted in those countries which are major originators of dangerous goods traffic.

Annex 18 requires States to bring its standards into their own national legislation. In addition the Annex requires that "States shall take the necessary measures to achieve compliance with the detailed provisions contained in the Technical Instructions". There are several ways that States can introduce the provisions of Annex 18 and the Technical Instructions into national legislation. The two main ways are:

a) to write into the legislation the actual standards of Annex 18, plus all the detailed provisions of the Technical Instructions. This will almost certainly entail a full translation of the ICAO documents, if the national language is not English, French, Russiam or Spanish (the main ICAO languages); no mean task where over 500 pages of specialized text are involved;

b) to write the standards of Annex 18 into the legislation and include a requirement to comply with the Technical Instructions. This seems simpler, but the edition of the Technical Instructions needs to be specified. If reference is to a named edition, the law must be amended to keep up with future editions; if to the 'current' edition, then sanction is being given to editions as yet unwritten and so unknown, not a practice that commends itself to lawmakers.

Achieving Compliance

To achieve wholehearted acceptance for any set of rules it is necessary to show that they are fair, reasonable and necessary. Ideal regulations will be understandable, practicable and enforceable. Perhaps that cannot be said about every aspect of the Technical Instructions, although undoubtably the ICAO document is nearer to the ideal than any other set of rules designed for the transport of dangerous goods.

At present the regulations are frequently ignored and there would seem to be

three main reasons for this. Firstly, wilful disregard of the legal and moral requirements. Secondly, ignorance of the existence or the applicability of the regulations. Thirdly, a difficulty in understanding or interpreting the lengthy and complex rules.

The law must contain a provision for penalties in the case of non-compliance. Penalties may be a fine, or sometimes a loss of licence, the latter being the more powerful; a fine is a fine, but loss of one's licence is loss of business! Fear of such penalties may not be the most effective way of reaching the desired high standard of safety. The main result of a high level of legal retribution can be to strengthen the resolve not to be caught!

A better, and probably more effective, approach is to try to ensure that the requirements are never unnecessarily onerous, to remove restrictions that make no real contribution to safety, to respond to problems that show up in the field and to write the rules in clear and unambiguous terms.

Complying with dangerous goods legislation can be seen as a nuisance, involving a lot of effort and often a lot of money. The shipper must either go to the trouble and expense of having specially trained staff or will need to utilize the services of an agent specializing in such shipments. The necessary packaging will not be cheap and the air carrier may well exact an extra charge for the additional documents he has to deal with. Many a shipper, and many an operator, must have asked himself: is it really worth doing this properly, what are the chances of something going wrong, what is the likelihood of non-compliance being detected? The chances may be small but the stakes are high. The answer lies in awareness programmes so that everyone involved understands the problems and the possible consequences, plus suitable training programmes to show that there are safe and reasonable solutions.

There are other, non-legal, penalties and perhaps they can be more effective deterrents to any thoughts of breaking the rules. Recently a major international carrier accepted a shipment of 3 litres of mercury, which was not in the correct packaging. The shipment was placed in the hold of a Boeing 747 and there it stayed overnight. Next morning it was found that the mercury had been leaking - the aircraft had to be taken out of service for two months and the necessary structural repairs cost over one million dollars. After the loss of the Boeing 707 at Boston the subsequent investigation identified several responsible (or irresponsible?) individuals and a number of fines were levied; but much worse than the fines will be having to live with those deaths on their consciences.

As has been said before: 'If you think safety is expensive, try having an accident'.

Steps to Safe Transport

Safety here means safeguarding the lives of ground and flight crews, passengers and the general public. Many substances have a potential for hazard and that hazard will be magnified in the closed environment of an aircraft.

Packagings to be used to transport dangerous goods by air need to be designed for the following conditions:

Temperature variations - from -40°C to +55°C (appropriate ullage must be provided);
Pressure variations - at altitude the pressure may have reduced by 68 kPa, allowing a suitable safety factor, packagings have to be tested at a pressure differential of 95 kPa (most cargo holds are pressurized but pressurization systems do fail and such an emergency should not be compounded by the dangerous goods containers failing as well);
Vibration range - from 5 mm amplitude at 7 Hz (corresponding to 1 g acceleration) to 0.05 mm amplitude at 200 Hz (corresponding to 8 g acceleration).

Dangerous goods can be carried safely, if they are correctly:

1) Identified - the Technical Instructions contains a list of some 3000 entries covering the articles and substances most frequently shipped (and also those few substances which are forbidden for transport by air), with their UN identification number;
2) Classified - by UN hazard class or division;
3) Limited in quantity - to the mass or volume shown in the Technical Instructions, this limitation is intended to ensure that the loss of contents from a single package will not be catastrophic;
4) Packaged - using packaging that meets the specification given in the Technical Instructions, although for very small quantities of some classes non-specification packaging is permitted;
5) Labelled - with one or more of the 19 hazard labels, thus ensuring ready identification of the potential hazard(s);
6) Marked - with the Proper Shipping Name and other special markings that may be required;
7) Documented - on a Dangerous Goods Transport Document, this includes a declaration signed by the shipper that all the applicable rules have been followed;
8) Inspected - for compliance with the above and for damage or leakage, both upon acceptance by the airline and again prior to loading on the aircraft;

9) Loaded - positioned,segregated and secured in the hold as required;
10) Notified - the captain must be given written information about the quantity and nature of dangerous goods on the aircraft and their stowage position.

Some Problems

Ideally each dangerous substance would be listed with an unique name and an unique identification number. Although this is recognized as being very desirable, for various reasons it has not been achievable in practice. Neither has it been possible, in all cases, to use simple readily-understandable names. Some names are very similar, for example: Thionyl chloride/Vinyl chloride/Phenyl chloride. Some are very liable to mispronunciation, e.g.: Cyclooctatetraene or But-1-ene-3-one. Some just seem impossible (to the non-chemist), try saying: Triisocyanatoisocyanurate of isophoronediisocyanate solution or Cyclotetramethylenetetranitramine. The Technical Instructions blithely requires, during an in-flight emergency, that the crew transmit by R/T the proper shipping names of the dangerous goods on board!

Other misunderstandings have arisen from the innocent use of ambiguous markings. A package consigned by Mercury Air Freight was offloaded from the aircraft when a loader saw that the package was marked 'Mercury'! A similar problem arose with packages of the publication 'Hazardous Cargo Bulletin' which had simply been marked 'Hazardous Cargo'!

In drafting regulations it needs great care to try to give everything simple and single meanings. For example, an 'explosive hazard label' should not be called an 'explosive label'.

Future Changes To The Regulations

Neither the UN Recommendations nor the ICAO Technical Instructions are perfect, but they have reached a high standard of technical accuracy and comprehensiveness. The gaps that existed earlier are being filled, anomalies are being eliminated and ambiguities being resolved. But this adds up more to safety on paper than to safety in practice. We have a very good regulatory base; the rules, if followed, will ensure that dangerous goods travel safely. Alas, there is a continuing history of dangerous goods incidents and near-accidents(a few are quoted in the Annex to this paper). The problems arise from the regulations not being followed. More effort should now be put into examining why this is so, rather than striving to move the requirements nearer to perfection. Perhaps we have reached a state of over-regulation? Some shippers do not try to comply because it is too difficult, too expensive and because they consider the rules to be unnecessarily stringent. Many of the quantity limits were arbitrarily fixed a long time ago and have never been re-examined. The interests of safety would probably be best served by easing some of the present restrictions.

For aviation, one specific area that needs to be re-examined is the system of different rules for passenger aircraft and for cargo aircraft. Some substances are forbidden for carriage on passenger aircraft but are allowed on cargo aircraft. While for substances that are allowed on both types of aircraft, much larger quantities per package are permitted where only the cargo aircraft crews are involved. As an example, the maximum quantity of 1.4S explosives that is considered safe in a single package on a passenger aircraft is 25 kg; what are the special circumstances on a cargo aircraft that make it safe to now have 100 kg of these explosives per package? It is difficult to think of any. ICAO has, as yet, made no attempt to justify such differences - they seem to arise from history rather than from logic.

When, for aviation, the ICAO rules took over from the earlier IATA requirements, a number of improvements in safety standards were thought to have been achieved. This was particularly so in the area of packaging for which ICAO required the use of specification packaging for all dangerous goods, with a few minor exceptions; while IATA had required such packagings only for the larger packages carried on cargo aircraft. As the years go by, this ICAO principle is increasingly seen as possibly still desirable but definitely impracticable. To give manufacturers time to make available containers conforming to the United Nations specifications and governments time to set up testing and certifying facilities, non-specification packaging has been allowed for a 'transitional' period. This was originally set to end at the beginning of 1988, then it was moved to 1990, the latest date is now 1991. By then perhaps some of the major countries will be ready, but there are certain to be many others where implementation will still be impossible. Meanwhile, there have been no reported incidents or accidents due to the use of the transitional packaging; just as there were never any problems from the non-specification packaging allowed by the old IATA regulations. ICAO is beginning to accept that the intended change to all-specification packaging is unnecessarily restrictive and so is introducing the concept of small packages and limited quantity packages which will not be required to meet the full UN specifications. Some relaxation of the requirements for packages containing quantities only a fraction of the maximum allowed seems fully justified and by increasing the level of compliance will actually improve safety. A paradox the regulators should bear in mind when considering other changes.

It would be helpful if a minimum

hazard quantity could be established for some classes or for some individual substances. At the moment the merest speck of most of the listed dangerous chemicals has to receive the full treatment of the regulations, even though the possible hazard is so small as to be completely insignificant. There are for instance a number of substances which are poisonous in large quantities, but which in small quantities are used for medicinal purposes. Indeed caffeine and aspirin come very close to the borderline of the criteria used for the classification of poisons. The introduction of the concept of a 'de minimus' quantity (the law does not concern itself with trifles) would be fully justified. The devising of suitable minimum values would have its difficulties but should not be completely impossible.

The complex interlocking structure of the various regulatory bodies concerned with dangerous goods is shown in the diagram at the end of this paper. They do not all work together in complete harmony, but the degree of cooperation has significantly increased over recent years. Very few consignments of dangerous goods are able to complete their journey using only one mode of transport. There was a time when changing from one mode to another could mean a need to change the hazard labels and to prepare new documents using different identification names and numbers. That is seldom necessary now, although there are still some differencies between the various regulations which cannot be justified for safety reasons.

Conclusion

To survive, society needs to transport goods and ever increasingly this is by air. There will always be a proportion of those goods possessing potentially harmful properties, which may be explosiveness, flammability, toxicity, corrosivity or the dangers - more recently added to the list - of infection and radiation. Through experience, often bitter experience, man has learnt to supress these dangers. We now know that, with suitable precautions, nearly all substances can be transported in safety. This most definitely applies to transport by air.

To improve this aspect of safety in air transport there is a need to reduce cost penalties (particularly extra charges by airlines), to improve and extend training (not least for shippers), to improve the regulations (removing unjustifiable restictions) and to impose (and publicize) appropriate penalties for non-compliance.

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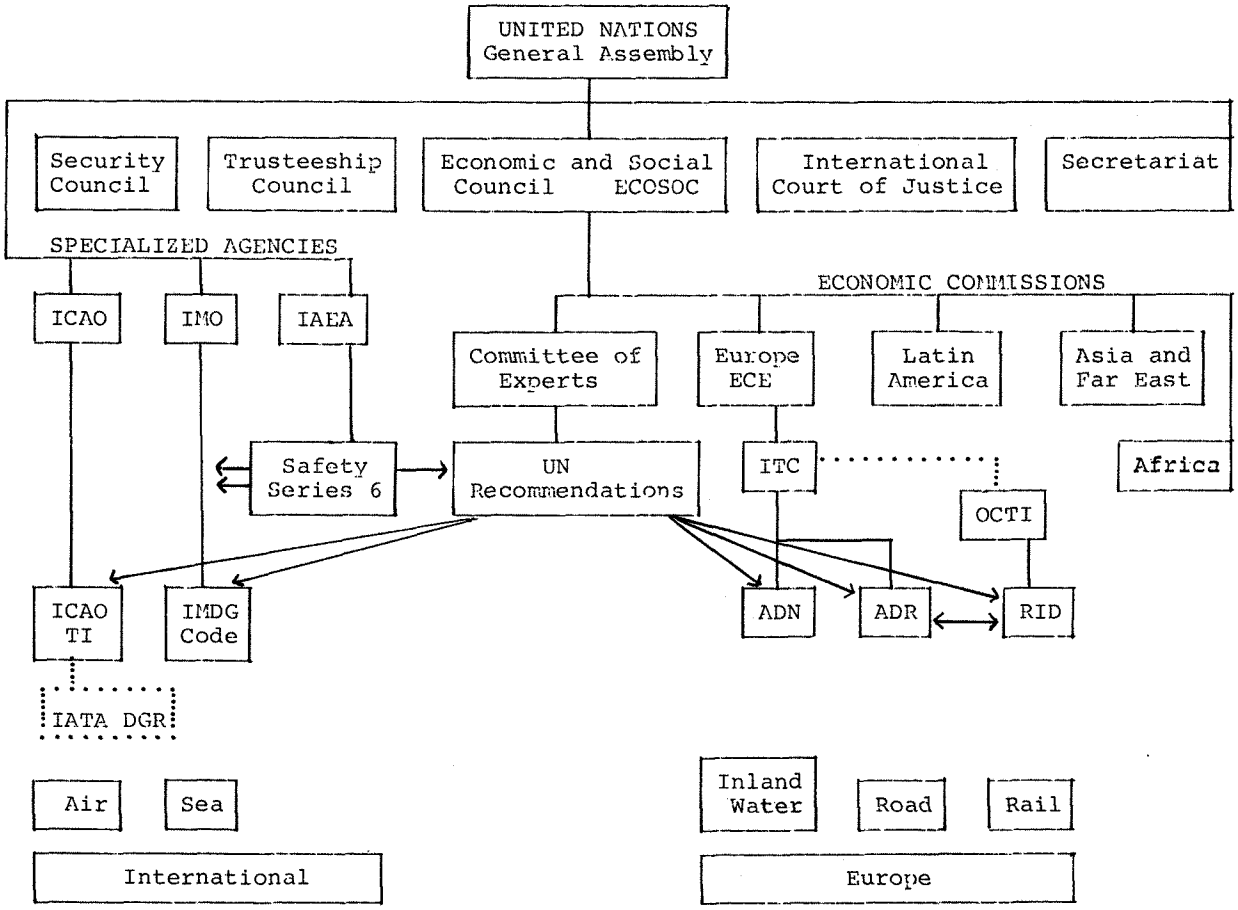
MAJOR ORGANIZATIONS INVOLVED IN INTERNATIONAL REGULATIONS FOR TRANSPORTING DANGEROUS GOODS



ADN - European Agreement Concerning International Carriage of Dangerous Goods by Inland Waterways

ADR - European Agreement Concerning International Carriage of Dangerous Goods by Road

ECE - Economic Commission for Europe

ECOSOC - Economic and Social Council

IAEA - International Atomic Energy Agency

IATA DGR - International Air Transport Association, Dangerous Goods Regulations

ICAO - International Civil Aviation Organization

IMDG Code - International Maritime Dangerous Goods Code

IMO - International Maritime Organization

ITC - Inland Transport Committee

OCTI - Office Central des Transports Internationaux par Chemin de Fer (Central Office of International Railway Transport)

RID - European Agreement Concerning Carriage of Dangerous Goods by Rail

TI - Technical Instructions for the Safe Transport of Dangerous Goods by Air.

Annex

A small selection of the many reported incidents involving dangerous goods

With a slight change of circumstances, all these incidents could have been serious accidents.

1. During flight a strong smell of petrol was detected in the passenger cabin. A passenger admitted to having in his rucksack a camping stove filled with petrol.
2. Prior to departure, a special safety announcement was made about the danger from some items that might be in passengers' baggage. This resulted in the passengers of that flight surrendering 12 large fireworks and 2500 smaller fireworks.
3. During the flight of a cargo aircraft, fumes were noticed coming from cargo loaded on the main deck. The fumes were causing eye irritation, so the crew donned smoke goggles and diverted to the nearest suitable airfield. Later the trouble was traced to steel drum of Ethyl isocyanate, the cap of which had been over-tightened causing the seal to split; the pressure differential in flight was sufficient to release the fumes.
4. When unloading the hold, an electric wheelchair with an installed wet battery was found to be unrestrained and lying on its side. Acid had leaked across the hold floor.
5. During baggage loading a suitcase burst into flames. The case was found to contain 6 boxes of matches, one of which had ignited.
6. A large container was declared as 'Chemicals, not restricted' and after flying one sector had to be transferred to another flight. During this process it exploded, badly injuring two airline employees. The remains of the container were seen to include various liquids and broken glass bottles, with neither cushioning nor absorbent material. The invoice was eventually translated and the contents shown to have been: 2 litres Nitric acid, 2 litres Ammonium hydroxide, 2 litres Phosphoric acid, 2 litres Perchloric acid and 2 litres Sulphuric acid.
7. A smoking suitcase was pulled off an aircraft just before the suitcase burst into flames. It was found to contain a broken gallon glass jar of Nitric acid.
8. The baggage handler was badly injured when a passenger's bag exploded. It was found to contain 10 practice hand grenades, 5 firecrackers and a smoke bomb.
9. After landing 7 out of the 10 occupants of a passenger aircraft were found to be suffering from the effects of toxic gas inhalation. The poison fumes came from a leaking, undeclared inadequately packed, drum of Hydrofluoric acid. In addition, corrosion damage had been caused to the aircraft structure.
10. As baggage was being loaded into the hold, a smell of gas was evident. This was traced to a container of camping gas packed in a suitcase. The passengers were asked if the owner of the case with campling gas in it would identify himself - at that five people stepped forward.
11. During cruise, on a scheduled passenger service, the flight deck started to fill with petrol fumes. The crew put on their oxygen masks and made an emergency landing. Amongst the cargo was found a petrol-soaked cardboard package marked 'Motor-bike, handle with care'. Within the package was a motor-cycle, upside down.
12. A package marked 'Material for auto lamps' safely survived its flight, but when transferred to a train it burst into flames causing considerable damage. It was found to contain Barium azide, which is highly explosive and forbidden for transport by air.
13. Several boxes of 'Steering correctors' were loaded on an aircraft, closer examination of the shipping documents revealed a note stating: "Rocket motors, highly explosive - in the event of accidental ignition, retire to a point at least ½ mile away.
14. At the security check, a passenger was found to have 960 disposable lighters in his hand baggage (these readily leak with a pressure differential), he admitted that there were 163 more in his checked baggage.
15. When the cargo hold was opened an acrid smell was noticed. Examination showed that the fumes were coming from a box containing bottles of Methyl methacrylate, one of which was leaking from a loose screw cap. A dog being carried in the hold had been overcome by the fumes. Incorrect documentation and packaging had been used and the chemical had interacted with the cushioning material employed.
16. During the cruise the passenger cabin started to fill with irritant and corrosive fumes. Immediately after landing an emergency evacuation was carried out during which 20 of the 125 passengers were injured. The trouble was caused by a package marked as 'Laundry equipment' but which contained 47 kg of Sodium hydroxide and Hydrogen peroxide solution. It is thought that the Sodium hydroxide had leaked and come into contact with water which results in a reaction. With fumes coming from the hold the rescue services treated it as a fire. A water spray was applied through a hole in the cabin floor; this caused further reaction and dispersed the chemical weakening the hold structure.