

TRANSPORT OF RADIOACTIVE MATERIALS BY POST

**SUMMARY REPORT OF A SEMINAR
ON TRANSPORT OF RADIOACTIVE MATERIALS BY POST
ORGANIZED BY THE
INTERNATIONAL ATOMIC ENERGY AGENCY
IN CO-OPERATION WITH THE
UNIVERSAL POSTAL UNION
AND THE
INTERNATIONAL CIVIL AVIATION ORGANIZATION
HELD IN VIENNA, 24--27 OCTOBER 1983**



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FOREWORD

Mankind has always been exposed to low levels of radiation, from many natural sources including the sun and naturally occurring radioactive substances. The effects of radiation are better understood and radiation exposures more carefully controlled than almost any other hazard. Since the early 1960's, it has been possible to ship radioactive materials by mail although such shipments are still prohibited in many countries.

These are the summary proceedings of the Seminar on Transport of Radioactive Materials by Post arranged by the International Atomic Energy Agency in cooperation with the Universal Postal Union and the International Civil Aviation Organization to explore the need for such shipments and to examine some of the reasons for prohibiting such shipments. Postal administrators from more than 30 countries, and representatives from shippers, and carriers came together in Vienna, 24-27 October 1983 for a free exchange of views. They concluded that shipment of radioactive materials by post is safe and economical and fulfils a need. Therefore, such a service should be available throughout the world. To that end, education and implementation of uniform standards are necessary.

These proceedings will be given wide distribution to promote a better understanding of the safety requirements for shipping radioactive materials by post and to encourage adoption of the IAEA/UPU/ICAO regulations for such shipments.

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SUMMARY AND CONCLUSIONS

1. Adequate, up-to-date regulations for international and domestic shipment of radioactive material by all modes of transport, including by mail, have been published by the IAEA. UPU, ICAO, IATA and other international organizations as well as a majority of the countries of the world have adopted most sections of the Agency's Regulations for the Safe Transport of Radioactive Material (Safety Series No. 6).
2. Although there is an apparent need for shipping radioactive material by mail, some countries allow only domestic shipments and the postal regulations applied in these countries often differs from the international regulations, some being less stringent and others being more stringent. Only about 25 countries are known to allow international (as well as domestic) shipments, some of these on an import basis only.
3. The use of post for shipping radioactive materials is constrained by a number of factors, including:
 - (i) the large number of countries which do not allow such shipments;
 - (ii) the lack of consistent national regulations applied by countries;
 - (iii) perceived hazards of such shipments, mostly due to lack of correct information;
 - (iv) actual or perceived unreliability of postal shipments at large;
 - (v) economic reasons.
4. From the discussions and comments at the Seminar, it appears that the option of shipment by post would be advantageous to enhance both the safety and economy of transporting, as well as to increase availability of, radioactive materials. This appears to be particularly true in developing countries where other distribution systems are not yet functioning effectively.
5. Although shipment of radioactive material by post is prohibited in many countries, many shipments are taking place, some perhaps illegally. It was agreed it is better to legalize all consignments within specified limits, and to encourage implementation of simple, safe, uniform and easy-to-follow rules, rather than having illegal, unsatisfactory and possibly unsafe packages in the mail.
6. Where experience is available, no problems have been identified. Only very few accidents and incidents involving postal transport of radioactive materials have occurred, and no injuries have been reported. Nevertheless, the use of even more reliable mail services (e.g., Express Mail, known in some countries as Datapost) might

encourage use of the postal service and make it easier for Postal Administrators to agree to implement the UPU requirements and allow shipment of radioactive material by post.

7. The Agency's Regulations for transport by post as adopted by the UPU and ICAO are considered to provide a high level of safety and ensure a negligible element of risk for all parties involved. A more uniform application of these regulations within UPU Member States should be encouraged. The competent authority for implementation of the other parts of the Agency's Regulations in each of the Member States should be invited to advise the Postal Administrators and assist in applying the requirements to national as well as international postal shipments.
8. Although the current Regulations appear to be adequate, they should be reviewed by the IAEA, UPU, ICAO, and IATA relative to the newly issued Basic Safety Standards for Radiation Protection (Safety Series No. 9). The object should be to assure either that these standards are being met currently, or that changes are made in the Regulations to assure compliance.
9. Since it was felt that uniformity of regulations is of international concern, any deviations of national regulations should be brought to the IAEA and UPU for discussion.
10. Although postal shipments of radioactive material are considered to be extremely safe if the international regulations are followed, accidents may occur. In that case the area should be roped off and a qualified specialist called in.
11. According to IAEA Regulations, the shipper is responsible for the safety of the consignment. Liability issues, however, are not covered, but this matter will be looked into by the UPU.
12. The development of training, educational and informational materials specific to the postal transport of radioactive materials for use by UPU member countries was strongly encouraged by most attendees. The materials should be developed by cooperative actions of the IAEA, UPU, ICAO, and IATA and made available to UPU member countries in the form of pamphlets, reports, movies, video tapes, etc., in the working languages of the agencies involved. These materials should contain information on, for example:

- (i) the background and primary concerns of the regulations;
- (ii) how to safely handle the mail;
- (iii) what to do in case of an accident.

The materials could be used as follows:

- (i) training materials - for consignors (i.e., shippers);
- (ii) educational and informational materials - for postal authorities, postal workers and members of the public.

INTRODUCTION

The International Atomic Energy Agency (IAEA) was established in 1957 "to seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world". At present 111 countries belong to this autonomous member of the United Nations system. The Agency is authorized to establish standards of safety for activities involving atomic energy.

The Universal Postal Union (UPU) was established in 1874 under the "Berne Treaty". That treaty was the forerunner of a multilateral convention governing the international postal service. The UPU became a specialized agency of the UN in 1948. Member countries of the Union, some 166 countries, virtually every country in the world, are bound by the Acts of the Union for international postal service. These Acts include a Constitution, General Regulations, the Convention and detailed Regulations.

The International Civil Aviation Organization (ICAO) is also a specialized agency of the UN. Its aims were set out in the Convention on International Civil Aviation signed by 52 nations in 1944 in Chicago. ICAO formally came into being in 1947. With 151 Member States, it now represents all the nations of the world with any significant aviation activity. ICAO sets standards to be used by the aviation world for the safe transport of dangerous goods.

In 1959, following a directive of the Economic and Social Council of the UN, the IAEA undertook to establish standards of safety in the transportation of radioactive materials on as wide a basis as possible and by all modes of transport, including transport by post. With expertise provided by Member States and in cooperation with UPU and ICAO, the IAEA developed Regulations for the Safe Transport of Radioactive Materials. These were first published in 1961 and adopted by UPU and other international transport organizations as well as most Member States of the Agency so that by 1969, these standards were applicable to most international transportation of radioactive materials.

Uniform standards are essential for safe and expeditious transportation of radioactive materials. This is especially true of transport by mail (post) where minimal effort is made to identify package contents and individual item inspection is not feasible. Therefore, it was disturbing to learn from the Agency's attempts to ship safeguards samples, the results of a CEC study and information provided by UPU, that now only a few countries permit shipment of radioactive material by post.

In 1980, to explore the reasons for this, the Agency undertook to arrange a Seminar on Transport by Post. At the Agency's invitation, UPU and ICAO agreed to co-sponsor such a Seminar.

The objective of the Seminar was to encourage safe and efficient carriage of radioactive material by post. It was designed to bring together Postal Administrations, Competent Authorities for other modes of transport, carriers, shippers and radiation safety people, to discuss the nature and magnitude of the hazards associated with radioactive items that can be transported by post, the safety and administrative requirements, the need for and advantages of allowing such shipments, and any concerns caused by such shipments.

These are the Summary Proceedings of that Seminar which was held in the Vienna International Centre, Vienna, Austria, 24-27 October 1983. 19 papers were presented, each one followed by questions and comments from the floor. Following the review of these discussions, six appendices are provided. Appendix I contains a Glossary of Terms to assist the reader. Appendix II provides a summary statement by the Rapporteur to the Seminar, Mr. Bennerstedt of Sweden. Appendix III lists the attendees at the Seminar. Appendix IV lists the papers presented, in the order presented. Appendix V provides the introductory papers presented, and Appendix VI provides abstracts of the discussion papers. Copies of the complete papers presented at the Seminar can be obtained upon request from the Radiological Safety Section, Division of Nuclear Safety, International Atomic Energy Agency, Vienna, Austria.

There was also a floor discussion and a round table discussion where topics that required further elucidation were brought up. The results of this discussion are contained in the main body of this Summary Proceedings. On the second day, during an extended coffee break, a number of transport packagings for different modes of transport were exhibited and demonstrated by representatives of several shippers.

It has been estimated that nearly one third of all shipments of radioactive materials would be allowed by post, although only a much smaller fraction is being transported by that mode at present. One of the aims of the Seminar was to identify the reasons why more postal shipments are not made and determine if any changes are possible and/or desirable. The desire to encourage shipment by post is not for the purpose of promoting radioactive materials shipments per se, but rather stresses an interest on behalf of the IAEA, UPU and ICAO, as well as the shippers, to have the materials transported the fastest, cheapest and safest way possible. In certain cases this implies the use of postal services; in other cases, other normal modes of transport should be used. In any case, it is important that shipment by post be available as an option.

The regulations for postal transport promulgated by the IAEA have been adopted by the UPU and ICAO. In spite of this, not all national postal authorities apply these regulations domestically, and perhaps for other reasons, many do not permit such shipments either nationally or internationally. The participants of the seminar were urged to discuss the reasons for this and exchange information on the various aspects of transporting radioactive materials by post. The object of the Seminar was to allow regulators, shippers and carriers to better understand each other's points of view regarding radioactive items in the mail. The need for such shipments, the administrative and safety requirements associated with them and the experiences of countries, organizations and shippers accepting radioactive postal items were other topics of interest.

ADVANTAGES AND NEEDS OF POSTAL SERVICES

The postal services are available to practically anyone. Items within a wide range can be sent to almost any person around the world. To deliver the mail, every known means of transport is used. Thus, the postal system forms the world's biggest communications network. Usually the minimum charges are lower for post than for equivalent service by other modes of transport. Therefore, it is often advantageous to send single items by mail, especially to remote areas, whereas bulk shipments could be less expensive by other means.

The documentation needed for postal shipment is often far simpler than what is required for other modes of transport. This means fewer obstacles to both shippers and carriers, and customs procedures are facilitated. With efficient handling, and speedy and assured delivery, radiation exposures are kept to a minimum. Rapid delivery is often a requisite, due to the relative short half-life of some compounds. This is especially the case for radiopharmaceuticals that lose effectiveness as the activity of the material decreases due to normal radioactive decay. Certain other compounds, such as biological samples, deteriorate with time. Also, to be useful for medical, safeguards or other purposes, some samples must be delivered quickly for analysis. Depending on how well the postal services of the countries involved function, it may or may not prove advantageous to send the material by mail. The use of more rapid and reliable mail services known as the "International Express Mail Services", such as "Datapost", might be considered to encourage shipment by post. If this were done, Postal Administrations might be more inclined to allow such shipments and to agree to implementation of the UPU regulations. If the number of countries allowing such shipments were increased and the regulations made uniform, or at least consistent, the potential of the postal services would be greatly enhanced. It was agreed this would increase the reliability of such shipments. As experience is gained and communicated, the perception of risk associated with such shipments will be reduced.

At its best, the postal service can be characterized as expeditious, inexpensive, and reliable. What, then, are the actual needs of such a service? It was generally agreed that medical compounds, e.g., radio immuno assay kits, should be allowed for humanitarian reasons. Also, there exists an extensive mail order market in certain countries, where radioactive consumer products, such as smoke detectors and watches, are sold and mailed. It would be meaningless to impose stricter rules on the transport of these products than apply to their use and disposal. Among other items mentioned that could and perhaps should be allowed by mail were mantles for gas lanterns, static eliminators, exit signs, electronic tubes, welding rods, soil samples and analytical safeguards samples.

This does not necessarily mean that all of the above objects will always be sent by mail, once allowed. But from the discussions and comments it appears that such shipments should be made possible since the need may arise from time to time. That is, the option should be left open through implementation of proper regulations by member countries of the UPU. UPU has the largest membership; all countries that are members of the IAEA or of ICAO are also members of UPU.

The UPU even went so far as to recommend campaigns by the agencies designated as the national competent authorities for implementing the IAEA Regulations to make the national postal administrations aware of the needs of the senders and the requirements recommended by UPU for international postal shipments. However, it was pointed out, making that service available is at the option of the country and cannot be imposed by UPU.

REGULATIONS

Several speakers expressed the view that it is practically impossible to assure that no radioactive materials are shipped in the mail. Therefore, it is better to publish safe, relevant regulations for the transport of such materials rather than having to deal with illegal, unsatisfactory and possibly unsafe packages. These rules should be practical and easy to follow to warrant full compliance.

At present, it appears that only a small number of countries have adopted national regulations for shipment of radioactive materials by post which are consistent with UPU requirements. These national regulations often differ from the international regulations accepted by the IAEA, UPU, ICAO and IATA. In some countries, the regulations are less stringent than their international counterpart; in other countries they are more stringent. Many of the countries that have accepted radioactive postal consignments have regulations that are equal to or equivalent to the international regulations. Of those countries that allow postal shipments, some only allow domestic movement, whereas others allow only import/export and still others allow both.

According to the international regulations, materials with a specific activity less than 2 nCi/g are not considered to be radioactive material for purposes of transport. Above that, four categories of shipments are defined; namely:

- exempt quantities
- low level solids and low specific activity materials
- Type A materials
- Type B materials.

For radioactive materials to be allowed by post, the contents must be in exempt quantities. Specifically, the activity must not exceed the applicable exemption limit shown in Table I. Also, the radiation level (dose rate) at the surface of the package must be less than 0.5 mrem/h. The material shall be securely packaged so there will be no leakage in normal transport, and little or no contamination of the outer surfaces is allowed. For international transport, the outside of the package must be labelled "Radioactive materials"; and must carry the name and address of the consignor with the request that the consignment be returned in the case of non-delivery; the name and address of the consignor and the content of the consignment must be indicated on the internal packaging. Also, the package shall be deposited with the postal service only by consignors authorized by the national competent authority; and it shall be dispatched by the quickest route, normally by air. In addition, for both international and domestic shipments, the package must be marked on an internal surface "Radioactive" so that a warning of the presence of the radioactive material is visible when opening the package. Further details on these requirements can be found in paper IAEA-SR-83/9.

Table I. Package Contents Limits for Transport by Post

Nature of Contents	<u>Package Contents Limits^a</u>	
	<u>Instruments and Articles</u>	<u>Materials</u>
Solids		
Special Form	10 ⁻¹ A ₁	10 ⁻⁴ A ₁
Other Forms	10 ⁻¹ A ₂	10 ⁻⁴ A ₂
Liquids		
Tritiated Water		0.1 to 100 Ci ^b
Other Liquids	10 ⁻² A ₂	10 ⁻⁵ A ₂
Gases		
Tritium	20 Ci	2 Ci
Special Form	10 ⁻³ A ₁	10 ⁻⁴ A ₁
Other Forms	10 ⁻³ A ₂	10 ⁻⁴ A ₂

a The values of A₁ and A₂ are specified in Safety Series No. 6, and range from 0.002 to 1000 Ci, with a few values unlimited for materials such as thorium-232 and natural or depleted uranium.

b Value depends upon the tritium concentration.

The regulations described above are those jointly accepted by the relevant international organizations. For reasons not always clear, some countries have adopted different regulations. In Norway and Sweden, for example, the dose rate limit is 10⁻³ mSv/h (0.1 mrem/h), and the activity in a single package must not exceed the ALI (Annual Limit on Intake) value as published by the International Commission on Radiological Protection, ICRP. In most cases, the ALI values are more restrictive than the corresponding IAEA limits for postal packages which generally are 100 times the ALI or even higher for materials in non-dispersible solid form. In Switzerland, on the other hand, activities up to 20,000 times the ALI values are permitted by post domestically, which are much larger than the IAEA limits. In Switzerland, however, packages containing activities greater than the IAEA postal limits, have to bear radioactive labels, category I-WHITE or category II-YELLOW, as applicable. In addition, the surface dose rate limit and the transport index limit of category II-YELLOW packages for transport by post do not conform with the values given by the IAEA, although those values have been accepted for transport by other modes in Switzerland. In Austria, only parcels are accepted for national movements, and only registered letter items are accepted for international shipments, but the limits are consistent with the IAEA limits.

The list of national deviations from the international regulations is much longer. It illustrates the fact that often particular rather than general solutions are chosen - in most cases without consulting any of the international organizations. Certainly, this does not encourage or facilitate the use of the international postal service. On the contrary, it causes confusion and uncertainty, and may create safety problems in a field where there need not be any.

Consequently, representatives of the international organizations, together with many other participants, voiced objections to the use of local regulations. It was felt that any future development was hampered by such differences; a uniform set of rules for national and international postal movement being the only viable and realistic alternative. No evidence was given to the contrary. Countries now wishing to permit shipment of radioactive material by post are urged to adopt the UPU/IAEA requirements, and countries which are applying other than UPU Regulations were encouraged to reconsider their practice.

To be effective, rules must be simple and practical so that people can understand them and comply with them. Compliance is a crucial question, but it was made clear that in the postal service neither the competent authorities nor the postal administrations or other organizations could be expected to engage in extensive control or follow-up inspection activities. As a basic concept, one simply has to trust the consignors. They must be authorized, the requirements must be clear, and consignors held responsible for any non-compliance that is discovered and any damage due to lack of compliance with the regulations.

It was pointed out on several occasions that the international shipment of radioactive material by post is optional and subject to bilateral agreements. The low acceptance level (only about 15% of UPU Member States) was thought to be at least partly attributable to the complexity of implementing the regulations, for example as regards control of items posted. It was suggested that one means of inducing more administrations to take part in the international exchange of radioactive postal items might be to have fewer administrative procedures as long as that can be done without affecting the overall safety.

Several possible solutions were suggested and discussed at some length. The most important change which was suggested by ICAO, was to add an absolute activity below which the material would not be considered radioactive material. This would complement the present 70 kBq/kg (2 nCi/g) specific activity limit. Although no changes in Agency policy is foreseen regarding the postal regulations, the question of a "de minimis quantity" will be forwarded to the group of experts which will meet during the week of 7-11 November 1983 to complete the comprehensive review and revision of the IAEA transport regulations, Safety Series No. 6.

Nevertheless, no matter how desirable changes may be, it was felt that it is more important to implement uniform regulations worldwide.

LABELLING AND MARKING

Only one of the labelling and marking prescriptions quoted above seemed to be controversial, and that was the white label bearing the words "Radioactive materials" on the outside of the package which is required under the present Regulations. Representatives of several postal administrations, especially from developing countries, regarded the label as a necessary piece of information. It was argued that in case of an accident, obviously some action has to be taken; the more that is known about the contents of the damaged consignment, the greater the chances for taking proper precautions. Moreover, the absence of this label on incoming items may lead customs officials to request such items to be opened by the post, especially if the customs declaration is incomplete. The discovery of radioactive contents can then cause great alarm to postal staff.

These arguments were disputed by the IAEA, IATA and others. The Agency regards labelling and marking as administrative details that are not required for radiation safety with these limited quantities of material. One of the shippers called attention to the inconsistency between labels on postal consignments and no labels on excepted items by air freight. Any item is required to be labelled for international transport by post, whereas 10 times that same quantity of material could be sent by air freight without labels. This, it was suggested, was further evidence that the postal labels are unnecessary and inappropriate. It was recalled that the present regulations are mainly a result of an agreement reached between UPU and IAEA. According to IATA, labels should not be required.

One postal administration claimed to be willing to carry anything that does not require special handling, but felt the word "Radioactive" evokes apprehension and fear, even though the quantities permitted are harmless. The question asked as a result was, "so why label?" It was suggested that up to a certain activity level, no labels should be required, and above that level the consignment should not be allowed by mail. The ICAO representative found labelling a controversial question, but reminded the delegates that there will be a change from the white "Radioactive materials" label to a durable marking saying "Radioactive materials. Quantities permitted for movement by post", as had been already announced during the seminar. The UPU representative pointed out that the revised procedure had been approved by the Union's Executive Council in 1982 and that a proposal to amend the Union's Acts to that effect would be submitted to its next Congress in 1984. At least one participant thought this a dubious course of action in that more detailed information may be misinterpreted as indicating a greater hazard, and the effect of the change might be just the opposite of what was strived for.

Consensus was not apparent on this issue.

EXPERIENCES, ACCIDENT PROVISIONS

Countries having any experience of postal transport of radioactive materials reported that no special problems could be identified and no serious accidents involving radioactive materials had taken place. Most postal items are carried by air, and the documentation needed is very simple. Both ICAO and IATA confirmed that no additional documentation is required for items accepted for postal shipment.

The question was raised whether undeveloped, high-sensitivity photographic film could be damaged by radiation penetrating from adjacent radioactive consignments. With a surface dose rate limit of 5×10^{-3} mSv/h (0.5 mrem/h) this was believed to be virtually impossible. An IAEA representative stated that in earlier consideration of this question, it had been concluded that if there is any risk of damage to ultra high-sensitivity films, appropriate action was to be taken by the shipper of the film. This could mean either segregation of the film from other items or protective shielding, since radioactive postal items cannot and should not be required to be separated from the rest of the mail.

It was discussed whether packages should be checked for compliance with the regulations before being accepted for postal transport, e.g., a quick survey of surface dose rates using a Geiger counter (as practised in the UK). Representatives from other countries with experience of this type of postal movements did not see any need for such checks. Since the shippers are authorized and have received information on the current regulations, compliance usually follows. Any revealed act of non-compliance will be properly punished. Consequently, postal workers are expected to accept the consignments in good faith. As was pointed out by the ICAO representative, when the rules are followed, this is safe enough, and there has been no evidence of unsatisfactory conditions so far.

The international regulations clearly stipulate that the responsibility belongs to the consignor, i.e., the shipper, rather than the carrier. Liability issues, however, are not addressed in the IAEA Transport Regulations. Although it was clearly understood that liability usually would fall to the shipper, many participants felt existing provisions should be studied and the UPU representatives promised to look into the matter of liability further.

No matter how safe the consignments are, per se, accidents could occur with possible dispersion of the radioactive contents, leading to contamination and perhaps even ingestion of some of the material. In response to a question of the need for emergency planning to cover such a situation, an Agency representative claimed that it was merely a matter of cleanup. The total risk is at a minimum because of the low activity limits for each package which are prescribed in the Regulations. If the contents are dispersed, radiation doses will be within the safe limits of the ICRP; and secondly, the accident provisions are actually quite simple: rope off the area and send for an expert, who can carry out a radiation survey and offer advice on cleanup. Other than that, it was felt that questions on safety control and emergency response are best handled by the national competent authorities.

As an example of what can be done to enhance transport safety at large, the French system of specialized mobile emergency units was mentioned. In the case of postal accidents, it was considered satisfactory by a majority of the experienced Member States to rope off the area and call some qualified specialist, such as the police, the fire department, the competent authority or the like.

What would happen, it was asked, if a mailbag containing 30 radioactive packages was involved in an accident or a fire? Should there be a limit on the number of radioactive packages per bag, or should the packages be separated from the bulk of the mail? It was suggested that no limit on the number of packages per bag is needed, neither should radioactive consignments be segregated. Most packages contain far below the permitted activity level, so that normally the entire contents of as many as one hundred packages would have to be released before the allowed activity limit of one such package would be exceeded. It was also noted that any material released would be diluted many times over to very low concentration levels by the dispersive nature of fires.

Another issue involving costs arose in regard to the extent of practical and administrative precautions taken to avoid a highly unlikely accident of limited consequence. In discussing the possibility of reducing the activity limits for postal shipments, e.g., to the ALI values, it was noted that there is no such thing as a "zero risk situation", regardless of the substance or undertaking. In every action there is always an element of risk, however small. To attempt to reduce it further may not prove economically feasible or justifiable. This process is known as optimization whereby one sets out to keep radiation doses as low as reasonably achievable (ALARA), social and economic factors being taken into account. Under the ALARA concept, which is recommended by the ICRP, postal shipments may be preferred in many instances where presently other modes of transport are used. Therefore the option of shipment by post should be available.

It was suggested that some standardization of packagings could be helpful, since practice varies widely at present and unsatisfactory conditions could be caused by the wrong choice of packaging material. The current regulations of the IAEA have been formulated to specify what is to be achieved rather than specifying how it is to be achieved, thus placing a burden of proof on the shipper. No change of this policy is foreseen for the 1984 edition of the Agency's Regulations.

Finally, it was estimated that one year of handling of radioactive materials by a postal worker normally leads to a radiation dose well below what may result from a single medical X-ray examination. The overriding conclusion of this was that legal transport of radioactive material by post, i.e., applying IAEA/UPU/ICAO regulations, is by no means dangerous.

TRAINING, EDUCATION, INFORMATION

General acceptance of radioactive postal consignments is essential if the option is to be available and used to its fullest potential. The psychological barriers and misconceptions so frequently encountered in the field of radiation protection can only be remedied by information and - where applicable - training. This seems to be particularly important in the area of international transport by post. There are about 360,000 post offices in all parts of the world. About 80% of UPU Member States are developing countries. Any instructional material supplied for use by postal employees has to be kept at a very basic level, far less technical than the current Regulations, to be understood. The presentation of facts and prescriptions would be even more valuable if some advisory material and practical examples were added.

ICAO and IATA already have a training programme for shippers of dangerous goods in general. These organizations, too, emphasized the need for training and declared their willingness to cooperate in producing the material. Due partly to financial problems, the UPU representatives could make no commitment at this stage but agreed that providing of educational material and training is highly desirable.

One of the shippers present at the Seminar confirmed the importance of education and indicated his company is now offering training programmes for police and fire departments, carriers and hospital staff. Training of postal workers was also advocated. This view coincides with the programme now being carried out in France, where specialized mobile units have been trained to handle transport emergency situations. In Austria, the postal staff is well informed and instructed as regards radioactive consignments. Several speakers representing a variety of countries and organizations claimed that safety officers should be informed on proper accident procedures and that shippers, postal staff and carriers should be given instructions on how to package and handle radioactive materials.

However, not all participants were in favour of training programmes for postal workers. It was argued that if training is necessary, perhaps the proper action to take would rather be to lower the present activity limits. It was also argued that since the present limits are considered to provide adequate safety by most participants, offering training programmes for postal employees must be an obvious case of elevating a non-problem to a problem in an area where no real problems exist. On the other hand, if training is needed, so are refresher courses, and staff turnover must be taken into account. There were serious doubts expressed as to this being an optimal use of financial and other resources, relative to the vanishingly small hazards associated with postal transport of radioactive materials.

At this point, a distinction was made between training, on the one hand, which should be reserved for shippers, and education and information, on the other hand, to be offered to postal staff and carriers. As far as the latter groups are concerned, the object is to reassure them that packages containing radioactive materials can be handled safely, granted a few simple rules are followed. IAEA representatives agreed that training in general does not appear to be necessary or appropriate, but that the Agency would take the production of information and educational materials under consideration.

The information and educational materials suggested were pamphlets, reports, movies, video tapes, etc. It was suggested that any material of that nature should be developed by the IAEA in close cooperation with the UPU, ICAO and IATA, in the working languages of these organizations. Such materials would need to be made available to all UPU postal administrations, the training or education process thereafter being a matter to be handled on a national basis. Among other things, the following aspects should be covered: the background and primary objectives of the IAEA/UPU/ICAO Regulations; instructions on how to safely handle the mail; and appropriate action to be taken in case of an accident.

A P P E N D I C E S

APPENDIX I GLOSSARY OF TERMS

The following glossary of terms used in the text is provided to assist the reader.

- Activity - An amount of a radioactive nuclide in a particular energy state at a given time. Activity has commonly been measured in curies (Ci); but the unit now to be used in the SI system is becquerel (Bq), where $1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq}$.
- ALARA - An acronym for "as low as reasonably achievable". The design, plan, and subsequent use and operation of sources and practices shall be performed in a manner to ensure that exposures are as low as reasonably achievable, economic and social factors being taken into account (see IAEA Safety Series No. 9). It is a synonym of "optimization of radiation protection".
- ALI - An acronym for "annual limit of intake". The activity of a radionuclide which, taken alone, would irradiate a person, represented by Reference Man, to the limit set by the ICRP [Ref. ICRP Publication No. 30] for each year of occupational exposure (see IAEA Safety Series No. 9).
- Competent Authority - An authority designated or otherwise recognized by the government for a specific purpose in connection with radiation protection. For transport, competent authority shall mean any national or international authority designated or otherwise recognized as such for any purpose in connection with IAEA Safety Series No. 6.
- Consignment - Any package or packages or load of radioactive materials presented by a consignor for transport.
- Consignor - Any person who presents a consignment of radioactive materials for transport, and who is named as consignor in the transport documents. The term "person" includes individuals, organizations and governments.
- Deminimis - Part of the legal maxim "de minimis non curat lex", the law does not concern itself with trifles, which is sometimes used to designate levels of individuals and collective effective dose equivalent so low that the competent authority may ignore them for a defined regulatory purpose.

Dose rate - See "Radiation Level"

Half-life - For a single radioactive decay process, the time required for the activity to decrease to half its value by that process.

IAEA - International Atomic Energy Agency

IATA - International Air Transport Association

ICAO - International Civil Aviation Organization

ICRP - International Commission on Radiation Protection

Package - The packaging together with its radioactive contents as presented for transport.

Packaging - The assembly of components necessary to ensure compliance with the packaging requirements of IAEA Safety Series No. 6. It may, in particular, consist of one or more receptacles, absorbent materials, spacing structures, radiation shielding, and devices for cooling, for absorbing mechanical shocks, and for thermal insulation. These devices may include the vehicle with tie-down system when these are intended to form an integral part of the packaging.

Radiation Level - The dose equivalent rate, which is a measure per unit time of the radiant energy absorbed in a specified body. For transportation, radiation level has been commonly expressed in the units of rem/h; but the units now to be used in the SI system are Sv/h (sievert/hour), where $1 \text{ rem/h} = 10^{-2} \text{ Sv/h}$.

Radioactive Material - For transport, is any material having a specific activity greater than 70 kBq (2 nCi/g).

Special Form - Radioactive material in either an indispersable solid form or in a sealed capsule.

Specific Activity - The activity of a radionuclide per unit mass of that nuclide; or, for a material in which the radionuclide is essentially uniformly distributed, the activity per unit mass of the material.

APPENDIX II

SUMMARY STATEMENT BY RAPPORTEUR

In the 19 papers presented at the seminar and during several discussions, a great many issues and different points of view have been touched upon.

First of all, there seems to be a need for postal shipment within and between countries around the world. Manufacturers are eager to find a swift, safe and inexpensive mode of transport. End users, such as hospitals and scientific institutions, often rely on fast delivery. Also, I'm sure the need would be there once postal transport were allowed in countries now prohibiting it.

With a need so clearly documented, there seems to be a wide gap to bridge between the need for and the use of postal movement. And this is not necessarily due to some action or non-action on part of the postal authorities. Even where the service is offered, it is not used to its full potential. Should we, then, try to expand and spread the use of the postal services? It is my feeling that the participants of this Seminar share my view that at least the option should be there, and many of us would welcome an expanding market. This goes not only for certain IAEA representatives but UPU, ICAO, and IATA representatives as well, I believe.

The present-day status is that some countries do not permit radioactive materials by mail. The ones that do permit this kind of consignments have adopted a whole spectrum of regulations, particularly activity limits, ranging from the ALI values of the ICRP to 1/5 of the A₂ values given in the IAEA Regulations. As some sensible mean value of it all stand the IAEA Regulations for postal transport. I think I have the support of most delegates gathered here when I say that the Agency's Regulations form the best - in fact, perhaps the only - platform to choose for a country now wishing to permit radioactive materials in its mail flow. If there was a consensus on this issue, I think we agreed that international movement calls for internationally accepted rules. And the point is: we don't have to look twice to find them.

Once the Regulations have been implemented, people like myself may do their best to change certain parts of them. Also, countries that have now implemented regulations of their own for internal postal movement should perhaps consider recognizing the IAEA/UPU/ICAO Regulations for any international movement they wish to take part in. The majority of the delegates seem assured this is the best way to promote safe postal shipments and uniform prescriptions of various kinds.

Why, then, is it that so many countries refuse to accept mail containing radioactive substances? Countries with several years of experience in this field have stated that, in their experience, there have been no actual problems. Of course there is always the risk of an accident when dealing with radioactive matter. But it has been pointed out on several occasions that uniformity of regulations is by far more important than to strive for an absolute safety, or zero risk, that could never be achieved anyway.

In most cases the refusal to handle radioactive consignments reflects a lack of expertise, a lack of proper knowledge. This creates fear and anxiety - without a reason for it. The problem grows out of proportion. So we discussed training of postal staff and carriers at some length, and found it perhaps a bit dubious. Some form of enlightenment, however, seemed to be justified. Whether to call it education or just plain information is perhaps a matter of individual taste. Films were mentioned, video tapes of course being an attractive alternative. It was agreed that this material should be developed by cooperative actions of the IAEA, UPU, ICAO and IATA.

Once such a material exists and has been distributed to the countries or organizations that ask for it, and once we can demonstrate that the regulations are actually followed by the authorized consignors, I am convinced that the transport of mail containing radioactive materials will be as rapid, inexpensive, and above all as safe as is reasonably achievable - and generally accepted at the same time. If this turns out to be the case, I think the goals of this Seminar have to a large extent been achieved.

Thank you.

APPENDIX III

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APPENDIX IV

LIST OF PAPERS in order of presentation

No. of paper IAEA-SR-83/	Author(s)	Title of paper
-	B.A. Semenov <u>M. Rosen</u>	Opening Remarks
12	R.B. Pope	Goals of the Seminar on Transport of Radioactive Materials by Post
13	J.M. Milne	The Role of the UPU in the Conveyance of Radioactive Materials (Le rôle de l'UPU dans le transport des matières radioactives)
14	J.L. Cox	The Role of ICAO in the Transport of Radioactive Material by Post
15	J.M. Milne	Keynote Address: International Regulations on the Conveyance of Radioactive Materials by Post (La réglementation internationale du transport des matières radioactives par la poste)
9	<u>R.F. Barker</u> R.B. Pope	Safety Requirements for the Transport of Radioactive Materials by Post
11	T. Bennerstedt	Radiological Considerations in the Transport of Radioactive Materials by Post
18	F.E. Gardner	Requirements and Controls for Shipment of Radioactive Material by Post in the United States
4	S. Deron <u>U. Wenzel</u>	Impact of Nuclear Materials Transfer by Mail on International Safeguards
7	C. Faloci <u>S. Piermattei</u>	The Shipment of Radioactive Materials by Post within Countries of the European Communities
10	P. Atanassov	Reasons Preventing Certain Postal Administrations from Taking Part in the Transport of Radioactive Materials

No. of paper IAEA-SR-83/	Author(s)	Title of paper
1	H. Stapfer	Experiences et problèmes soulevés lors de l'envoi postal exprès de matières radioactives en Suisse (Experience and Problems created by the Express Postal Dispatch of Radioactive Materials in Switzerland)
8	H. Knauthe	The Transport of Radioactive Materials by Post in Austria
2	J.R. Walton	The Use of Postal Service by Amersham International plc
6	<u>P. Breur</u> C.B. Killian W. Keegan, G. Law	The Shipment of Radiopharmaceuticals by Post
17	<u>M. Goss</u> M. Rustomji	Practical Experience of the British Post Office in Handling Packages Containing Radioactive Materials
5	T. Bennerstedt	Mailing Radioactive Materials in Sweden
19	T. Biro	The Radiological Safety of Some Typical Shipments of Small Quantities
3	<u>B.C. Bernardo</u> E.M. Valdezco	Transport of Radioactive Materials by Post in the Philippines
16	R.M. Jefferson	The Need for Postal Movements of Radioactive Materials in the USA

APPENDIX V

INTRODUCTORY PAPERS

The goals of the Seminar and the roles of the UPU and ICAO in, and the regulatory and radiological considerations of transporting radioactive materials by post were first discussed at the Seminar. As these issues served as a basis for the remainder of the Seminar, they are reproduced in their entirety in this appendix.

1. The goals of the Seminar were set forth by Mr. R.B. Pope of the IAEA in paper IAEA-SR-83/12 as follows:

In order to allow nuclear technology to benefit mankind, radioactive materials must generally be transported safely, expeditiously and economically throughout the world. Some of the most basic applications of nuclear technology require the use of only small quantities of radioactive materials. These may be sufficiently small that national and international postal services could frequently offer the most effective means of transporting them. In order to facilitate the international movement of such materials, standards for shipping small quantities of radioactive materials by post have been established by the International Atomic Energy Agency (IAEA). These standards are set forth in Safety Series No. 6 - Regulations for the Safe Transport of Radioactive Materials, 1973 Edition (As Amended). These regulations were published by the IAEA in 1979 in English and in 1981 in French, Spanish and Russian. These regulations provide specific safety standards for both the packaging and the transport of all forms of radioactive materials, and generally all Member States (of the IAEA) and those international or multi-national organizations or agencies concerned with regulating transport are encouraged to adopt them for both domestic and international shipments. At the beginning of Session II, Mr. Barker (in Paper No. 9) will discuss the details of the regulations as they apply to transport by post.

The IAEA regulations have been implemented by the Universal Postal Union (UPU) in a Convention in 1966 and, more recently, by the International Civil Aviation Organization (ICAO). Other regional organizations and international modal transport organizations have also implemented the Agency's regulations in their own regulatory statutes, articles, instructions, etc. However, not all national postal authorities recognize these regulations, or for other reasons do not allow such shipments.

It has been estimated that nearly one third of all shipments of radioactive materials fall in the category where they could be transported by post. This Seminar is intended to provide for an exchange of information on the various aspects of transporting radioactive materials by post. This will allow regulators, shippers and carriers to better understand the nature and magnitude of the hazards associated with radioactive items which can be transported by post, the radiological aspects of such shipments, the experiences of those shipping these materials by post, the need for such shipments, and the administrative and safety requirements associated with postal shipments. Problems of, and reasons for, precluding postal shipments of radioactive materials will also be addressed. It is hoped that, through the presentations which will be made, questions addressed to the speakers, an open floor discussion and a concluding round table discussion, a better understanding of the safety, need and desirability of postal shipments of radioactive materials will be gained.

We who have organized this Seminar, the IAEA, UPU and ICAO, welcome you all here. We hope you will find the next four days beneficial and enlightening. We encourage all of you to participate in the discussions. Specifically, a "floor discussion" has been scheduled for the end of Session IV on Tuesday afternoon. We specifically request that those of you who will not have the opportunity to present papers at this Seminar will contemplate what is said here and also the problems or issues which exist in your area of responsibility, and be prepared to participate freely in the floor discussion.

2. The role of the UPU in the conveyance of radioactive materials was described by Ms. J.M. Milne of the UPU in paper IAEA-SR-83/13 as follows:

Before explaining the role of the UPU in the conveyance of radioactive materials, I should like to give a brief introduction to our Organization for those among you who do not yet know it very well.

The origin of the UPU

The Universal Postal Union is an intergovernmental international organization like the IAEA; it became a specialized agency of the United Nations in 1948. By that time, however, the Union had already been in existence for 70 years. Indeed, representatives of 22 countries had signed in Berne, Switzerland, on 9 October 1874, the "Treaty Concerning the Establishment of a General Postal Union". In 1878, the Union changed its name to "Universal Postal Union" (UPU), a name which it merits since it now has 166 member countries, virtually all the countries in the world. Its headquarters are still in Berne where its Secretariat, known as the "International Bureau" and consisting of a total of 160 people, is located.

The Acts of the UPU and its aims

The basic Act of the Union is the Constitution which first of all sets out the aims of the Organization, viz: "... developing communications between peoples by the efficient operation of the postal services, and (to) contributing to the attainment of the noble aims of international collaboration in the cultural, social and economic fields." The Constitution also stresses the universality of the Union, specifying that all its member countries form a single postal territory for the reciprocal exchange of mail. From this basic principle follows that of freedom of transit, ie the obligation for intermediate administrations also to convey items handed to them in transit by another postal administration.

The main provisions concerning the operation of the international postal service are contained in a Convention, supplemented by Detailed Regulations which, like the Constitution, are binding on all Union member countries. They govern, in particular for "letter-post items" (Letters, postcards, printed papers and small packets), questions of rates (maximum and minimum charges and sizes and weight limits of items), inter-administration accounting and the actual operation of the services, including the conveyance of radioactive materials.

Optional Agreements govern the operation of the other postal services (including financial postal services such as international postal money orders). Of these Agreements, the only one which concerns us here is the Postal Parcels Agreement which contains similar provisions to those in the Convention and its Detailed Regulations regarding the conveyance of radioactive materials in parcels. (Unlike letter-post items, parcels are always registered and subject to Customs control. Moreover, the maximum weight for parcels (20 kg) is higher than the one for letter-post items (2 kg).

It should perhaps be emphasized that the Acts of the UPU govern the international exchange of items between postal administrations and do not seek to regulate the movement of items (including items containing radioactive materials) on the national level.

The bodies of the Union

Congress

The supreme authority of the Union, consisting of representatives of all its member countries, is Congress which usually meets every five years. Its main purpose is to revise the Acts of the Union. The next UPU Congress will take place next year (1984) in Hamburg (Federal Republic of Germany). An opportunity to amend the present provisions will therefore arise shortly.

The Executive Council

The body which ensures the continuity of the work of the Union between Congresses and coordinates all the activities of the UPU is the Executive Council. It may also make proposals and recommendations to Congress, which are generally accepted. It has 40 members and meets once a year at Union headquarters in Berne. It was the Executive Council which approved UPU participation in this seminar and which will be informed about the results of this meeting.

The Consultative Council for Postal Studies

This body, made up of 35 members, is responsible for studying technical, operational, economic and technical cooperation problems faced by Union member countries. This body, which has not so far had to consider the conveyance of radioactive materials by the post, has just held its annual session in Berne.

The International Bureau

As already mentioned, the International Bureau is the UPU's Secretariat. It serves as an organ of liaison, information and consultation for the administrations of Union member countries. In particular, it coordinates, publishes and distributes information of all kinds which concern the Union and the operation of the international postal service.

The world postal network

The Post affects everyone in their daily life, linking the inhabitants of every country in the world - not only the inhabitants of large cities but also those of the most remote and isolated communities. To deliver mail to all its users (usually to their residence), the Post uses every known means of transport - the most modern and the most ancient. As a result, it forms the world's biggest communications network. That is, by the way, the slogan selected for UPU Day on 9 October 1983. (In this connection, the UPU is playing an active part in World Communications Year decided on by the United Nations for 1983.)

Postal security

In view of the size of the postal network and the number of different types of transport used, a tremendous number of people take part in forwarding mail. We think, first of all, of postal staff working in post offices, sorting offices or delivering items to their addressees. In addition to the postal officials, we have Customs staff who are required to examine postal items from abroad. Secondly, there are the staff of the various means of transport (road, rail, sea and air) who among other things, load and unload the mail.

The Post obviously has to guarantee the safety of all these people - not to mention the security of all the items entrusted to it. That is why the inclusion in letter-post items and postal parcels of dangerous substances is formally prohibited by the Acts of the UPU. Moreover, in the last few years, the UPU has taken a series of practical measures designed to exclude dangerous materials from the Post as effectively as possible. I would add that these measures have mainly been taken at the request of ICAO and IATA who were and are concerned for the safety of aircraft carrying postal items. (Nowadays, most postal items are carried by air for at least part of their journey and this mode of transport is normally prescribed for items containing radioactive materials.)

Conditions for shipping radioactive materials by post

Notwithstanding its policy of excluding all dangerous items from the Post, the UPU admitted in 1964, mainly for humanitarian reasons, radioactive materials for postal conveyance. The items admitted are those which are exempted from the IAEA's own Regulations from special conveyance prescriptions. This decision, which was taken after lengthy study, was subject to several conditions or restrictions. These conditions and the reasons for them will be the subject of the second UPU paper (IAEA-SR-83/15).

Optional nature of the service

Because of these special conditions, conveyance of radioactive materials is optional, ie the exchange of such items is restricted to relations between postal administrations which have declared their willingness to admit them either in their reciprocal relations or in one direction only, normally inward. According to information sent to the UPU International Bureau and given in the annex hereto, only 25 postal administrations currently take part in this service, ie 15 percent of Union member countries.

Conclusion

It is very understandable that this situation is a matter of concern to the IAEA. It may be explained in part by the fact that a fair number of postal administrations are unaware of the types of radioactive materials exempted by the IAEA Regulations which could be admitted without danger for postal conveyance. On the other hand, the consignors of such articles may well not fully understand the concern of the postal side and its liability as regards security. It was therefore most appropriate that the IAEA should have taken the initiative of bringing the parties concerned together to examine all aspects of the problem. As co-sponsor of the seminar, the UPU hopes that the detailed substantive discussions which will take place here over the next few days will enable participants to reach a better understanding of the problems and concerns of their partners and that they will culminate in concrete solutions.

List of UPU member countries which admit radioactive materials for conveyance
by post

Australia	Niger
Botswana	Peru
Burundi	Senegal
Cyprus	Singapore
Great Britain	Switzerland
Guatemala	Thailand
Guinea	Togo
Iran	Turkey
Ireland	United States of America
Japan	Zambia
Korea (Rep)	Zimbabwe
Lesotho ¹	
Liechtenstein	Kiribati ²
Malawi	
	<hr/> 25 countries (+ 1)

¹ Inward only.

² Independent country whose position with regard to the UPU is not yet settled.

3. The role of ICAO in the transport of radioactive materials by post was established by Mr. J.L. Cox of ICAO in paper IAEA-SR-83/14 as follows:

The Role of ICAO in the Transport of Radioactive Material by Post

1. ICAO - The International Civil Aviation Organization - is, like the International Atomic Energy Agency and the Universal Postal Union, a specialized agency of the United Nations. It is very appropriate that these three organizations should collaborate in the holding of this Seminar, all three are involved in the regulation of the transport of radioactive material by post, all three have the common aim of ensuring that such transport is carried out safely and efficiently.

2. ICAO's prime purpose is to foster the planning and development of all aspects of international civil aviation. The aims of the organization are enshrined in the Convention on International Civil Aviation which was signed by 52 nations gathered in Chicago in 1944. Since then the membership has grown to include 151 sovereign States and thus represents all the nations of the world with any significant aviation activity.

3. The technical work of the International Civil Aviation Organization is largely accomplished by the adoption of Annexes to that Chicago Convention. Annexes contain Standards and Recommended Practices aimed at achieving the necessary level of standardization for the operation of safe, efficient and regular air services. The latest of these Annexes, adopted in 1981, is Annex 18 entitled the Safe Transport of Dangerous Goods by Air. This Annex contains broad standards which are supplemented by detailed requirements published in a document known as the Technical Instructions for the Safe Transport of Dangerous Goods by Air.

4. Thus, the International Civil Aviation Organization now sets the standards to be used by the aviation world for the safe transport of dangerous goods. However, for many years IATA - the International Air Transport Association - published its Restricted Articles Regulations and they were used by the majority of international airlines. But because those regulations were developed by an industry group, most governments were unable to give them the necessary legal backing and thus compliance was difficult to achieve. Moreover the IATA Regulations did not use the United Nations system of hazard classification nor the United Nations identifying numbers for the dangerous goods most commonly carried. This was confusing to shippers and made multi-modal carriage more difficult.

The expertise of IATA has not been lost as they have been able to participate fully in the framing of the new ICAO rules contained in Annex 18 and the Technical Instructions. This work commenced in 1975 and has culminated in the 1984 Edition of the Technical Instructions which becomes applicable on the first of January 1984 and is expected to be used by all of the 151 member States. The ICAO Dangerous Goods Panel of experts is made up of specialists in chemistry, packaging, airline operations, regulation drafting and other associated fields; its members coming from 10 different countries, from IATA and from the International Federation of Airline Pilots' Associations. The Panel meets every six months, keeping the Technical Instructions up-to-date, preparing a new edition for publication each September and adapting the United Nations Recommendations and the IAEA Regulations as necessary to meet the particular problems and conditions of aviation. A considerable emphasis is placed by ICAO upon training. It is recognized that a code of regulations, no matter how good, will fail in its purpose unless all those concerned are not only aware of the rules, but also are able to understand them and to apply them.

5. Most international mail is liable to be flown at some stage of its journey. Thus any article or substance coming within the definition of dangerous goods, that travels in the mail, is the concern of ICAO. In general the postal services are not considered suitable for the transmission of dangerous goods. The exceptions to this are infectious substances and radioactive materials, each of these only being allowed under certain restrictive conditions.

6. There is a need for certain radioactive materials to travel by post, a point which I am sure will be well amplified by other speakers at this Seminar. ICAO believes that this should be allowed provided it can be done safely, with no undue risk to anyone involved, i.e., the acceptance staff, the cargo handlers, the passengers and the aircraft crew. The limitations for postal packets of radioactive materials, as developed by the International Atomic Energy Agency, are supported by the International Civil Aviation Organization; they would seem to assure the necessary protection to personnel. Certainly we have heard of no evidence to suggest otherwise. However if there is such evidence this Seminar provides the forum where it should be produced. If any speakers have such evidence then we should of course wish to consider what changes to the regulations ought to be made.

7. The danger to humans from a radioactive substance is an invisible one. It is probably this quality which often causes the subject of radioactivity to be approached emotionally - even by normally rational people. However I hope that during this Seminar we shall be trying to look at the problems involved on a rational basis - while remembering that others may react emotionally to anything labelled, either literally or figuratively, as radioactive.

8. There seem to be two popular misconceptions related to radioactive materials, misconceptions often held by otherwise knowledgeable people. The first is that any object which comes into close proximity with a package of radioactive material is liable to become radioactive itself; for example, a belief that if a chicken travels next to a package of radioactive material then it may start laying radioactive eggs! But this just cannot happen unless the chicken should manage to eat the contents of the package! The second misconception is that radioactive material can be so shielded by packaging material that no radioactivity can escape. Other dangerous goods can be put into leakproof containers, e.g., a sealed glass bottle. However with radioactive materials shielding will only reduce the level of radioactivity, not eliminate it.

9. Perhaps there is a third misconception or misunderstanding which should be mentioned. This is that the human race was not affected by radioactivity until that momentous day when someone split the atom, an event which has caused trouble ever since! However, the truth is that radioactivity has always been with us, though unrecognized for most of man's existence. Radiation reaches us all as cosmic rays; there is low-level radiation from many everyday substances, for instance milk or building bricks; and there are naturally occurring radioisotopes in the make-up of every human body.

10. Radioactive materials allowed in the post are limited in two ways. They must be in one of the categories of exempt items (although this term becomes "excepted items" in ICAO usage), one of the main requirements for which is a limit on the radiation level at any point on the external surface of the package of 5 μ Sv/h (0.5 mrem/h). This radiation level will depend on the type and quantity of radioactive material and also on the shielding qualities of the packaging. Also there is a maximum permissible activity level, that is the actual activity of the radioactive substance, a quality not affected by shielding or packaging. For carriage in the mails this level is set at one-tenth of the exemption limits shown in a special table contained in the IAEA Regulations and repeated in the ICAO Technical Instructions.

11. If the above rules are followed, is the resulting package safe for the postal worker to handle and should it be carried in aircraft, or in other means of transport, without any of the special precautions usually required for radioactive materials? The answer of the theoretician is yes, but perhaps more importantly we have yet to see any practical evidence which would suggest that this procedure is at all unsafe.

12. The activity and radiation limits for postal packets were devised by the International Atomic Energy Agency and were accepted by the Universal Postal Union and the International Civil Aviation Organization as safe and reasonable. For various reasons many postal authorities, although members of UPU, have seen fit to impose further restrictions of their own or to prohibit such packets entirely. One of these reasons no doubt is a feeling that, to be on the safe side, it would be better to have nothing to do with anything that is radioactive. As I attempted to show earlier this is an impossibility, we cannot avoid radioactivity, but we can observe its effects and determine acceptable levels. What is the effect of such a prohibition, does it really stop such packages from being offered to the postal service? I very much doubt that it is completely effective or anywhere near to being so. There will be many people who, feeling sure that no harm will be done and knowing that detection is unlikely, will send such articles in the mail but without indicating the radioactivity of the contents. However, having decided not to comply with the label requirements, they are unlikely to bother about the other limitations. The result is an unsatisfactory and possibly unsafe package.

13. The question is often put: Why not ban all dangerous goods from air transport? The answer is that such a prohibition would not stop dangerous goods from being carried, they would still be there but without any regard to the many rules that make their carriage safe. The most dangerous of the dangerous goods that fly are those that travel underground! With radioactive materials, as with all other potentially dangerous goods, it should be our aim to provide regulations that reduce that potential hazard to an acceptably safe level. Such regulations, however, need to be more than just a safe way of doing things; they must also be practical to implement, understandable by those involved and promulgated in such a way that the word reaches all those who need to know.

14. There is a need to convey by mail numerous manufactured articles having minimal radioactivity and, with suitable safeguards, it would seem quite safe for this to be done. The large number of countries which impose their own restrictions or prohibitions, instead of accepting the internationally agreed precautions, often make the legal carriage of such goods impracticable. The result of this would seem to be that in some cases these goods are still sent by mail but without proper markings and without attempting to conform with any of the regulations. At this seminar we have an opportunity to discuss the problems associated with carrying radioactive materials by mail. In particular I hope we shall be exploring the reasons why some postal administrations, and indeed some airlines, find difficulty in accepting the international recommendations for carrying such goods. I trust we shall look at this with open minds. Are those internationally agreed precautions not well enough understood? Is the low level of risk they aim to achieve not appreciated? Or is there after all a need for some extra protection for all the workers who are liable to come into contact with these packages? These are some of the questions to which this seminar should provide the answers.

4. Ms. J.M. Milne of the UPU then discussed the international regulations on the conveyance of Radioactive Materials by Post, in paper IAEA-SR-83/15, as follows:

Introduction

1 As our first paper (IAEA-SR-83/13) shows, very few postal administrations admit radioactive materials for conveyance by the post. The main aim of this seminar is to try to identify the reasons for this situation and, if possible, to find ways and means of inducing a greater number of administrations to take part in this service.

2 In this respect, the contributions from the postal administrations represented here should help us to see things more clearly. Some of them are going to explain the reasons which have so far prevented them from carrying out the service while others already operating the service will describe the procedures applied in their countries. The practical experience of the latter administrations should be particularly useful in showing how difficulties can be overcome.

3 By way of introduction to these papers, I think it would be useful to review the international regulations prepared by the IAEA and the UPU - not without difficulty - which serve as the basis for the exchanges of radioactive materials by post between various countries. One may indeed wonder whether these regulations in themselves constitute a barrier to the exchange of radioactive materials and - if so - how they could be relaxed without affecting the safety of postal staff and other people handling such items.

The origins of the regulations

4 The Universal Postal Union started dealing with the problem even before the establishment of the IAEA in 1957. In fact, as long ago as 1955, the postal administration of the Federal Republic of Germany, noting the ever-increasing possibilities of radioactive materials being used for medical and scientific purposes, asked the UPU International Bureau to make an inquiry on that subject.

5 According to the findings of that inquiry, the problem had not yet arisen for a fair number of administrations whereas it was under study in others. At the same time, some administrations prohibited the conveyance of radioactive materials on the basis of their national legislation while others authorized shipment thereof subject to compliance with strict regulations.

6 This situation led the Austrian postal administration in 1959 to propose studying the problem in order to find a general solution and possibly to prepare similar regulations to the ones which the UPU had already introduced for the dispatch of perishable biological substances. (We shall see later that the conveyance of such substances by the post raises basically the same problems as the conveyance of radioactive materials.) At the same time the IAEA Group of Experts was preparing draft regulations for the general transport of radioactive materials.

7 Considering that the Post could not evade its obligation to take part in the conveyance of such materials, the UPU Executive and Liaison Committee (now the Executive Council) agreed in 1961 to consider the question, on certain conditions, viz:

- the content of the items must not include anything of a noxious nature for the staff of postal administrations required to handle them;
- the external radiation therefrom must not harm other postal items under normal conditions of conveyance;
- the items in question must bear a label indicating the nature of the contents in order to expedite the measures to be taken in the event of deterioration or accident;
- such items may be shipped overseas by air only and, as applicable, for short distances by express;
- exchanges must be restricted to official or officially authorized bodies.

8 Working out the draft regulations proved to be a very arduous task. In general, the members of the Executive and Liaison Committee accepted as a basis the "IAEA Regulations for the safe transport of radioactive materials", particularly the chapter concerning "no danger" shipments. However, for many administrations, the questions of make up and checking of the items raised complex problems. The assurances given by the IAEA representative about the minimal danger of external radiation and contamination for human beings and radiographic films were finally accepted and draft regulations were submitted to the UPU Congress in Vienna in 1964 and approved by it.

9 These regulations are given in both the Acts of the UPU (Convention and Detailed Regulations)¹ and, in a slightly different form, in the IAEA Regulations for the safe transport of radioactive materials. Extracts from these two sets of regulations are given for information in the annex to this paper.

The bases of the regulations

10 The starting point for this legislation - which has not been questioned up to now - is that the conveyance by the post of radioactive materials must be confined to items exempted by the IAEA Regulations from transport prescriptions because of their very low activity. For various reasons, these latter prescriptions are not repeated word for word in the UPU Acts but excerpts from the IAEA current regulations are given in a UPU publication entitled "Compendium of Information (Convention)".

11 Apart from this basic provision, the conveyance by post of radioactive materials is subject to other conditions as regards:

- the conditions of posting (prior consent from the competent authorities of the country of origin; the postal administration may also designate special post offices for the posting of items containing radioactive materials);
- the marking of the items (by means of a white label bearing the words "Radioactive materials"; name and address of the sender to be written on the outer and inner wrapping and an indication of the contents on the inner wrapping);
- items are conveyed by the quickest route, usually by air;
- items must be registered (a provision introduced at the 1974 Lausanne Congress to ensure supervision of the items from posting to delivery to the addressee).

12 The absence of a provision about the steps to be taken in the event of an accident should be noted; the authors of the regulations presumably considered such a provision to be unnecessary in view of the basically harmless nature of the radioactive materials admitted by the Post.

13 Lastly, it should be noted that the exchange of radioactive materials through the post is optional, since the UPU considers that bringing the service into general use might cause problems for some administrations and that it would therefore be premature to make it compulsory. Consequently, an administration which accepts outward items containing radioactive materials must ensure that such items are accepted on the inward route in the country of destination.

¹ The possibility of conveying radioactive materials in postal parcels was recognized from the start but the equivalent regulations (copied from those in the Convention) were not formally introduced until the 1974 Lausanne Congress.

Aspects of the regulations which seem to cause problems

14 Of all the conditions laid down by the postal side, only two - admittedly, quite important ones - have been disputed by IAEA, viz:

- the marking of items containing radioactive materials;
- the conditions for posting items containing radioactive materials (prior consent from the competent authorities of the country of origin).

Marking of items

15 The question of the labelling of items containing radioactive materials was discussed at length in 1962 and 1963 when the present regulations were drawn up. At the time, the IAEA representative objected to this measure arguing that the IAEA Regulations made no provision for a label for items "exempted" from special transport prescriptions. Most administrations, however, insisted on special labelling for items containing such materials in order to protect postal staff and other items in the event of an accident, and also to ensure rapid transmission. Consequently, the present regulations provide for the use by the sender of a white label bearing the words "Radioactive materials". (The UPU Acts do not lay down a particular design for this label.)

16 This question was brought up again in 1982 at a meeting of the Advisory Group for the present review of the IAEA Regulations, at which the UPU International Bureau was represented. On that occasion, the abolition of any external marking on postal items was again proposed. In support of such abolition, it was noted that the UPU white label might be confused with the IAEA white label prescribed for items, the activity of which is considerably higher - and that the words "Radioactive materials" has negative psychological effects on postal staff and airline personnel.

17 As a compromise solution, the UPU representative suggested replacing the white label by the plain and durable wording, to be written on the outer wrapping: "Radioactive materials. Quantities permitted for movement by the post".

18 At its 1982 session, the UPU Executive Council approved that solution and recommended that the next UPU Congress (Hamburg 1984) should amend the UPU Acts accordingly. Moreover, if the new IAEA Regulations should come into force before the Hamburg Congress Acts, the UPU would take steps to ensure advance application by postal administrations of the new marking procedure.

19 It is therefore hoped that this measure will ease the handling of postal items containing radioactive materials by helping to dispel the apprehension of staff handling such items.

Conditions for posting items containing radioactive materials

20 Under existing postal regulations, such items are admitted for conveyance "subject to prior consent from the competent authorities of the country of origin". According to the IAEA Regulations, the items "shall be deposited with the postal service only by consignors authorized by the national competent authority".

21 This is undoubtedly the restriction which was most strongly challenged by the IAEA when the postal regulations were drawn up in 1961-1963. Postal administrations have, however, insisted on the need to verify whether IAEA Regulations have been observed by senders and whether the items posted do not in actual fact present any danger.

22 In 1973, the IAEA again approached the UPU to ask it to abolish this condition, as the panel of experts to review the IAEA Regulations at that time had expressed the view that it was superfluous. (IATA, which was represented on the panel of experts, considered that the measure was unrealistic, particularly when consignments of watches, instruments and radioactive materials for medical purposes were involved.)

24 The UPU agreed to consult postal administrations on that subject. The inquiry carried out in 1975 revealed, however, that most administrations were against abolishing that condition, arguing that it would be difficult to exercise effective supervision if the posting of items was not subject to prior authorization. They therefore feared that postal officials would be exposed to risk in the event of failure to comply with the maximum authorized quantities and the prescribed conditions. Consequently, the UPU came out in favour of retaining this condition in the UPU Acts as well as in the IAEA Regulations. This view was shared by the Customs Co-operation Council (CCC) which was consulted in that connection.

Experience with perishable biological substances

25 While the position has not changed since then as regards radioactive materials, the UPU has meanwhile had before it a request to relax the conditions for posting perishable biological substances. Indeed, the sending of such substances by post is subject to similar conditions to those for sending radioactive materials - since they can only be exchanged between officially recognized qualified laboratories.

26 In order to facilitate the exchange of specimens by post, the World Health Organization (WHO) asked the UPU to abolish that condition as regards non-infectious perishable biological substances, arguing that such substances - unlike infectious substances - presented no real risk. When they were consulted in 1981-1982, most administrations pointed out that, if the conditions of posting were relaxed, it would no longer be possible to ensure that items, posted by occasional senders, were really not dangerous. Consequently, the UPU Executive Council declined, at its 1982 session, to recommend an amendment to the Acts.

27 It might be useful to mention here the results of an even more recent inquiry (end of 1982) which we undertook at the request of the WHO to find out the reasons preventing postal administrations from taking part in the international conveyance of infectious perishable biological substances, particularly in the conveyance of diagnostic specimens. It must be stressed that these are substances which present a real risk and which cannot therefore be compared with radioactive materials admitted for conveyance by the post. That having been said, the reasons given by administrations are of some interest:

- safety considerations - fear of danger to postal staff and other items in the event of damage or leakage;
- lack of necessary installations to provide special handling of such items;
- prohibitions imposed by national legislations;
- absence of demand on the part of potential senders or on the part of other postal administrations.

28 In the light of the results of this consultation, two courses of actions were agreed on with the WHO. For its part, the WHO will endeavour to solve the problem on the national level by asking the public health authorities to approach the postal administrations of their countries with a view to encouraging them to admit the conveyance of infectious substances. On the postal side, the next UPU Congress will be asked to appeal to administrations to take part in the service for humanitarian reasons.

29 It may reasonably be deduced from the attitude of the postal administrations with regard to perishable biological substances, that they would still be opposed to the idea of relaxing the conditions for posting radioactive materials. In other words, it is not the existing regulations in themselves which stand in the way of the extension of the service but in all probability the difficulty experienced by administrations in ensuring technical verification of the radioactive materials posted.

30 The detailed procedure for such verification is not spelled out in the IAEA-UPU Regulations as such but the UPU "Annotated Acts" contain the following note in this connection:

"Before such consent is granted, the administration of origin, or the responsible body appointed to this end, as the case may be, ensures that these dispatches conform to IAEA prescriptions, by requesting, for example, that a prototype packing for each category of item be submitted to it for approval."

31 In other words, it is assumed that postal administrations either have the services of a qualified specialist at their disposal or can call on the specialized services of another body in their country "appointed for this purpose". Moreover, once the authorization is given, it is presumably necessary, at least in some cases, to make periodic checks to ensure that the items posted are still in conformity with the prototype. It is therefore understandable that, for many countries, particularly for the developing countries which make up 80 percent of UPU membership, it is difficult to set up a verification procedure. The representatives of some postal administrations are going to explain to us how they have solved these problems and we hope that the other administrations will be able to benefit from their experience.

Possible solutions

32 Possible solutions depend to a large extent on the information provided during this seminar on the size of the problem, ie the different types of items involved, their characteristics and their number, the countries in which such items are posted and the countries of destination. Without wishing to go too far at this stage, it might be possible to contemplate, on the lines of what was agreed with the WHO on the sending of infectious substances by post, action by IAEA Member States at the national level. Such a campaign, which could be selective, would be aimed at making the postal administration of their country aware of senders' needs - and, if appropriate, to help that administration to carry out the technical verification of the items posted. In some cases, it might be enough to induce a postal administration to accept shipments of radioactive materials from other countries.

33 Subject to the views of the postal representatives present here, we might also ask the next UPU Congress to appeal to postal administrations to take part in the conveyance of radioactive materials.

Extracts from the Universal Postal Convention of Rio de Janeiro 1979 concerning
the transport of radioactive materials

CONVENTION

Article 21

Perishable biological substances. Radioactive materials

1 Perishable biological substances and radioactive materials made up and packed in accordance with the respective provisions of the Detailed Regulations shall be subject to the tariff for letters and to registration. Their admission shall be restricted to those member countries whose postal administrations have declared their willingness to admit such items, whether reciprocally or in one direction only. Such substances shall be forwarded by the quickest route, normally by air, subject to payment of the corresponding air surcharges.

2 Furthermore, perishable biological substances may be exchanged only between officially recognized qualified laboratories, while radioactive materials may be posted only by duly authorized senders.

Article 36

Prohibitions

...

4 The insertion in letter-post items of the following articles shall be prohibited:

...

- d explosive, flammable or other dangerous substances; nevertheless, the perishable biological substances and radioactive substances mentioned in article 21 shall not come within this prohibition;

CONVENTION, DETAILED REGULATIONS

Article 121

Make-up. Radioactive materials

1 Items containing radioactive materials, whose contents and make-up comply with the regulations of the International Atomic Energy Agency providing special exemptions for certain categories of items, shall be admitted for conveyance by post subject to prior consent from the competent authorities of the country of origin.

2 Items containing radioactive materials shall be provided by the sender with a special white label bearing the words "*Matières radioactives*" (Radioactive materials), which label shall be officially crossed out should the packing be returned to the place of origin. These items shall also bear in addition to the name and address of the sender, a request in bold letters for the return of the items in the event of non-delivery.

3 The sender shall give his name and address and the contents of the item on the inner wrapping.

4 Administrations may designate special post offices for the posting of items containing radioactive materials.

Revised 1973 edition (amended version)

PART A

Transport by post

547. A consignment of radioactive materials that conforms with the exemption provisions of Section III, paras 301 – 313, of these Regulations and in which the activity content does not exceed one tenth of those listed in Table V may be accepted for domestic movement by national postal authorities, subject to such additional requirements as those authorities may prescribe

548. A consignment of radioactive materials that conforms with the exemption provisions of Section III, paras 301 – 313, and in which the activity content does not exceed one tenth of those listed in Table V may be accepted for international movement by post, subject, in particular, to the following additional requirements ¹⁰

- (a) it shall be deposited with the postal service only by consignors authorized by the national competent authority,
- (b) it shall be dispatched by the quickest route, normally by air,
- (c) it shall carry on the outside a white label bearing the words "radioactive materials", which shall be crossed out if the package is returned empty,
- (d) it shall carry on the outside the name and address of the consignor with the request that the consignment be returned in the case of non-delivery, and
- (e) the name and address of the consignor and the content of the consignment shall be indicated on the internal packaging

¹⁰ These requirements are prescribed by the convention of the Universal Postal Union

5. Mr. R.F. Barker, a consultant to the IAEA, and Mr. R.B. Pope of the IAEA described the Safety Requirements for the transport of radioactive materials by post in paper IAEA-SR-83/9, as follows:

INTRODUCTION

There is perhaps no aspect in the field of atomic energy which is more important for the manufacturer and the user, the insured and insurer, the regulated and the regulator to have a common understanding - of the subject matter, of their separate programmes, and of the problems which they mutually face - than safety in the transportation of radioactive materials. Moreover, there is probably no aspect of atomic energy on which so many and varied interests must interact than on this same aspect.

In order to allow the benefits of nuclear technology to improve the physical, economic and social life of man, radioactive materials must be transported safely, with minimal delay and without extensive or unnecessary administrative procedures.

Radioactive materials in varying forms, and presenting varying degrees and kinds of safety considerations are now being shipped into, within and through most countries of the world.

In many fields devices or materials which are only slightly radioactive or contain very small quantities of radioactive material are in common use. Subject to necessary safety precautions, these materials may move by water, air, motor, or rail carriers, or parcel post. Because of the very low hazard potential posed by many of the materials, radiological experts have determined that they often could be carried safely by post. It is estimated that nearly one third of all shipments of radioactive materials could be transported by post. Indeed, within many countries and often internationally, large numbers of postal shipments are being made safely and expeditiously in accordance with IAEA, UPU and ICAO rules.

This paper will provide a summary of the history and philosophy behind the development of the Agency's transport regulations as applied to postal shipments. The types and quantities of materials which the Agency's regulations would allow to be transported by post will be described and comparisons will be made with other materials and packages which have been judged to be too hazardous for postal carriage. The Agency's regulations for postal transport will be reviewed, both the current version and proposed changes thereto. Other advisory materials will also be reviewed.

BACKGROUND

Man has always been exposed to ionizing radiation from naturally occurring sources. The natural background radiation levels vary quite widely for different parts of the world and at different altitudes above the earth and in different regions inside the earth's surface. The earliest record of radiation injury dates back to about 1500 when lung diseases were observed in miners of Saxony and Bohemia. Autopsies in 1879 by Herting and Hess of these miners revealed malignant growths in the lungs, but the cause thereof was not really understood until the discovery in 1896 of X-rays by Roentgen, and of radiation from uranium by Becquerel. Also, in 1898, the Curies discovered and separated radium

from uranium and production of that as one of nature's sources of radiation began. Skin burns were also observed about that time. In 1915, Russ made recommendations for radiation protection to the British Roentgen Society (most being unheeded), but it was not until 1928 that the International Commission on Radiological Protection was formed and published the first set of recommendations for radiation protection. The first self-sustaining neutron chain reaction was initiated on December 2, 1942, under the West Stands of Stagg Field at the University of Chicago under the direction of the late Enrico Fermi - that is considered to have launched the nuclear era.

In 1946, the Oak Ridge National Laboratory in the United States began producing radioisotopes in nuclear reactors for other than military purposes and such artificially created sources of radiation became available in a wide variety of types and forms and in virtually unlimited quantities.

As radioisotopes became available, many uses were developed which improve the standard of living and aid in medical diagnosis and therapy. The benefits to man are significant. For example, very small sources of Americium 241 are used in smoke detectors for early detection of fires in homes. Tritium activated lights illuminate the dials on many types of instruments, exit signs, watches and telephones. Many different types of electronic devices use small sources for ionization or as reference sources. In medicine small amounts of many radionuclides are widely used for diagnosis; in many cases, the individual takes the radioactive material directly into his body - either by injection or by mouth. In many cases, the quantities are sufficiently small or the level of radioactivity so limited that the potential for radiation exposure from such sources is essentially negligible. As a result, it was suggested early in the development of transport regulations that very small quantities could be carried by post.

Since 1948, several millions of packages of radioactive material have been shipped safely using all modes of transport, including post. According to a study carried out in the US¹, approximately 2.5 million packages were transported in the US in 1975, nearly one million in the exempt category and almost 200,000 were shipped by post.

Based upon 1980 to 1982 data recently reported to the Agency, it is estimated that 650,000 package-shipments per year were made in the Federal Republic of Germany, France and Italy alone. Approximately 580,000 of these annual shipments were radiopharmaceuticals, and -- of the 650,000 packages -- approximately 320,000 were in the exempt classification. At least some of these could possibly have been transported by post. Yet, of these three countries, only France permits postal shipments of radioactive materials, and only about 350 postal shipments resulted.

EARLY HISTORY OF TRANSPORT REGULATIONS

The development of transport regulations can be traced back to 1936, when the Kodak Processing Station in Chicago noted periodic density

variations occurring in film sent in by mail for processing. Subsequent investigations proved that special delivery packages from radium companies were accompanying the mail sacks containing film. Tests indicated that dental films were significantly fogged by being placed in contact with packages containing radium. As a result, in July 1936, the Postmaster General (of the USA) issued an order prohibiting any radioactive materials in the mail. This order remained in effect until April 1949, when regulations were established allowing small quantities to be sent by mail.² That order was perhaps the first regulation issued for the shipment of radioactive material by post.

The expanding radioactive material business and the shipments resulting therefrom prompted the calling together in the U.S.A. on May 22, 1946, of about 30 representatives of the photographic materials industry, the radium and radon industries, the Railway Express Agency, the American and Canadian Railroads, universities and hospitals, Air Transport Association, National Bureau of Standards, the Atomic Energy Commission, and the National Research Council, to discuss a draft of regulations for the shipment of radioactive substances which had been prepared by Dr. Failla of Columbia University. These were the first comprehensive regulations in the world governing safety in the transport of radioactive materials. These regulations, which went into effect in the USA on January 21, 1948, were drafted by the Subcommittee on "Shipment of Radioactive Substances" of the National Research Council, National Academy of Science whose Chairman was Dr. Robley D. Evans of the Massachusetts Institute of Technology.³

These early regulations limited the quantity of radioactive material shipped in a single package without special approval to not more than 2 Ci* of radium, polonium or other members of the radium family of elements, and not more than 2.7 Ci of any other radioactive material. A later amendment permitted solid Cs¹³⁷, Co⁶⁰, Gold¹⁹⁸, or Ir¹⁹² up to 300 Ci to be transported in a single outside container. Quantities above this had to be shipped by special arrangements and under conditions approved by the Bureau of Explosives of the Association of American Railroads which acted as the U.S. competent authority at that time. Similar actions are thought to have been taken in several other countries.

IAEA TRANSPORT REGULATIONS

The International Atomic Energy Agency was established in Vienna, Austria in July 1957. It is an international organization, considered to be a specialized agency in the United Nations system. The Agency is authorized by its Statute⁴ among other things:

"to establish or adopt ... standards of safety for protection of health and minimization of danger to life and property ... and to provide for the application of these standards to its own operations as well as to operations (supported) by the Agency or ... at the request of ... parties ... or of a State ... to activities in the field of atomic energy."

* Note - Ci - curie was the basic unit of radioactivity in use at that time.

The Agency's activities in Transport Safety, which are carried out by the Division of Nuclear Safety as part of a subprogramme of Radiological Safety, were initiated in the late 1950's. In view of the expanding use of radioactive materials for peaceful purposes at that time, the Agency undertook to develop harmonized safety rules for transportation of those materials on as wide a basis as possible and for all means of transport. Based on existing good practices and the few simple regulations already in effect including the US regulations, the Agency began the development of such rules in 1958.

The first edition of the Agency's Regulations for the Safe Transport of Radioactive Materials, Safety Series No. 6⁵, was published in 1961. In addition to being applied to the Agency's operations, they were "recommended to Member States and to International Organizations concerned as a basis for national and international transport regulations". Although they are called Regulations and do apply as Regulations to the Agency's own activities, they are recommended regulatory standards for international transport and it is incumbent on the individual Member State or international transport organization to adopt them and implement them in their own jurisdictions.

The Regulations were revised and updated in subsequent years to reflect experience in their application, new trends in radiation protection and changes in methods and technology. The most recent version, entitled "Regulations for the Safe Transport of Radioactive Material, 1973 Revised Edition (As Amended), Safety Series No. 6", was published in 1979. It is available in the four working languages of the Agency, English, French, Spanish and Russian. A comprehensive review of the Regulations is currently underway for a revision to be published in 1984. Both the Universal Postal Union (UPU) and the International Civil Aviation Organization (ICAO) are participating in that review.

By 1969, the Agency's recommended regulations had been adopted by, or used as the basis for, regulations of many Member States and almost all of the international organizations concerned with transportation, including the Acts of the UPU and Technical Instructions of ICAO, and by most of the Agency's Member States^{6,7}. As a result, the Regulations are applicable to transportation of radioactive materials almost anywhere in the world. Table I, Annex II, lists the Member States which have adopted the Agency's transport regulations. Table II, Annex II, lists international conventions which have incorporated the Agency's regulations.

The method of adoption by Member States varies. For example, some Member States may adopt by referring directly to the Agency's regulations whereas others may adopt by redrafting the contents of the Agency's regulations into their own statutes.

Data will be sought in the near future from Member States to more clearly define (1) the extent to which the Agency's regulations have been adopted, (2) which version has been adopted, (3) the method of adoption and (4) any exclusions or additions made to their regulations.

In applying the IAEA regulations, each Member State is encouraged to designate one person or group as "the competent authority" for implementing the transport regulations, including issuing approvals of packaging designs. The IAEA issues an updated list of the competent authorities each year⁸. For example, in the Federal Republic of Germany, the Bundesminister für Verkehr, Bundesminister des Innern, the

Physikalisch- Technische Bundesanstalt and the Bundesanstalt für Materialprüfung are all involved as the competent authority for approval of packages. Each country generally has designated one or more groups as the competent authority. Of course, the Postal Authorities regulate shipment by mail.

In addition, many competent authorities rely upon other groups to provide technical assistance and assessments, or part of the regulatory control may be directly vested by the competent authority in another group. In the U.S.A., for example, the DOT is the competent authority responsible for all international traffic of radioactive materials. Requests for container approvals, however, will often lead to the Nuclear Regulatory Commission (NRC) which reviews and approves many of the specific package designs. For carriage into and through certain States, cities and localities in the U.S.A., specific additional notification of and approvals of other groups may also be required.

PHILOSOPHY AND OBJECTIVES OF THE AGENCY'S REGULATIONS

The Agency's Regulations have been formulated to specify "what" is to be achieved rather than specifying "how" it is to be achieved. The purpose of having such a performance-based set of regulations is to provide as much freedom as possible to the designers, fabricators and users. This does however place a "burden-of-proof" on these groups to demonstrate that they have adequately satisfied the regulatory standards with their specific designs and procedures. It further places a technical burden upon the regulating groups to assure enforcement of the regulations. As a result, many Member States have developed or are developing stringent Quality Assurance procedures which must be followed to achieve that desired level of safety. Furthermore, the Agency has developed Advisory Material for the Application of the Transport Regulations, Safety Series No. 37² which contains general guidance on interpretation and application of the regulatory requirements for designers, manufacturers, competent authorities, shippers, carriers and others involved in transport of radioactive materials. These are discussed in detail in a later section of this paper. The Agency also offers specific advice and technical assistance on request from any Member State.

Concurrently, the need to provide adequate protection of health and safety, independent as far as possible from human error, requires that the responsibility for ensuring protection during transport belongs to the shipper to the maximum extent possible, not on carriers or their procedures. As a result, the contribution to safety by a carrier is minimized. However, transport industry workers are expected to treat radioactive material consignments with care, but no more so than would be accorded to any other shipment of dangerous goods.

In addition to the above, the regulations have been developed such that they are deemed:

- (1) to be practical, that is, they allow designers to consider feasibility and costs while assuring low risk;
- (2) to be clear and concise so they are not ambiguous, can be readily interpreted and easily enforceable; and
- (3) to provide traceability, through an adequate quality assurance programme from design to use and maintenance.

The objectives of the regulations are consistent with the portion of the Agency's Statute quoted earlier, to provide "safety for protection of health and minimization of danger to life and property". This is accomplished in the regulations by setting forth standards which protect plant workers, transport workers and the general public from external radiation and from the inadvertent release, dispersion, ingestion and/or inhalation of the radioactive contents of packagings in both normal and accident conditions of handling and transport. In addition, if the packaging contains fissile material, steps are taken to preclude the occurrence of a nuclear-critical event. Finally, since many radioactive materials generate heat, the regulations place requirements on the packaging design to assure proper heat dissipation to preclude damage to the packaging.

Protection is achieved through the regulations by a combination of (1) limitations on the contents of a package in terms of both its activity and the physical nature of the radioactive material, (2) specifications on the package design, and (3) placing certain simple controls on the handling and stowage to be followed during transport. More specifically, the protection offered by a packaging is proportional to the risk posed by its radioactive materials contents. For example, highly radioactive materials such as nuclear power plant spent fuel are required to be carried in packaging having more stringent design requirements and greater integrity and acceptance requirements than are relatively benign materials such as small quantities of radiopharmaceuticals.

In addition to the above noted objectives, the regulations have been structured such that, generally speaking, the carriage of a radioactive material package can be accomplished independent of the mode of transport, and can be regulated and controlled as part of regular commerce.

Finally, the regulations are structured such that the radiological protection which results is consistent with the requirements of the International Commission of Radiological Protection, and with the Agency's "Basic Safety Standards for Radiological Protection". A revision of Safety Series No. 9 was recently (1982) issued.¹⁰ The current revision of the transport regulations is taking into account the requirements set forth in this new edition of the Basic Safety Standards.

In the discussion which follows, many of these philosophies and objectives will be elaborated upon more completely as the details of the regulatory requirements are discussed.

PACKAGING CONTENTS LIMITS

Radioactive materials in transport represent a wide range of potential hazards to both transport workers and the general public. The regulatory provisions recognize this, and based on the level of hazard, establish several levels of containment or packaging requirements.

Since many substances, including the human body, contain minute amounts of radioactivity, a threshold below which materials are not considered to be radioactive for the purpose of transportation, is set at 0.002 microcuries per gramme (70 Becquerel per gramme).

Above this limit, all radioactive materials are divided into four general classes for establishing the containment requirements. These classes are:

1. Small concentrations and limited quantities which are exempt from special packaging;
2. Low level solids and low specific activity materials;
3. Type A quantities which require packaging that will retain the contents and shielding under conditions likely to be encountered in normal transport, including minor mishaps such as rough handling, exposure to rain, compression and penetration by other goods; and
4. Quantities exceeding Type A quantities, called Type B quantities, which require packaging capable of retaining the contents and most of the shielding under conditions likely to be encountered in transport, including impact, puncture, fire and immersion.

The quantity limits for the different classes of packages described above were determined using the following procedure. A quantity was determined for each radionuclide which presents no more than an acceptable level of risk from either internal or external exposure. Making reasonable assumptions regarding release and conditions of exposure of persons to the released material, an amount of each radionuclide that could be present in a single package of each class was calculated such that the likelihood is very small that an individual - transport worker or member of the general public - would be exposed to more than an acceptable level.

A Type A packaging must be designed to withstand normal conditions of transport but may lose its contents under severe accident conditions. The limits for Type A packages were determined for material in special form (A_1) where dispersal is unlikely so that the radiation level would not exceed 1 rem per hour at 3 meters from the unshielded source. For material not in special form, i.e., where dispersal is possible, the radiation level still must not be exceeded but also the quantity in this form (A_2) must be limited so that, assuming 0.1 per cent is released and 0.1 per cent ingested, the internal dose commitment will not exceed a quarterly dose limit for transport workers, which represents negligible risk because, as an accidental dose, it has a small probability of occurrence and if it occurs is a "once in a lifetime" event.

Examples of the quantities allowed in the different types of packaging are shown in Table III of Annex II. These examples are provided in terms of the A_1 and A_2 values. Examples of specific values of A_1 and A_2 for typical isotopes are given in Table IV of Annex II. Table III shows that the quantities which are allowed to be carried by post are at least 3 to 4 orders of magnitude lower than those which are carried in stronger Type A and Type B packagings.

Exempted Packages

Quantities not exceeding 10^{-3} of the Type A quantity limits are exempted from any special packaging standards but must meet certain other requirements. This factor of 10^{-3} where no packaging standards are set is consistent with the aforementioned assumption that under accident conditions, a Type A packaging provides some containment so that under

accident conditions it is unlikely that more than 10^{-3} of the contents will be released. With no special packaging, it is assumed all of the contents of the exempted package could be released but it is unlikely that more than 10^{-3} of the material released would be ingested or inhaled by any one individual.

Other factors are applied to account for the availability or non-availability depending upon the form of material. Liquid quantities are reduced by an additional factor of 10, whereas quantities of material incorporated into manufactured articles or instruments are increased by a factor of 10. Also articles manufactured of natural or depleted uranium or natural thorium, such as aircraft counterweights and tungsten-thorium alloys, are exempted without limits. Empty packages which have contained radioactive materials and otherwise might be required to be shipped as radioactive materials because of low levels of contamination or residues inside, are also exempted when properly closed, decontaminated to specified levels and all outside labels are no longer visible.

Many packages of materials, instruments, articles and also empty packages contain much less radioactivity than the quantity specified as the limit for exempted packages. Quantities not exceeding 1/10 of the exempted quantities are permitted to be transported by post. The experts have determined that these present a very low hazard potential. Also, that factor takes account of the fact that several packages of exempted radioactive material might be shipped at the same time by post.

The exempted quantities in terms of the A_1 and A_2 values for the different forms are summarized in Table V for materials and in Table VI for devices and instruments.

Strong Industrial Packages for LLS and LSA Materials

The same principle of considering physical form is expanded upon in the second division, low level solids and low specific activity materials. Radioactive material so dispersed in and diluted by inert material that it is inconceivable that under any circumstances likely to arise in transport a person could get enough material in his body to represent a significant internal radiation hazard is considered to be "inherently safe" from the radiotoxicity standpoint; i.e., the material itself controls the potential hazard if released, not its packaging.

Some packaging requirements and vehicle limits are imposed on LLS and LSA but these are primarily to control contamination, and no limits on amounts of activity per package are considered necessary for safety in transport.

Type A and Type B Packages

Packaging for radioactive materials of the remaining types, forms or quantities are specified according to the amount of activity involved. As discussed above, values for the maximum activity for specific radionuclides for the contents of packages in each of the individual divisions have been determined based on the radiation emitted by the unshielded radioactive material, the radiotoxicity of each radionuclide and the physical form in which the radioactive material is being shipped. These values are given in terms of A_1 and A_2 . A_1 for special form - non-friable, non-soluble, sizeable solid; and A_2 for all other forms.

Up to the A₁ or A₂ quantities, the radioactive material may be shipped in a Type A packaging which is only required to withstand normal conditions of transport and minor accidents. Above these limits, Type B packaging is required, that is packaging designed to withstand normal and certain accident test conditions. The latter type of packaging requires specific approval of each design.

REQUIREMENTS FOR POSTAL SHIPMENTS

Although the quantities that can be transported by post are very small, many radioisotopes for medical diagnosis, biological and analytical samples, calibration sources, manufactured articles, etc., can be and have been shipped safely by post in many countries and internationally since 1949.

The requirements for competent authority approval, package identification (labelling) and shipment notification for exempt materials and other types of packages are compared in Table VII of Annex II. The following describes requirements relating to postal shipments.

For domestic and international shipment by post the following is required (paragraph references are to the Agency's Regulations - see reference 5):

1. The quantity per item and per package must be within the specified limits (paras. 306, 309 and 310).
2. If the contents are fissile material, not more than 15 grams can be placed in any one package and the smallest external dimension shall not be less than 10 cm (para. 304).
3. The radiation level at the surface of each package must not exceed 5 μ Sv/h (0.5 mrem/h) (para. 302).
4. The contamination on any external surface of the package must not exceed 4 Bq/cm² (10^{-4} μ Ci/cm²) for β - γ emitters and low toxicity α emitters and 0.4 Bq/cm² (10^{-5} μ Ci/cm²) for all other α emitters (para. 303).
5. The package shall be described as "exempt" in the shipping papers (para. 305).
6. During normal conditions of transport there shall be no leakage of radioactive material from the package (para. 306(b)).
7. The package is marked "Radioactive" on an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package (para. 306(c)).

In addition, for international shipment by post, the following is required:

1. The consignor must be authorized by the national authority to deposit such shipments with the postal service (of the country where the shipment originates) (para. 548(a)).
2. The shipment is dispatched by the quickest route, normally by air (para. 548(b)).

3. The name and address of the consignor and the content of the package shall be indicated on the internal packaging (para. 548(d))
4. The outside of the package shall be labelled "radioactive materials" and the name and address of the consignor with the request that the consignment be returned in case of non-delivery (para. 548(c) and (d)).

PURPOSES OF THE REQUIREMENTS

As indicated earlier, the quantity in each package is limited so as to present no more than an acceptable level of risk in transport, even under accident conditions. The limit of 15 grams of fissile material in one package together with the minimum external dimension of 10 centimeters for each package makes it unnecessary to consider nuclear criticality since such small amounts with that spacing makes a nuclear critical situation (i.e., a self-sustaining chain reaction) impossible.

The limits on the radiation level at the surface of the package results in no significant exposure of people or film from radiation being emitted from the package. The radiation level at any distance from the package will be lower than at the surface of the package. For gamma radiation which is more often of concern, the radiation level is reduced by the inverse square law - i.e., it decreases proportional to the square of the distance and alpha radiation won't penetrate paper and beta radiation falls off very quickly so that beyond 1 meter it is negligible. The limits on contamination are also to control potential exposure. In most cases, exempt shipments are made in new, non-reusable packages and there will be no external contamination. If there is any contamination, it must be very low and represents no significant exposure potential.

The labeling and marking are primarily administrative details related to precautions to be taken when opening the package or when the carrier is unable to deliver the package to the consignee or in an emergency such as suspected leakage or an accident involving the package. It has been agreed by those involved in developing the Regulations, that packages containing no more than the exempted quantities or articles or equipment do not require the "RADIOACTIVE" label on the outside of the package and are only identified on the shipping papers as exempted radioactive materials. The Regulations do not specify a quantity below which something that qualifies as radioactive material (i.e., is above the 0.002 $\mu\text{Ci/g}$ specific activity) can be treated as not being radioactive for purposes of transport. A deminimis quantity is under consideration for some activities but none has yet been defined for transport.

As indicated earlier, the Agency's Transport Regulations were developed to be safe, practical, enforceable and, to the extent possible, comprehensive and uniformly applicable. Nonetheless, it is understood that when a Member State adopts these Regulations, conditions in that Member State may differ somewhat from those assumed and that State may find it necessary to specify certain additional requirements.

Also, in adopting the Regulations, some Member States and International Transport Organizations modify the requirements in varying degrees or take exception to some of the provisions. The modifications

are often in terms of the administrative details. Some countries may require approvals of packaging designs that under the uniform standards would not be required. These introduce inconsistencies in the requirements which cause problems, especially for international shipments. Therefore, such modifications should be avoided if at all possible. Uniformity in the regulatory standards for transport avoids unnecessary delays in the international shipments and expeditious movement is extremely important in keeping both actual and potential exposures to a minimum.

The competent authority for implementation of the transport safety regulations may be assigned to several agencies in a Member State often according to the mode involved. The Postal Authority is the logical agency for transport by post, and, indeed, that is the case in many Member States.

CHANGES TO AGENCY'S REGULATIONS

Among the specific changes in the Agency's Transport Regulations which are being considered for the 1984 Revision are the following which relate to shipment by post:

1. For international movement by post, packages are to be labelled on the outside "Radioactive Quantities permitted for Movement by Post" instead of the present white label bearing the words "radioactive materials". This change is mainly editorial and will place Safety Series No. 6 in accord with the UPU provisions.
2. New values are proposed for several of the A_1 and A_2 quantity limits. The system for calculating the limits has been revised mainly to take account of the latest annual limits of intake recommended by the International Commission on Radiological Protection and to control potential exposure due to contamination of the skin in case of a release of the radioactive contents. Several of the values are changed, some are increased and some decreased but most of the changes are only by factors of 2 to 5.

These and the other changes will be given a final review at the third meeting of the Advisory Group on the Comprehensive Review of the Transport Regulations to be convened by the Agency 7-11 November 1983, here at the Vienna International Centre.

ADVISORY MATERIAL FOR THE AGENCY'S REGULATIONS

The Agency, in consultation with radiological, packaging and transportation experts from Member States and International Organizations, has developed "Advisory Material for the Application of the IAEA Transport Regulations".⁹ This advisory material will be updated once the current process of revising the regulations is completed.

For completeness, the current advisory material relating to postal transport is reproduced here. The paragraph numbers cited are those from Safety Series No. 6.

"Transport by post (547, 548)

"3.12. It is important to note that, although the derivation of "exempt" quantities as outlined above justifies their safe transport by any means of transport without special packaging or administrative requirements, careful consideration led to the decision to reduce these quantities by a factor of 10 for transport by post as listed in Table I. This decision was taken because of the possibility of contaminating a large number of letters, parcels, etc., which would subsequently be widely distributed, thus increasing the number of persons who would be exposed to the possibility of an intake of 10^{-6} A₂. This reduction factor of 10 would also reduce the radiation level from a source which had escaped from its shielding to 0.1 mR/h at 3 m (100 mR/h at 10 cm), which was considered to be conservative enough for safety in the postal environment in comparison with what is already accepted for other modes of transport.

"Size and grouping of packages

"3.13. The package limits as determined above apply to individual packages, whether large or small, since each package has about the same probability of being involved in an accident and releasing its contents. The size of the package for most exempt items is therefore not specified. Some exempt items may include fissile materials and, for the purpose of nuclear criticality safety, the quantity per package is limited to 15 g and the minimum external dimension of the package to 10 cm.

"3.14. No activity limit applies to a load of packages or items, because the probability of many or all packages releasing their contents in an accident is very much less than that of a single package being disrupted. Criticality safety is ensured by the limit on the quantity of fissile materials present as in para. 3.13 above.

"Competent authority approval

"3.15. Items complying with the provisions of Section III of the Regulations are exempt from all the package and administrative requirements of Section VIII. In particular, the design for special form radioactive material, which in this context will invariably mean capsule design, does not require competent authority approval if the activity content of the capsule does not exceed 10^{-3} A₁. In the case of special form material in instruments and articles, this limit is increased to 10^{-2} A₁ for each item.

"3.16. It is, however, implicit in its definition that special form radioactive material in any quantity is required to comply with the impact, percussion, heating, leaching and dynamic bending test requirements specified in Section VII of the Regulations, paras. 726-737.

"3.17. The competent authority may, at any time, call upon the designer to demonstrate that his capsule designs comply with these test requirements. Similarly, the manufacturer may be called upon to demonstrate that the capsules are made according to the design specifications.

"3.18. Although, in general, it may not be possible for the competent authority to keep track of the encapsulated radioactive materials being transported under exempt conditions in his area of responsibility, he may wish, when he knows that such capsules are being made, to assure himself on occasion that the designs conform adequately to the definition of special form radioactive material in Section I of the Regulations, and that the capsules are being manufactured according to the design specifications.

"Consignor

"3.19. When delivering the exempt items for transport, the consignor is required to certify that the item meet the regulatory requirements for transport as exempt items. Therefore, although competent authority approval of exempt items is not required, the consignor must be prepared to provide the appropriate competent authority, if requested, with evidence that the items as shipped meet the applicable requirements. It is also important for the consignor to ensure that the external radiation level from the package is less than 0.5 mrem/h and that any contamination on the external surfaces of the package does not exceed the levels in Section V of the Regulations, para. 502.

"3.20. The consignor is also required to ensure that the marking "Radioactive" (Section III of the Regulations, para. 306(c)) is present inside the packaging. This is required so that a person can be made aware that radioactive material is present before he opens that part of the packaging which actually contains the radioactive material."

CONCLUSION

We have seen that safety in transport by post is provided by limiting the quantities of radioactive materials shipped in any one package, taking into account the type and form of the material and by observing a few simple regulatory requirements and safety practices in preparing the package for shipment. Because of the inherent safety provided by the limited quantities in a postal shipment, no special care is required during the transport phase, i.e., while the package is in the mail. Under certain circumstances if such a package were to be involved in a serious accident or fire in transportation, which is possible but very unlikely, some radioactive material could be released. Again, because of the limited quantities of materials involved, this is unlikely to present more than a problem of decontamination, i.e., clean up.

Based on the record that has resulted from following the safety regulations, it can be concluded that radioactive materials can be transported safely and economically by all modes of transport, including post. To maintain this record, "the Agency plans to continue its work to establish and maintain adequate, up-to-date standards for transport safety and to increase its efforts to promote harmonization of requirements for safety in the transport of radioactive materials among the various national and international organizations. We will continue to participate in and encourage studies to assess the radiological impact of transport throughout the world, provide for exchange of information on research in the area of transport safety and, where possible, expand our programme for providing guidance and assistance in the implementation of and compliance with the safety standards"¹¹.

We hope this Seminar will help to enhance communication between the Postal Authorities and the modal authorities in at least the Member States represented here. Also, we hope the Postal Authorities in attendance will better understand the types of radioactive materials permitted by international regulations to be shipped by mail and will be willing to accept such shipments without reservations.

ANNEX I

REFERENCES

1. Transport of Radioactive Material in the U.S., NUREG-0073, US NRC, 1976.
2. "Interpretation of Regulations Governing the Shipment of Radioactive Material", Carl W. Buckland, Jr., A.M.A. Archives of Industrial Health, Volume 19, January 1959.
3. Nuclear Science Series Report No. 11, Publication 205 (1951).
4. Statute, International Atomic Energy Agency, As Amended up to June 1973.
5. Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition (As Amended) Safety Series No. 6, International Atomic Energy Agency, Vienna 1979.
6. Safe Transport of Radioactive Material, IAEA/PI/A.2E, 82-00010, IAEA, Vienna, 1982.
7. International Regulatory Control of the Transport of Radioactive Materials, G.E. Swindell, IAEA Bulletin - Vol. 21, No. 6, December 1979.
8. National Competent Authorities List No. 14, IAEA, Vienna, October 1982.
9. Advisory Material for the Application of the IAEA Transport Regulations, Second Edition, Safety Series No. 37, IAEA, Vienna 1982.
10. Basic Safety Standards for Radiation Protection, Safety Series No. 9, (1982 Edition), IAEA, Vienna (1982). Jointly sponsored by IAEA, ILO, NEA(OECD), WHO.
11. "Regulation of Radioactive Safety in Transport", M. Rosen, Director, IAEA Division of Nuclear Safety, presented at the International Conference on the Urban Transportation of Irradiated Fuel, 12-14 April, 1983, London, England.

ANNEX II

Table I Member States which have adopted the IAEA's radioactive material transport regulations*

Argentina	Germany, Federal Republic of	Poland
Australia	Greece	Portugal
Austria	Hong Kong	Romania
Bangladesh	Hungary	Singapore
Belgium	Iceland	South Africa
Bolivia	India	Spain
Brazil	Indonesia	Sri Lanka
Bulgaria	Iraq	Sudan
Canada	Israel	Sweden
Colombia	Italy	Switzerland
Cuba	Japan	Thailand
Czechoslovakia	Malaysia	Turkey
Denmark	Monaco	United Kingdom
Ecuador	Mongolia	USA
Egypt	New Zealand	USSR
Finland	Norway	Vietnam
France	Peru	Yugoslavia
German Democratic Republic	Philippines	

* These states include those most actively engaged in transport both for domestic and international purposes.

Table II International Organizations which have incorporated the IAEA's radioactive material transport regulations by convention.

By sea:	International Maritime Organization (IMO), International Maritime Dangerous Goods Code
By air:	International Air Transport Association (IATA) Restricted Articles Regulations and International Civil Aviation Organization (ICAO) Technical Instructions
By rail:	International Convention Concerning the Carriage of Goods by Rail (CIM)
By road:	European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)
By post:	Acts of the Universal Postal Union

TABLE III EXAMPLES OF PACKAGING CONTENTS LIMITS

	<u>Type of Package</u>	<u>Contents</u>	<u>Activity Limit other than Special Form</u>	<u>Activity Limit Special Form</u>
I.	Exempt, Transported by Post	Solid Material	$\leq 10^{-4} A_2$	$\leq 10^{-4} A_1$
	Exempt, Transported by Post	Single Instrument	$\leq 10^{-3} A_2$	$\leq 10^{-3} A_1$
	Exempt	Single Instrument	$\leq 10^{-2} A_2$	$\leq 10^{-2} A_1$
II.	LSA	Activity Uniformly Distributed	$(\leq 10^{-4} A_2/\text{g})$	
	LLS	Consolidated wastes, Activity Uniformly Distributed and Insoluble	$(\leq 2 \times 10^{-3} A_2/\text{g})$	
III.	Type A	-	$\leq A_2$	$\leq A_1$
IV.	Type B	-	$> A_2$	$> A_1$

NOTE: $1.0 \leq \frac{A_1}{A_2} < 340,000$

TABLE IV EXAMPLES OF ACTIVITY LIMITS (1973 Regulations as Amended)

<u>Radionuclide</u>		<u>A₂^a (Ci)</u>	<u>A₁^b (Ci)</u>
Actinium,	Ac-227	0.003	1000
Americium,	Am-241	0.008	8
Caesium,	Cs-137	20	30
Cobalt,	Co-60	7	7
Krypton (uncompressed)	Kr-85	1000	1000
Krypton (compressed)	Kr-85	5	5
Mixed Fission Products		0.4	10
Molybdenum	Mo-99	100	100
Plutonium	Pu-239	0.002	2
	Pu-241	0.1	1000
Strontium	Sr-90	0.4	10

a Other than special form

b Special Form

Table V SMALL (EXEMPT) QUANTITIES

<u>SOLIDS AND GASES</u>	<u>PACKAGE LIMITS (Ci)*</u>
Tritium	20
Special Form	$10^{-3} A_1$
Other Forms	$10^{-3} A_2$
<u>LIQUIDS</u>	
Tritiated Water	
0.1 Ci/Liter	1000
0.1 - 1.0 Ci/Liter	100
1.0 Ci/Liter	1
Other Liquids	$10^{-4} A_2$

* For postal shipment, multiply all values by 10^{-1}

Table VI (EXEMPT) DEVICES AND INSTRUMENTS

<u>MATERIAL</u>	<u>ITEM LIMITS (Ci)</u>	<u>PACKAGE LIMITS (Ci)*</u>
<u>SOLIDS</u>		
Special Form	$10^{-2} A_1$	A_1
Other Forms	$10^{-2} A_2$	A_2
<u>LIQUIDS</u>	$10^{-3} A_2$	$10^{-1} A_2$
<u>GASES</u>		
Tritium	20	200
Special Form	$10^{-3} A_1$	$10^{-2} A_1$
Other Forms	$10^{-3} A_2$	$10^{-2} A_2$

* For postal shipment, multiply all values by 10^{-1}

TABLE VII REGULATORY REQUIREMENTS

C l a s s	Competent Authority Approval Required		Identification Required		Consignor required to notify country of origin and countries en route*
	Country of Origin	Countries en route*	External Label**	Transport Documents	
I. <u>Exempt</u> - By post	No International consignor authorized	No -	None*** "radioactive materials"	Described as "exempt"	No -
II. <u>LSA-LLS***</u>	No	No	Radioactive Label: White-I, Yellow-II or Yellow-III	Described as "Radioactive LSA" or "Radioactive SCO"	No
III <u>Type A</u>	No	No	Radioactive label Type A - mass	Describe consignment and inform carriers	No
IV <u>Type B(U)</u> - Package design - Shipment	Yes No	No No	Radioactive label Type B (U) - mass	- same -	- Yes, if contents exceed 3×10^3 A ₁ or A ₂ or 3×10^4 Ci
V <u>Type B(M)</u> - Package design - Shipment	Yes Yes	Yes Yes	Radioactive label Type B(M) - mass	- same -	- Yes
VI <u>Fissile Materials**</u> - Package design - Shipment	Yes Yes	Yes Yes	Radioactive label Fissile- mass	- same -	- Yes
VII <u>Special arrangement</u> - Shipment	Yes	Yes	Radioactive Yellow III label - mass	- same -	Yes
VIII <u>Special form material</u>	Yes	No	none	-	No

- * Countries through or into which (not over) the shipment goes
 ** Name and address of consignor is required for all packages
 *** From proposed revision
 **** Internal label "Radioactive"; items marked "Radioactive"

6. Radiological considerations in the transport of radioactive materials by post were reviewed by Mr. T. Bennerstedt of Sweden, in paper IAEA-SR-83/11, as follows:

BACKGROUND

Over the last few decades, the amount of radioactive materials being shipped throughout the world has increased rapidly. The activity per consignment varies widely. The contents may be a couple of smoke detectors, a strong cobalt source to be used in medical therapy, or radioactive wastes from a nuclear power plant.

It is safe to assume that the number of radioactive consignments being sent by mail is also increasing. However, when mailing radioactive materials one has to be far more restrictive than in other modes of transport. Only minute amounts can be permitted, and the packaging requirements have to be stringent. There are a number of reasons for this, e.g.,

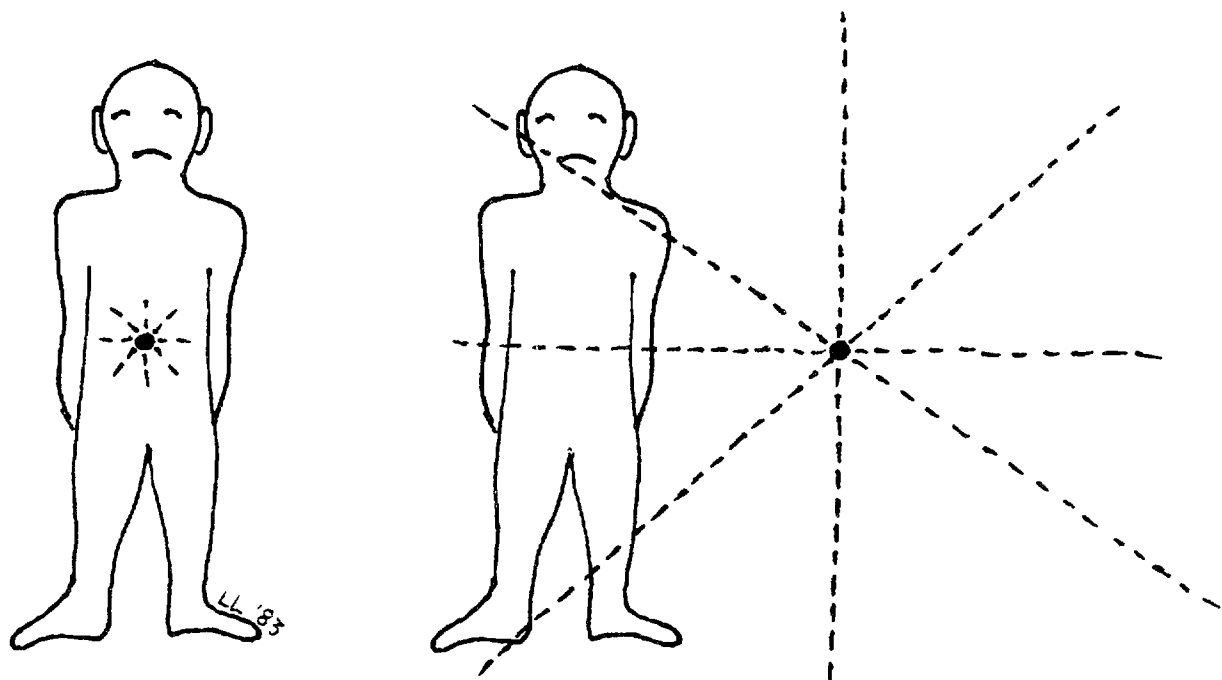
- No one expects a postal consignment to be dangerous
- Members of the staff as well as members of the public have to be protected against any unnecessary irradiation and should not be exposed to hazards greater than those normally encountered in any low-risk occupation
- In most countries, mailbags receive a fairly rough treatment, endangering inadequately packaged fragile goods
- Most people handling the mail have little or no radiological training and do not know what to do in case of an emergency.

When limiting the quantities of radioactive materials, the element of risk is reduced accordingly.

PROPERTIES OF RADIOACTIVE MATERIALS

What, then, are the potential hazards? Let us start by looking at the radioactive material itself. It may emit alpha, beta, gamma, or neutron radiation.

Alpha and beta radiations are readily stopped by a fairly thin protective shielding. A few millimeters of lead will do. Therefore, there will be no leakage radiation from properly packaged alpha or beta emitters. If, however, there is a leakage of the radioactive material itself, this material may be inhaled or ingested. If so, there is no shielding left to protect the human tissue. This may result in a so-called internal radiation dose, since the radioactive source is located within the body.



Internal and external radiation doses

Gamma and neutron radiations are not that easy to stop, but may penetrate even thick shields of lead. A certain radiation level, or dose rate, has to be allowed outside even a perfectly packaged gamma or neutron source. If not, the shielding would have to be forbiddingly thick and heavy.

But the dose rate has to be limited in order to keep the so-called external radiation dose at a minimum. Apart from this, a leakage of the radioactive contents may give rise to an internal radiation dose.

TRANSPORT OF RADIOACTIVE MATERIALS BY MAIL

What, then, can possibly happen when transporting radioactive postal consignments? Two typical cases may be distinguished.

Normal transport

In the first case, no accidents occur during transport. If the amount of radioactive material is below the appropriate activity limit given by the Agency, and if the contents are properly packaged, no harm will be inflicted on

- staff
- members of the public
- undeveloped photographic film
- other consignments
- vehicles, office facilities, etc.

This follows from the fact that proper packaging means that

- there is no contamination of the outer surfaces
- there will be no leakage of radioactive material
- the surface dose rate will be less than the stipulated limit (which, in turn, is achieved by keeping the activity below the limit and by using adequate shielding).

Hence, during normal transport there will be no internal radiation doses and as low external radiation doses as are reasonably achievable.

Accident during transport

In the second case, the package breaks due to some accident.

Special form radioactive materials may give rise to external radiation doses, if the shielding is lost due to the accident. Dispersion of the radioactive material can take place only under extreme circumstances. Hence, internal radiation doses are most unlikely.

If the radioactive material is a solid, other than special form, or if it is a liquid, the accident may result in external as well as internal radiation doses, since the material under certain circumstances may be dispersed.

If the radioactive material is a gas, it may cause external and internal radiation doses. However, with proper ventilation the gas will probably be removed before anyone gets close to the broken package. Most likely, the resulting radiation doses will be zero.

From a radiological point of view, the worst case is represented by a broken package containing some radioactive liquid. We then have the problems of external and internal radiation doses, as well as a tedious decontamination procedure.

With proper packaging, however, little or no radioactive material will be dispersed, be it a liquid or whatever. Even if the contents should not be completely absorbed, risks are kept at a minimum if the activity is limited. Both external and internal radiation doses have to be considered when setting these limits. For other than postal transports, the IAEA Regulations give activity limits A_1 and A_2 . Which one is to be used depends on the physical properties of the material. Packages containing less than a specified, minute fraction of these values are said to be exempt and can be transported fairly freely. The IAEA activity limit for postal consignments is one tenth of this exemption limit. A sizable portion of the radioactive contents of such a consignment may be accidentally swallowed or inhaled without any radiological reason for alarm.

The accident would, of course, have to be followed up. Firstly, access to the package and to the area in question should be restricted. A radiation safety officer should be called in to perform a survey,

assessing the level and spread of contamination. When decontamination and any additional precautions have been completed, suitable measures will have to be taken by all parties involved to prevent future accidents of the same kind.

But what if the staff should fail to notice that the contents are radioactive? In that case, contamination, inhalation, and ingestion may occur without anyone knowing until it is too late. This illustrates perfectly the need to limit the activity contents of the consignment, and, hence, keep the risk at an acceptable level.

In a paper to be presented later on, it is argued that the IAEA activity limits should, generally speaking, be lowered. However, I am convinced that in most practical situations the present limits will prove satisfactory.

CONCLUSION

If appropriate dose rate limits, activity limits, and packaging instructions are given and followed, almost complete radiological safety is guaranteed. The alternative is training of staff, segregation of packages, and detailed handling instructions - a tedious and far from failsafe solution. If the IAEA Regulations are applied, no postal authority should hesitate to allow radioactive consignments, neither on a domestic level nor internationally.

APPENDIX VI - ABSTRACTS OF DISCUSSION PAPERS

The following has been excerpted from the "discussion" papers presented at the Seminar. Complete copies of the papers are available, upon request, from the Radiological Safety Section of the Nuclear Safety Division, International Atomic Energy Agency, P.O. Box 100, Wagramerstrasse 5, A-1400 Vienna, Austria.

1. The requirements and controls for shipment of radioactive materials by post in the United States was discussed by Mr. F.E. Gardner of the USA in paper IAEA-SR-83/18. In the USA, the regulations on radioactive matter are contained in the US Postal Service Domestic Mail Manual by reference to Publication 6. As a practical matter, Postal Service domestic regulations on hazardous material are based on the rules contained in the US Department of Transportation regulations and international air transportation tariffs on hazardous material. Postal Service regulations are as restrictive as those source regulations and rules and in some cases more so.

Effective July 1, 1983, US Postal Service regulations for domestic and international mail have been amended to reflect US Department of Transportation rules for transportation of radioactive material, which includes limited quantities, instruments and articles and excepted articles containing natural uranium or thorium. This change conforms to the latest revised international standards as promulgated by the International Atomic Energy Agency.

2. The impact of nuclear materials transfer by mail on International Safeguards was presented by Messrs. S. Deron and U. Wenzel of the IAEA in paper IAEA-SR-83/4. International Safeguards is one of the objectives of the International Atomic Energy Agency. Within this framework small quantities of nuclear material are frequently shipped from facilities of the IAEA Member States to the Agency and analyzed for Safeguards verification at the IAEA laboratories. Only rapid transfers of these materials would allow the Agency to comply with the commitment of a timely verification of safeguarded material the Agency has assumed to its Member States. However, stringent regulations govern the transport of radioactive materials and especially intricate administrative procedures must be followed prior to each individual shipment. This limits the capability of the Agency to meet the timeliness requirements when verifying a number of safeguarded materials.

Mailing of nuclear materials would speed considerably the Safeguards verification by means of chemical analysis. For this purpose the Agency has adapted its analytical procedures to be compatible with the provisions of the UPU convention. Upon presentation of this paper the Agency wishes to invite the competent postal authorities to consider acceptance of nuclear materials mailed in accordance with the regulations of the UPU convention and the IAEA safety standards.

3. The shipment of radioactive materials by post within countries of the European Communities was described by Mr. C. Faloci and Ms. S. Piermattei of Italy in paper IAEA-SR-83/7. In a study carried out in 1980 under a contract of the Commission of the European Communities on "Inventory of

the administrative procedures for the transport of radioactive materials existing in the CEC countries" it appears that in only three of the nine Member Countries, the shipment of radioactive materials by post is allowed. These countries are France, the United Kingdom and the Federal Republic of Germany. The constraints placed upon postal shipments in these countries were outlined.

The different modes through which the Postal shipment of radioactive materials is allowed in these three countries underlines the fact that each country has peculiar needs to satisfy and postal shipments are admitted in such a way to satisfy such needs.

Generally, the transport by post does not represent a fast and simple mode to ship radioactive substances, such as those used for medical purposes. It does however allow these materials to reach the most isolated places and to be distributed rapidly, on a wide scale. It seems, therefore, important that efforts be made so that an even larger number of countries accept this mode of transport.

4. The reasons preventing certain postal administrations from taking part in the transport of radioactive materials were discussed by Mr. P. Atanassov of the People's Republic of Bulgaria in paper IAEA-SR-83/10. Even though it is now twenty years since the 1964 Vienna Congress allowed the conveyance of radioactive materials by post, there are still very few administrations offering this service.

On the one hand, although there are not many of these items to be shipped, there are enough to warrant this type of service. On the other hand, the provisions of the IAEA Regulations specify the obligation to ensure secure packaging of the items and the safety of the staff handling them, thus prompting a negative psychological reaction on the part of postal workers.

The UPU regulations provide serious guarantees regarding the admittance of radioactive materials for conveyance by post. The Executive Council of the UPU is considering submitting to the 19th Congress of the UPU some proposals designed to amend certain of these provisions with a view to replacing the white label with the plain and durable marking "Matières radioactives. Quantités admises au transport par la poste" (Radioactive materials. Quantities permitted for movement by post). We consider that this new marking will clarify somewhat the question of minimal risk.

The question of liability of postal administrations and the potential danger are important factors which limit this service, since none of the UPU or IAEA provisions specify the liability of the postal administration or sender should the above-mentioned regulations not be observed. In our view, it is the absence of specific provisions in the Acts of the UPU and the potential risks which prevent administrations, including our own, from offering this service.

5. The experience and problems created by the express postal dispatch of radioactive materials in Switzerland was discussed by Mr. H. Stapfer of Switzerland in paper IAEA-SR-83/1. In Switzerland, consignments permitted by post are usually shipped promptly and safely. However, the limiting conditions are considerable: the maximum and minimum activity are only a 1/5 of what is normally permitted; the shipment is permitted only with one or two bars on the label; and there are maximum

restrictions on weight. Conversely, the advantages of shipment by post are: it is not necessary to make use of accompanying documents; and for small amounts of radioactive material there is no need for labels such as "Exempted radioactive material" - only the address and the consignor are necessary.

A number of problems have been identified. The major problem is that the delivery often reaches the client too late. Also the Swiss have no experience with international shipments.

6. The transport of radioactive materials by post in Austria was discussed by Mr. H. Knauthe of Austria in paper IAEA-SR-83/8. The Austrian Administration addressed in 1959 a request to the Executive Council (former Executive and Liaison Committee) of the UPU to investigate the possibility of posting items containing radioactive materials. This initiative resulted in the regulations for the transport of radioactive materials in the UPU Convention, as decided by the Vienna Congress 1964.

The opinion is that it is much better to regulate the transportation of radioactive materials under certain security conditions than to leave the transport of such items in uncertainty. In Austria, every Postal Official knows that items containing radioactive materials are admitted; and he is aware that the posting of such items can only be achieved under special conditions. He is well informed and not helpless when a customer has the intention to post an item containing radioactive materials.

In Austria's domestic service, transport of radioactive materials is only permitted in postal parcels. The respective label for dangerous goods - edited by the Austrian Federal Railways - must be used. There is a conformity of transport regulations for radioactive materials between Postal and Railway Services.

In the international service, Austria is one of the 25 countries which admits postal items containing radioactive materials in departing and in arriving traffic.

In the international service, Austria admits only letter-items - no parcels - containing radioactive materials. These items must be registered; they have to be transported by the quickest means - mainly by air. Posting is restricted to the Post Offices 1150 Wien, 8020 Graz and 2444 Seibersdorf.

The dispositions laid down in the Convention of the UPU and its Detailed Regulations are observed. Items containing radioactive materials are only admitted from organizations and institutes which are authorized to post such materials. In Austria, clients interested in obtaining the authorization concerned have to apply to the Federal Ministry for Health and Environmental Protection.

7. The use of postal service by Amersham International plc was presented by Ms. J.R. Walton of England in paper IAEA-SR-83/2. Amersham supplies several thousand radioactive products for use in medicine, research and industry worldwide.

The average number of packages handled daily is about 1,000 but this could be as high as 2,000 on a particularly busy day. About 80% is for export and Amersham is selling into 132 countries, but mainly via

subsidiaries into the more advanced countries. The packages are grouped together in consignments and an indication of the number of consignments by each transport method is as follows. Figures are per calendar month.

Air	1,882
Amersham Transport	1,545
UK Road Operator	2,642
UK Post	30
Collection by Customer	50
Rail	20
Sea (average of years figures)	1 per month

The use of post is mainly confined to the UK with only 3 or 4 packages per year being sent overseas.

The main reason for not making more use of post is the volume of Amersham's business and their method of distribution. The majority of their export shipments are bulked together to a distributor, thus enabling them to take advantage of economical rates offered by other methods of transport. About 40% of Amersham's packages would be acceptable by post with activity below the excepted level, but the majority of these are shipped with other radioactive packages which cannot be sent by post and this provides an economical and reliable method of distribution.

Another significant reason, particularly with export, is the need for next day guaranteed delivery, due to the short half-life of some products and the expectation of the customers medical aspects. This can be achieved by pre-booking space on a designated flight. The normal schedule is for goods to be packed in Amersham's warehouse during the day and despatched to the airport or to a UK Road Distributor in the evening.

The use of post when it is permissible is only advantageous to Amersham for single orders where time is not so critical and the cost of post is significantly cheaper. Few of Amersham's orders fall within this category.

Amersham's experience with the postal system has been good, with no delay reported by the customers. The packages have been accepted without difficulty at their local post office and documentation is simple in comparison to other methods of transport. For single small packages the cost is lower, mainly because of the lower minimum charge than for other transport methods. Packages are normally sent by registered letter post to obtain a quicker delivery service.

At present Amersham is assessing the cost saving by using post for single excepted packages within the UK. There could well be an increase in their use of post, providing they are satisfied that they can give their customers a satisfactory delivery time at an acceptable cost. Amersham's needs are discussed with local Post Office representative who continues to advise us of the services offered. It is unlikely that the use of post for export will increase.

8. The shipment of radiopharmaceuticals by post was described by Mr. Peter Breur of the Federal Republic of Germany in paper IAEA-SR-83/6. New England Nuclear (NEN) produces a variety of radioactive products to meet the needs of the research and medical communities throughout the world. NEN's position is that all efficient,

non-threatening methods of transport should be used to get products promptly to the customer. A large number of these products, classified as "Limited Quantities" in the USA Code of Federal Regulations, Title, 49, Part 173.391., can be shipped by post. These include sealed reference standards used for calibration of sensitive instruments, medical diagnostic kits, and radioactive chemical compounds. New England Nuclear has designed its packaging for the safe transportation of its products.

NEN's distribution department constantly reviews transport systems to assure fast and efficient delivery of our product. In recent years they have reduced their mail and mail express shipments from three hundred and sixty-six (366) packages weekly to forty (40). There are a number of reasons for this. Commercial systems can consolidate shipments of "Limited Quantity" with packages of larger amounts of radioactivity, thereby assuring faster deliveries, reduced rates, and most importantly, quick and easy traceability. Many times, with parcel post, it took weeks and sometimes even months to confirm or trace delivery. This became expensive and wasteful. By the time original shipments were traced and returned for credit, they were outdated and of little use. Delayed shipments disrupted research plans. Lost or damaged packages labeled "radioactive" created a public concern. Replacement and return shipments were subject to the same delivery problems.

New England Nuclear has set up training programs for police and fire departments for commercial carriers, and for hospital staffs. If the postal system is to be used for the transport of radioactive materials, it is strongly advocated that a training program for postal workers be provided so they will have an understanding of what they are handling.

9. The practical experience of the British Post Office in handling packages containing radioactive materials was summarized by Messrs. M. Goss and M. Rustomji of England in paper IAEA-SR-83/17. To take account of existing practice in countries already admitting radioactive substances in their postal services, the 1964 Vienna Congress decided to admit for postal conveyance, on an optional basis, consignments of radioactive materials, the activity of which did not exceed one tenth of the activity of items exempted from special prescriptions by the IAEA regulations. The 1974 Lausanne Congress admitted radioactive materials in the parcel post. Great Britain has been accepting these items in the inland services for over 30 years now and in the overseas services since 1964.

Packages containing material with a specific activity not greater than 0.002 $\mu\text{Ci/g}$ are by definition not radioactive and can be sent in the post without any restriction or controls. However certain items above that limit may be accepted in the post provided that they are excepted radioactive materials under paragraph 2; 7.5 of the 1983 International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by air and their activity does not exceed one tenth of those listed in Table 2.11 of the ICAO instructions.

Prospective senders, who must be recognized establishments or institutions dealing in radioactive material, must apply to Post Office Headquarters for authorization to use the service. They must supply containers or receptacles as well as information on the chemical nature of the radioactive substance. After advice from a Government expert radiologist, the Post Office approves the packaging and authorizes the applicant to post.

There seem to be four main areas where problems can and do arise. Instructions are included in our rule books to advise what to do in the event of one of the following happening:

- 1) Packages exceeding the acceptable limit;
- 2) Damaged packaging;
- 3) Package undeliverable as addressed; and
- 4) Packages without correct markings.

The main area where problems actually do arise concern the relatively large number of incoming parcels which arrive without the label "Matières Radioactives" on the outer wrapping and sometimes without a correct declaration on the customs forms. This can cause great alarm to postal staff who may be instructed by customs officials to open a package and suddenly find themselves faced with radioactive contents. It also delays the parcel and causes administrative problems for customs. They regard such packages which are not properly marked and declared as liable for customs duty. This in turn leads to complaints from the recipient of the package who feels that it should be free from customs duty as a radioactive import.

The main problems in handling packages containing radioactive material are administrative ones. The Post Office has to seek outside expert advice on packaging etc. before items can be accepted for transmission. It also needs to have access to experts in the rare event that something should go wrong with the package. Once though the packaging has been approved, then the items are treated virtually like any other postal packet. They are sorted along with ordinary mail and travel in the same mail bags. They are thus subject to the normal hazards of transmissions by post, but our experience over the years with handling packages containing radioactive material has been virtually trouble-free.

10. The mailing of radioactive materials in Sweden was presented by Mr. T. Bennerstedt of Sweden in paper IAEA-SR-83/5. In the mid 1970s, the only Nordic country to allow radioactive materials by mail was Sweden.

In 1977, a task group consisting of radiologists from Denmark, Finland, Norway, and Sweden was formed to create a joint Nordic policy. The packaging and handling instructions would have to be sufficiently stringent and easy to follow at the same time, in order that unskilled personnel and members of the public would suffer no harm, even in the case of an accident. The 1973 IAEA Regulations were picked as a starting point. Radio immuno assay kits, consumer products (such as smoke detectors, watches, and compasses) and various kinds of instruments and articles were believed to constitute the bulk of the radioactive consignments.

After four years of work, the group submitted its recommendations to the postal and radiation protection authorities of the participating countries. Presently, the recommendations have been implemented - with minor modifications - in Norway and Sweden.

The Nordic Recommendations considered five aspects:

- 1) applicability,
- 2) dose rate limit,
- 3) activity limit,
- 4) packaging,
- 5) labeling and marking; all of which are summarized in the paper.

The policy recently adopted by the Swedish Post Office is in very close agreement with the Nordic Recommendations just described.

In the table below, the IAEA Regulations, the Nordic Recommendations, and the policy of the Swedish Post Office are summarized.

	IAEA Regs.	Nordic Recs.	Swedish Policy
Surface dose rate limit	0.5 mrem/h	0.1 mrem/h	0.1 mrem/h
Activity limit	One tenth of exemption limit, usually greater than the ALI	The ALI	In most cases, the ALI
Allowed contamination	10^{-4} or 10^{-5} $\mu\text{Ci}/\text{cm}^2$	None	None
Declaration	Exempt	None	Exempt
Packaging Labelling Marking	The IAEA, Nordic, and Swedish instructions are in good agreement with one another		

So far, some fifteen licenses have been issued by the Swedish Post Office, after consultations with the National Institute of Radiation Protection. Ten of these concern radio immuno assay kits. Various articles, mostly smoke detectors not intended for domestic use (i.e., other than consumer products), account for the rest.

As for international movement by mail, the IAEA Regulations stipulate that the radioactive material "shall be dispatched by the quickest route, normally by air". Radiologically speaking, this is very reasonable. There is one catch, however, no matter whether it is a national or an international transport: the IATA requires that all dangerous goods, exempt or not, be treated separately and properly declared in any transport documents. In Sweden alone, 11 million consignments are shipped each day. It would be virtually impossible to keep track of all exempt - and thus, practically safe - consignments, which constitute but a minute fraction of the total number. Until this problem has been solved, each package of licensed radioactive material to be mailed within Sweden has to bear a label saying "Air mail not permitted". This is the only way the Post Office can guarantee that IATA Regulations will not be violated.

11. The radiological safety of some typical shipments of small quantities was discussed by Mr. T. Biro of Hungary in paper IAEA-SR-83/19. There are more than 20000 radioactive items transported per year in Hungary through the Institute of Isotopes, which deals with all export and import of radioactive products and is the main supplier for domestic consumers. This corresponds to several thousands of shipments performed mostly by rail and road, and some by air. A significant part of the shipments covers small quantities for radioactive materials, mostly in-vitro Radioimmunoassay (RIA) kits. This amounts to about 10000 items per year.

Postal transport - which is at present prohibited in Hungary - would be quicker and more economic. But are present packagings adequate for postal carriage and what items should be permitted?

The paper presents arguments that current recommendations of package limits for post are sufficiently safe. In addition it can be stated that in the case of certain kinds of consignments, such as smoke detectors, when the usual content of items renders physically possible the intake of 10^{-6} A₂, this is highly improbable because of the inherent retention of the item (device) itself. While in the case of typical consignments, such as RIA kits, the actual contents are so small, that even total escape and intake would not result the limiting dose.

Postal service would be beneficial, as practically all consignees can be reached directly and without delay. Even if there is any ambiguity felt with the limits set by the regulations, the most frequently transported consignments would not cause any additional risk due to their radioactivity. Therefore in well defined cases, such as in-vitro RIA kits, and international approval of postal transport is strongly recommended. In many other cases, such as smoke detectors, the benefit might be questioned, but safety would not be worse than with other modes of transport, if IAEA regulations are followed.

12. The transport of radioactive materials by post in the Philippines was presented by Mr. B.C. Bernardo and Ms. E.M. Valdezco of the Philippines in paper IAEA-SR-83/3. Generally, the shipment of radioactive materials in the Philippines is regulated by the Philippine Atomic Energy Commission (PAEC). Postal authorities may, however allow the importation of radioisotopes (for medical and industrial applications) only for users who are licensed to import, possess and use radioactive materials. Licensing procedure, based on the International Atomic Energy Agency's Regulations for the Safe Transport of Radioactive Materials (1973), by the Department of Nuclear Regulations and Safeguards, PAEC, is described and some data on postal shipment are presented in the paper.

13. The Seminar was brought to a conclusion by Mr. R.M. Jefferson of the USA discussing the need for postal movements of radioactive material in the USA, as summarized in paper IAEA-SR-1983/16. A recent study reveals that there are about 2.4 million packages of radioactive materials moved annually in the USA. These, of course, encompass a very broad spectrum of materials. At one end are the spent nuclear fuels and other large quantity materials upon which almost all of the public attention is focussed. At the other end of this spectrum are those very low level radioactive materials (limited quantities) which present almost zero risk. As a matter of cost and convenience, some of these limited quantity shipments are transported by the postal system.

The level of involvement of the US postal system in transporting radioactive materials is not very significant. Approximately one quarter of one percent of the flow of packages of radioactive materials in the US were transported by mail. No matter how one evaluates that piece of information, it shows that postal movements in the US do not constitute either a major portion of the solution to transporting radioactive materials nor are they a major contributor to the problem. On the basis of this one piece of information it might be concluded that the US Post Office could refuse to handle these materials with little public impact. But based on these data one might also conclude that the US railroads, who


handle even fewer packages of radioactive materials, could likewise be eliminated from the picture with minimal impact. Neither of these conclusions are based upon all the facts.

For yet another set of reasons it can also be concluded that the postal system is important. The secondary distribution systems tied to the air and highway modes in the US are very expensive. The postal system, subsidized and designed to extend into the broad and dispersed receival points by averaging costs becomes easily the lowest cost option in many locations. Another factor behind the need for the use of the US postal system for transporting radioactive materials is the existence of an extensive "mail order" retail merchandising industry. Since a number of consumer products distributed by these retailers (such as smoke detectors and radio luminous watches) are radioactive and are suitable for postal shipment, the postal system has become more important in at least that one aspect. Further, after a slight decline in the postal merchandising activity in the US it is now recovering and reaching new records in total sales. This growth has in part spawned a new industry in the US dedicated to the movement and delivery of packages. While this new enterprise (United Postal Service) handles an ever larger proportion of the total packages originating from the mail order retailers they have two distinct drawbacks. First, they do not service all locations in the United States and second, they refuse to handle any radioactive material.


Thus, in spite of the relatively small number of postal shipments of radioactive materials this system meets at least one well-defined need in the US. A comparison of these postal shipments with the overall distribution of shipments makes it possible to conclude the US postal system could be utilized to handle a much larger volume than is currently the case.

The paper concludes by stating that it is possible to draw and defend several conclusions, some of which could contradict each other. Therefore, it should be sufficient to say that in the US, postal shipments are a desirable adjunct to the overall scheme of transporting radioactive materials. While elimination of this option would cause only minor hardships, its retention does not create problems either. In the simplest of terms, the utility of postal transport of radioactive materials in the US clearly outweighs its possible costs. This conclusion is probably true in other nations as well. Further, if the postal systems are to be used to move these materials it is important to maintain uniformity in the regulations. Therefore the IAEA efforts toward establishment and maintaining of the international guidelines contained in Safety Series No. 6 serve a very useful function.

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