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Safe Transport of Radioactive Material ,International Regulations & its Supporting Documents

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ABSTRACT

Safe transport of radioactive material regulations issued by IAEA since 1961, provide standards for insuring a high level of safety of people,transport workers, property and environment against radiation, contamination and criticality hazards as well as thermal effects associated with the transport of the radioactive wastes and material. The history ,development, philosophy and scope of these international regulations were mentioned as well as the different supporting documents to the regulations for safe transport of radioactive material were identified.The first supporting document , namely TS - G-1.1 (ST-2) ,Advisory material is also issued by the IAEA.It contains both the advisory and explanatory materials previously published in safety series Nos 7and 37 and therefore TS-G-1.1 (ST-2) will supersede safety series Nos 7 and 37. The second supporting document namely TS-G-1.2 (ST-3), planning and preparing for emergency response to transport accidents involving radioactive material ,which will supersede safety series No 87. In addition to quality assurance (SS#113), compliance assurance (SS#112), the training manual and others.

Key words:Safe transport, Radio active material,Activity limits,Packaging,Training

INTRODUCTION

The use of radioactive material is an important part of modern life and technology. Radioactive material is used extensively in medicine ,industry ,agriculture ,research , consumer products and electrical power generation .Tens of millions of packages containing radioactive material are consigned for transport each year throughout the world[1] .The quantity of radioactive material in these packages varies from very small quantities in shipments of consumer products to very large quantities in shipments of irradiated nuclear fuel.

The Regulations for safe transport of radioactive material establish standards of safety which provide an acceptable level of control of the radiation, criticality and thermal hazards to persons ,property and the environment that are associated with the transport of radioactive material. These Regulations depend upon the principles set forth in both the "Radiation Protection and the Safety of Radiation Sources " IAEA Safety Series No.120[2] and the " International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources" IAEA safety Series No. 115[3],jointly sponsored by the Food and Agriculture Organization of the United Nations ,the IAEA ,the International Labour Organisation ,the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development ,the Pan American Health Organization and the World Health Organization.Thus, compliance with these Regulations is deemed to satisfy the principles of the Basic Safety Standards in respect of transport.

These Regulations are suplemented by hierarchy of Safety Guides and Safety Practices including "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material" IAEA Safety Standards Series No.ST-2[4] ; Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material " IAEA Safety standard series No.ST-3[5]; "Compliance Assurance for the Safe Transport of Radioactive Material " IAEA Safety Series No.112[6] ; "Quality Assurance for the Safe Transport of Radioactive Material",IAEA Safety Series No.113[7] and others.

The IAEA first published Safety Series No.(6) in 1961 for application to the national and international transport of radioactive material by all modes of transport. Several reviews ,conducted in consultation with Member States and the international orangizations concerned, resulted in four comprehensive revisions being published in 1964, 1967,1973 and 1985.

Through the worldwide adoption of the IAEA`s Regulations for all modes of transport ,a very high level of safety during transport has been achieved.

IAEA REGULATIONS, HISTORY AND DEVELOPMENT

Although radioactive material has been used for more than a century ,signifcant use for beneficial purposes only began in the later 1940s and early 1950s . At that time ,since the utilization of this material was increasing dramatically ,it was rescognized that safe and effective transport arrangements were required in order to properly protect man and his environment.

Since 1957, the IAEA has exerted efforts towards developing and maintaining its Regulations for the Safe Transsport of Radioactive Material.

The result of this effort was the publication of the IAEA`s Regulations for the Safe Transport of Radioactive Materials, 1961 Edition, Safety Series No. 6 [9] .This first edition of the Regulations established basic prescriptions in terms of packaging standards and package make-up for the containment of radioactive material and for the prevention of criticality when the material is fissile[8].

Since the Regulations were first issued ,the IAEA has hardly worked with its Member States and relevant international organizations to update the Regulations ,taking advantage of experience in the application of the Regulations and of advances in technology and knowledge. Consequently ,the IAEA has issued several revisions to the Regulations.

The 1996 Edition of the Regulations was issued with a new nomenclature. It was identified as "IAEA Safety Standards Series , Requirements, No.ST-1,[11] rather than "Safety Series No.6. In 2000 a revised edition of ST-1 was issued and was identified as "IAEA Safety Standards Series Requirements ,No.TS-R-1 (ST-1 Revised) [12].

The Standing Advisory Group on the Safe Transport of Radioactive Material (SAGSTRAM) was established by the IAEA in 1978 to advise on the IAEA`s transport safety programme and on the development and implementation of the Regulations Safety Standards Commttee (TRANSSAC) was formed in 1996 (and renamed to TRANSSC in 2000) replacing the function of SAGSTRAM .This advisory body ultimately endorses the text for a revision to the Regulations, and recommends submission of that text to the IAEA Borad of Governors for approval.

A user desiring to transport a specified type of radioactive material consignment must study and assimilate requirements from all sections of the Regulations pertaining to that specific type of material although much of the information and requirements may not apply .

The "Schedules of Requirements for the Transport of Specified types of Radioactive Material Consignments"was published separately from the Regulations in 1986 as Safety Series No.80 [13].

The1996 Edition of the Regulations[11] includes schedules of requirements following the main body of the regulatory requirements . The schedules are not the complete and binding set of regulatory requirements .but can be used as a basic aid or"guide to national authorities and international organizations that may wish to adapt these Regulations [12] in schedule form."

Regulations Philosophy

The Regulations are fundamentally based on the philosophy that radioactive material being transported should be adequately packaged to provide protection against the hazards of the material under all conditions of transport including foreseeable accidents.

Therefore ,the philosophy of the Regulations is that, as far as possible:

(1) Packages of radioactive material should be dealt with in the same way as other hazardous goods;
(2) Safety depends primarily upon the package and not on operational control;
(3) The consignor should be responsible for ensuring safety during transport through proper characterization of the contents proper packaging of those contents , and proper operational actions.

Regulations Scope

The scope of the Regulations is clearly specified and applied to:
(1) the transport of radioactive material by all modes on land, water or in the air,
(2)Any transport which is incidental to the use of the radioactive material.

In this context, transport comprises all operations conditions associated with , and involved in the movement of the radioactive material including the :
(1) Design of the package;
(2) Manufacture ,maintenace and repair of the packaging ;and
(3) Preparation ,consigning ,loading, carriage (including in-transit storage), unloading and receipt at the final destination of loads of radioactive material and packages.

In this Regulations there are three general performace levels that relate to the design of the package:
(1) Routine conditions of transport (incident free),
(2) Normal conditions of transport (minor mishaps) ,and
(3)Accident conditions of transport.

On the other hand,theseRegulations do not apply to the following types of material:
(1) Radioactive material that is an integral part of the means of transport (such as depleted uranium conuterweights in a aircraft);
(2) Radioactive material moved within an establishment that is subject to appropriate safety regulations in force in the establishment and where the movement dose not involve public roads or railways;
(3) Radioactive material implanted or incorporated into a person or live animal for diagnosis or treatment (such as a cardiac pacemaker, or radionuclides injected into a person for medical purposes);
(4) Radioactive material in consumer products that have received regulatory approval, following their sale to the end user (such as smoke detectors);
(5) Natural material and ores containing naturally occurring radionuclides which are not intended to be processed for use of these radionuclides provided that the activity concentration of the material does not exceed certain limits .

PACKAGE AND PACKAGING REQUIREMENTS

By package is meant the packaging together with its radioactive contents as presented for transport. Packaging may, in particular, consist of one or more receptacle, absorbing materials, spacing structure, radiation shielding and devices for cooling,for absorbing mechanical shocks and for thermal insulation. There are six types of packaging.

1- ***Excepted Package***

Is a packaging containing excepted radioactive material, empty and may be transported provided that:

- It is in good condition and securely closed.
- Any lables which may have been displayed on it ,are no longer visible**.**

2-Industrial packages

These are packages designed to contain low specific activity materials (LSAM) or surface contaminated objects (SCO),are of three different Types, IP-1 ,IP-2 and IP-3.

3-Type (A) package

It is designed to withstand the normal conditions of transport and minor possible accidents.

4- Type (B) package

It is designed to withstand the normal conditions of transport and severe accident conditions. There are two classes namely:

- Type B (U), requiring unilateral approval (competent authority of the country of origin)
- Type B (M), requiring multilateral (competent authorities of all the countries through or into which the package may pass).

5-Type (C) package

It is designed to withstand severe crush, puncture and fire tests as well as impact high speed (90 m/sec). It is used to transport large quantities of radioactive material by air.

6-Packages containing fissile materials

These packages must be designed to ensure criticality safety during normal and accident conditions of transport.

General Requirements For All Packagings And Packages

1-The package shall be so designed in relation to its mass, volume and shape that it can be easily and safely handled and transported.

2-The design shall be such that any lifting attachments on the package will not fail when used in the intended manner.

3- Attachments and any other features on the outer surface of the package, which could be used to lift it, shall be designed either to support its mass, or shall be removable or otherwise rendered incapable of being used during transport.

4- The package shall be so designed and finished that the external surfaces are free form protruding features and can be easily decontaminated.

5- The outer layer of the package shall be so designed as to prevent the collection and the retention of water.

6- Any features added to the package at the time of transport which are not part of the package shall not reduce safety.

7- The package shall be capable of withstanding the effects of any acceleration and vibration during routine transport.

8- The materials of the packaging and any components or structures shall be physically and chemically compatible with each other and with radioactive content.

9- All valves, through which the radioactive content could otherwise escape, shall be protected against unauthorized operation.

10-In addition to the radioactive properties any other dangerous properties of the contents of the package such as explosiveness, flammability, corrosiveness…etc shall be taken into account in the packing, labelling, marking, placarding, storage and transport**.**

Categories For Packages And Overpacks

To protect the public and transport workers against radiation emitted by the material during transport, the radiation level in the vicinity of the packages is limited.With regard to the shielding provided ,packages are classified in three categories, I-WHITE ,II-YELLOW and III-YELLOW(see Figs1&2).Each is associated with specified maximum radiation levels at the external surface of the package(0.005 mSv/h) ,(0.05 – 0.5 mSv/h) – (0.5-2mSv/h) and at a distance of one meter from the surface (TI)(0) ,(0-1)& (1-10) respectivly .The TI is determined by multiplying the radiation level at one meter by 100, i.e RL_{1m} (mSv/h)x100

While most of the pure alpha and beta-emitters could be transported as white packages, it would be econmical to transport gamma emitters as yellow packages. Otherwise considerable amounts of shielding would be required to bring the radiation levels to those corresponding to white packages .All fissile materials are packed and shipped in such a manner that criticality cannot be reached under any foreseeable circumstances of transport.

Occupational exposure arising from transport activities

The occupational exposure arising from transport activities, where it is assessed that the effective dose.,

(a) Is most unlikely exceed 1mSv in a year, neither special work patterns nor detailed monitoring nor dose assessment programmer nor individual record keeping shall be required;

(a) Is likely to be between 1 and 6 m Sv in a year, a dose assessment programmer via work place monitoring or individual monitoring shall be conducted;

(c) Is likely to exceed 6 m Sv in a year, individual monitoring shall be conducted.

When individual monitoring or work place monitoring is conducted appropriate records shall be kept.

CONTROLS FOR CONTAMINATION AND LEAKING PACKAGE

The non- fixed contamination on the external surface of a packages shall be kept as low as practicable and under conditions likely to be encountered in routine transport, shall not exceed the following levels:

(a) 4 Bq/cm^2 for Beta and gamma emitters and low toxicity alpha emitters; and

(b) 0. 4 Bq/cm^2 for all other alpha emitters.

The same limits apply to the external and internal surfaces of overpackes, freight containers, tanks and intermediate bulk containers**.**

If it is evident that a package is damaged or leaking, or if it is suspected that the package may have leaked or been damaged, access to the packages shall be restricted and a qualified person shall, as soon as possible, assess the extent of contamination and the resultant radiation level of the packages.

Packages leaking radioactive content may be removed under supervision but shall not be forwarded until repaired or reconditioned and decontaminated.

Activity Limits Content For Packages

1- Excepted package

Excepted package shall not contain activities greater than; those mentioned in table (2)

Table (2): Activity limits for excepted packages.

Physical state of Contents	Instruments and Articles		Materials
	Item limits	Package limits	Package limits
Solids:			
Special form	10^{-2} A_1	A_1	10^{-3} A_1
Other forms	10^{-2} A_2	A_2	10^{-3} A_2
Liquids:	10^{-3} A_2	10^{-1} A_2	10^{-4} A_2
Gases:			
Tritium	$2x10^{-2}$ A_2	$2X10^{-1}$ A_2	$2X10^{-2}$ A_2
Special form	10^{-3} A_1	10^{-2} A_1	10^{-3} A_1
Other forms	10^{-3} A_2	10^{-2} A_2	10-3 A_2

- For transport by post, the total activity in each package shall not exceed 1/10 of the relevant limits specified in table (6).

2- Industrial packages

- The total activity in a single package of LSA material or in a single package of SCO shall be so restricted that the radiation level of 1 rem/h (10 mSv/h) at 3 meters from the unshielded material or object is not exceeded.The activity in a single package shall also be so restricted that the activity limits for a conveyance shall not exceeded the limits as shown in table (3)
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Table (3): Activity limits for LSA Material and SCO in industrial packages.

Nature of Material	Activity limits for conveyances other than by inland water-way	Activity limits for a hold or compartment of an inland water craft
LSA –I	No limit	No limit
LSA –II,LSA III		
Non-combustible Solids	No limit	$100A_2$
LSA-II		

LSA-III Combustible Solids And all liquids and gases	$100A_2$	$10A_2$
SCO	$100\ A_2$	$10A_2$

3-Type (A) packages

Although type A packaging is designed to withstand the normal transport conditions, it must be assumed that it will not retain its full containment in a foreseeable type of accident, referred to as a median accident, that falls short of the most severe type of accident and 10^{-3} of its content will be released .It is further assumed that10^{-3} of the activity released might be inhaled or taken through skin, by breakdown workers or member of the public. The overall assumption therefore is that in a median accident 10^{-6} of the radioactive contents of a type A package might enter the body . These values are designated A_1 and A_2 respectively. For Special from and non – special form materials,Values of A_1 and A_2 for certain radionuclides are shown in Table(4).

Table (4):Examples of A_1 and A_2 values(1)

Symbol of Radionuclide	A_1 TBq	A_2 TBq
^{198}Au	7	2
^{60}Co	0.4	0.4
^{131}I	.3	0.7
^{238}Pu	10	$1X10^{-3}$
^{90}Sr	0.3	0.3
^{65}Zn	2	2

4-Type (B) Packages

Type (B) Packages is intended to retain adequate shielding and containment under severe accident conditions, as demonstrated by passing a number of prescribed tests. The corresponding packages; that is type (B) packing plus radioactive contents are divided into two classes type B(U)and type B(M) as mentioned before.

There is no regulatory upper limit to the activities that may be transported in type B(U) and B(M) packages, .

5- ***Type C packages***

The 1996 Edition of the regulations ST-1 introduced a new Type C package specification. In recognition of the fact that impact velocities from aircraft crashes can be significantly greater than those from other modes. Transport of very large quantities of radioactive material by air requires Type C packages which are very robust. As with Type B(U) and Type B(M) packages, the Regulations do not specify activity limits of Type C packages.

6-Fissile packages

In addition to meeting the requirements pertaining to the radioactive properties of the material ,if fissile material is being transported, the package must also be designed to ensure criticalit safety under a variety of postulated conditions. Such packages require multilateral competent authority approval and they are given the additional designation as fissile packages.

7-Overpacks, freight containers, intermediate bulk containers and tanks

Each of these is used to facilitate the handling, stowage, and carriage of goods. An overpack is an enclosure such as a box, used by a single consignor to consolidate one or more packages so they may be treated as one. A freight container is an article of transport equipment that enables goods to be easily transferred between conveyances and from one mode of transport to another. An intermediate bulk container (IBC)is a portable packaging that has a capacity less than $3m^3$,which is designed for mechanical handling during transport, and meets the UN standards for IBCs. A tank has a fairly specific definition in the Regulations; however, most large containers that are envisioned when such a term is used with respect to transportation, will fit the definition.

Marking, Labelling And Placarding

*1- **Marking***

- Each package of gross mass exceeding 50 Kg shall have its permissible gross mass legibly and durably marked on the outside of the packaging.
- Each package which conforms to a type A package design shall be legibly and durably marked on the outside of the package with "Type A".
- Each package conforms to a type B package design shall be legibly and durably with identification mark allocated to that design by the competent authority, serial number of the design and marked with either Type B(U) or Type B(M) as required.
- Each package marked type B(U) or type B(M)shall be plainly marked by embossing ,stamping or other means resistant to the effect of fire and water with the trefoil symbol.

2-Labelling:

- Each package, overpack, tank or freight container shall bear labels according to the appropriate category (see Figs 1&2). Any labels which do not relate to contents shall removed or covered. Additional labels describing other dangerous properties shall be added.
- The labels shall be affixed to two opposite sides of the outside of a package or overpack or on the outside of all four sides of a freight container or tank.
- Each label shall be completed with, Contents.,Activity Curies(Ci) or Becquerels,(Bq) or in units of grams (g) for fissile material, A criticality safety Index, (CSI)is used.

*3- **Placarding***

Large freight containers carrying packages other than excepted packages and tanks shall bear four placards (see Fig 2).

The united Nations Number (UNN)for the consignment shall also displayed on the placards (lower half)or on a Separate one shown in Fig(3)which shall be affixed adjacent to the main placard in all four sides of the freight container.

STORAGE OF RADIOACTIVE MATERIALS

Radioactive materials except those in category I- WHITE packages, shall be kept separated from living accomodations, from regularly occupied working spaces that may be continually occupied by passengers or the public. A dose of 5 m Sv/y and 1mSv/y were used for calculation of the segregation distances for transport workers and general public respectively. They shall also be separated from undeveloped photographic films or plates so that these are not expected to be more than 0.1mSv/consignment .The appropriate segregation distance shall be derived on the basis of these assumptions.

Packages of radioactive material shall not be stored near dangerous goods with which common loading or storage is prohibited.The number of category II-YELLOW and III-YELLOW packages stored in one place, shall be so limited that the total sum of the transport indices in any individual group of such packages dose not exceed 50.Undelivered packages because of neither the consignor nor the consignee can be identified. And shall be placed in a safe location and the appropriate competent authority shall be informed as soon as possible and a request made for instructions on further action**.**

CUSTOMS OPERATIONS

Customs operations involving examination of the contents of a package containing radioactive materials should be carried out in a place where adequate means of radiation exposure control are provided, and in the presence of persons qualified to deal with radioactive materials. Any packages opened on customs should, before being forwarded to the consignee to its final instructions destination, be restored to its original packaging specifications so that all radiation protection requirements are restored.

GENERAL ACCIDENT PROVISIONS

In the event of a package of radioactive materials breaking or leaking, or becoming involved in a crash or fire, the affected area should be suitably segregated and no person should be allowed to enter or to remain within the segregated area until qualified persons are available to check radiation and contamination levels and supervise subsequent operation including salvage operations. However, the presence of radioactive materials should not be considered to prevent rescue operations or fighting of fires by qualified persons. All persons who may have become contaminated with radioactive materials should be subject to immediate examination and appropriate decontamination measure.

Any conveyance, building , location equipment or part thereof which has become contaminated as a result of an accident in the course of transport of radioactive materials should be decontaminated by qualified persons as soon as possible. Finally,a complete accident report should be submitted to the competent authority for further actions.

DOCUMENTS SUPPORTING THE REGULATION

The recognition of the more current information of both an explanatory and an advisory nature led the IAEA to publish a series a of documents beginning in 1961 when it issued "Notes on Certain Aspects of the Regulations" Over time, additional transport specific supportive safety series documents have been issued .These include (with most recent editions):

(1) Explanatory material (Safety Series No.7) recently (Safety Standard Series # ST-2).
(2) Advisory material (Safety Series No.37) recently (Safety Standard Series # ST-2).
(3) Schedules (Safety Series No.80).(Included in Safety Standard Series #ST-1)
(4) Emergency response guidance(SS No.87)recently (Safety Standard Series #ST-3)
(5) Complinance assurance guidance (Safety Series No,112).
(6) Quality assurance guidance (Safety Series No.113).

Advisory Material for IAEA Regulation

This Advisory Material is not stand-alone text. It only has significance when used concurrently as a companion to the IAEA Safety Standards Series No.ST-1 (1996 Edition).To facilitae cross –reference between it and the Regulations,each paragraph of the Advisory Material is numbered in correspondence with the paragraph of the Regulations to which it most directly relates.

The primary purpose of this publication is to provide guidance to users on proven and acceptable ways of complying with and demonstrating compliance with the Regulations. Member States and international organizations are invited to take note of this publication and to bring it to the attention of persons and organizations who make use of,or are subject to, the IAEA Regulations.

Emergency respose to IAEA regulations

Despite the extensive application of these stringent safety controls, transport accidents involving packages containing radioactive material have occurred and will occur. Whenever a transport accident involving radioactive material ,loss of shielding or loss of criticality control ,the consequences should be controlled or mitigated by proper emergency response actions.Historically ,there have been no reported transport accidents involving radioactive material that have resulted in serious radiological consequences. Despite this excellent safety record, plans should be developed, responsibilities should be defined and preparedness actions should be taken to ensure that an adequate emergency response capability is available when transport accidents involving radioactive material do occur.

The type of emergency planning and preparedness for responding to transport accidents involving the other types of dangerous goods,such as flammables, explosives, poisonous gases, corrosives and toxic chemicals, that are in transport every day.

A Safety Guide Emergency Response Planning and Preparedness for Transport Accidents Involving Radioactive Material was published in 1988.[14]This Safety Guide reflected the

Requirements of the 1985 edition of the Transport Regulations. The publication of the 1996 edition of the IAEA`s Transport Regulations necessitated that Safety Series No.87 be reviewed and revised to reflect the new regulatory requirements. Therfore ,the Safety Srandard ST-3 was published (2002)[(5)].

Compliance Assurance

The purpose of this document is to assist competent authorities in the development and maintenance of compliance assurance programmes in connection with the transport of radioactive material, and to assist applicants, licensees and organizations in their interactions with competent authorities .In order to increase co-operation between competent authorities and to promote uniform application of international regulations and recommendations it is desirable to adopt a common approach to regulatory activities .This document is intended to assist in accomplishing such uniform application by laying down most of the actions that competent authorities need to provide for in their programmes for ensuring regulatory compliance .

This document concerns specifically the radiation safety aspects of the transport of radioactive material ,i.e. the subjects that are covered by the Regulations .Radioactive material ,however ,may also have other dangerous properties (such as explosiveness, flammability , pyrophoricity ,chemical toxicity and corrosiveness); these must be taken into account in the regulatory control of the package design and transport.

Physical protection and safeguards control of nuclear material as well as aspects of third party liability are also mentioned in this document. These subjects are not within the scope of the Regulations, but they are included here because they have to be takan into account in the overall regulatory control of transport ,especially when the regulatory framewkork is established.

A country whose radioactive material transport is not yet fully esablished may develop its own compliance assurance programme in stages, depending on the size of that transport industry.

An effective programme for compliance assurance by a competent authority should take into account all users of the Regulations,i.e. persons or organizations which at one time or another ,may be subject to the requirements of the Regulations, such as: Consignors,.Carriers ,Suppliers /manufactures of packagings and,Multiple regulatory organization (shared responsibilites).

A compliance assurance programme should include two major elements:Firstly, the competent authority should review and approve certain activities in advance of the activity in question. Secondly ,the competent authority should ensure through a regulatory inspection and enforcement programme that all regulatory requirements are correctly fulfilled in practice.

Quality Assurance

The importance attached to Quality Assurance (QA) was significantly increased by its high profile treatment in the 1985 IAEA Transport Regulations This treatment recognised the value of (QA) in contributing positively to enhanced levels of safety in the transport of radioactive material .This importance was maintained in the 1996 Edition of the IAEA Transport Regulations (TS-R-1) .Paragraph 310 of TS-R-1 was extended to cover special form material and low dispersible radioactive material.

When QA principles are applied to radioactive material transport operations , it becomes possible to have all relevant aspects of the transport operations clearly identified, controlled and documented.This is the key to demonstrate positive assurance that those operations are carried out safely , efficiently ,and most importantly in compliance with the Regulations.

TS-R-1 not only defines QA but also indicates that QA programmes must be developed to cover the manufacture of the special form material, low dispersible radioactive material or package used to

physically transport the radioactive material.Further, QA programmes must also be established for the design, testing documentation,use, servicing and maintenance of the package, as well as shipment and in-transit storage operations.

When an organization has considered what its quality management or QA system is, or should be (by comparing it with a QA standard),it must ensure that the system is clearly understood and followed .

There may only be one QA programme covering all phases of radioactive material transport ,but usually are several separate QA programmes in effect during transport.

TRAINING

In approving the first revision to the Regulations in 1964,The IAEA`s board of Governors authorized the Director General to apply the Regulations to IAEA operations . Member States and other relevant organizations were encouraged to use the Regulations as a basis for their respective national regulations for domestic and international transport[15] .As a result, the Regulations have been adopted worldwide by Member States and international regulatatory bodies as the basis for relevant national and international regulations.

As one means of promoting safety in transport ,as well as encouraging harmony in regulatory control, the IAEA has from time to time organized training courses with the co- operation of Member State Governments and organizations.These have been aimed at individuals from developing countries with appropriate responsibilities in the area of the transport regulations and their implementation.The programme started with individual training courses to specific Member States in the early 1980s and regional training course for other countries in 1984 .Begining in 1987 formal regional and inter-regional training courses have been held about once per year at different Member States.

In order to encourage further training ,the IAEA found it desirable to develop a basic course text on the safe transport of radioactive material .It was therefore decided that the lecture notes from the 1987 course would form the basis of this text, and that it would be focussed on the 1985 Edition of the Regulations [15].The result was the IAEA`s Training Course Series No.1 which was updated to a second edition in 1991 [16].To facilitate a supplement to training , training Course Series No.1 was developed and issued in 1996 [17] . The current text is a furher update the training manual to make it consistent with the latest TS-R-1 Regulations [12],and to encompass the IAEA `s desire to structure its training courses in a modular format.

The purpose of a regional or inter-regional training course is to provide guidance to regulatory and key industrial personnel on the Regulations and practices for the safe transport of radioactive material .The objective of each IAEA training course is to ensure that the participants thoroughly understands the philosophy principles, and application of the provision of the transport Regulations.

The purpose of the training manual is to provide a rational method for convening a training course and to foster high quality training. The manual serves as a tool for insturctors to use in presenting subjects pertaining to the Regulations in a logical and understandable manner .It also allows training course participants to become knowledgeable about the Regulations

Fig.1

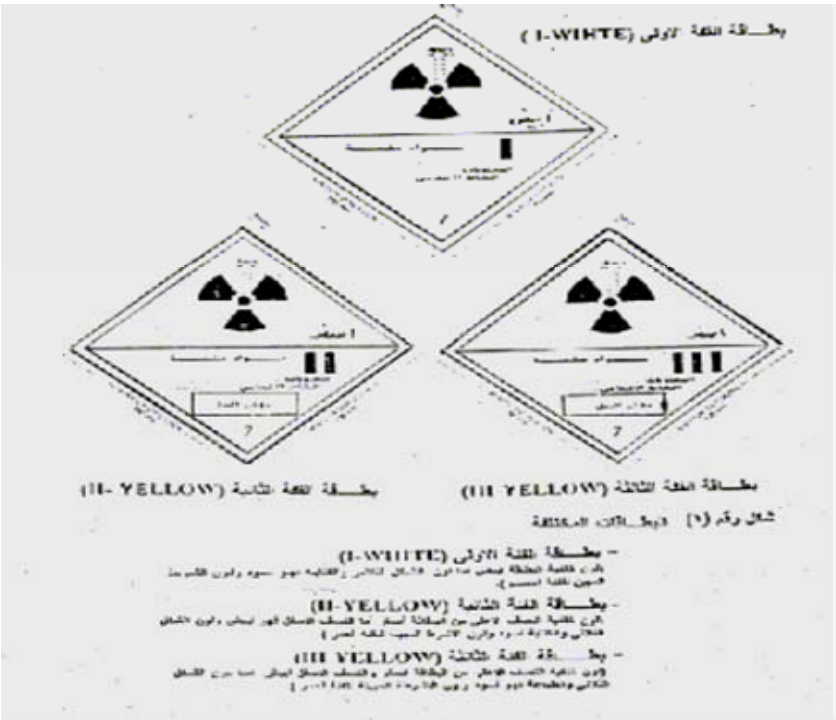

Fig. 2

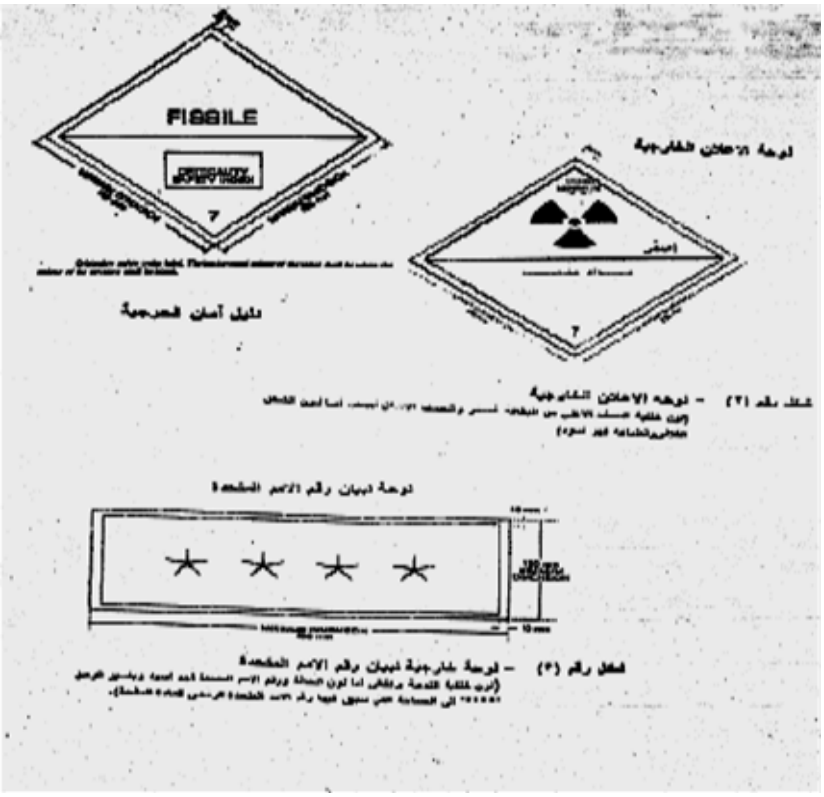

Fig. 3

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