THE RESTRUCTURING OF THE MODAL REGULATIONS COMPILATION OF SOME DIFFERENCES BETWEEN THE IAEA AND MODAL REGULATIONS

J.-Y. RECULEAU (1), Ch. FASTEN (2)
(1) Institut de Protection et de Sûreté Nucléaire; Fontenay-aux-Roses, France
(2) Federal Office for Radiation Protection; Salzgitter, Germany

ABSTRACT

In December 1996, the United Nations Economic and Social Council's (ECOSOC) Committee of Experts on the Transport of Dangerous Goods adopted a new structure for its "Recommendations on the Transport of Dangerous Goods". These recommendations are considered to represent "Model Regulations" for all modes of transport: road, rail, air and sea. In the last few years, all the Modal Organisations changed the structure of the regulations/agreements for the transport of dangerous goods to harmonise them with the UN-"Orange Book". In 2001, all of these amendments of the modal regulations will come into force with different transitional periods.
In addition to that, for the class 7 "Radioactive Material" the IAEA Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised) No.TS-R-1, were incorporated into the new structured modal regulations. In doing that, some deviations from the IAEA-Regulations were identified.

0 - INTRODUCTION

This paper describes (Part 1) the process leading to the elaboration of the different modal regulations and specifies (Part 2) the reasons why at different steps of the process, the transcription of the IAEA recommendations into the modal regulations is not complete. Then, this paper outlines (Part 3) the different types of IAEA recommendations, that the modal regulations do not incorporate. The following part (Part 4) deals, through examples, with the requirements included in the UN Orange Book and also in the modal regulations that are applicable to class 7 transport, even if these items are not included in the IAEA recommendations. Both these independent approaches, which need to be merged, lead to interference, discrepancies and supplementary requirements for class 7 transport.

ABBREVIATIONS AND REFERENCES :

TS-R-1 : Regulations for the Safe Transport of Radioactive Material of the International Atomic Energy Agency (2000 edition) : this document is a revised version of ST-1 (1996 edition), which incorporates a few modifications.

UN-OB : United Nations Orange Book (edition 1999) – Recommendations on the transport of dangerous goods – Model regulations – 11th revised edition.

IMDG Code : International Maritime Dangerous Goods Code of the International Maritime Organization (2000 edition).

ICAO-TIs : Technical Instructions of the International Civil Aviation Organisation (2001-2002 edition).

ADR : Agreement for the international transport of dangerous goods by road (2001 edition).

RID : Agreement for the international transport of dangerous goods by rail (2001 edition).

1 - ELABORATION PROCESS OF MODAL REGULATIONS

The process for elaborating the modal regulations for the safe transport of radioactive material is based on two principles :

- to write a set of recommendations for the transport of radioactive material, under the IAEA authority ;
- to harmonise the practices in the field of transport of all dangerous goods for all modes of transport, under the UN/ECOSOC authority ;

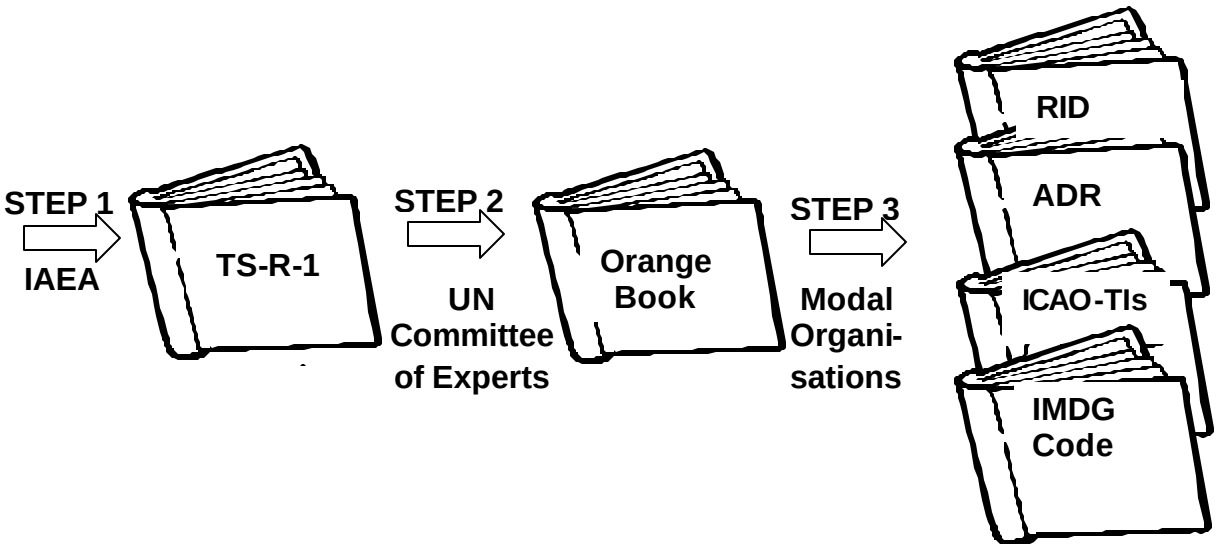
♦ **Input of the process** : The two sets of recommendations, on the one hand the Regulations for the Safe Transport of Radioactive Material (ST-1, 1996 edition) and on the other hand, the UN Orange Book (11th edition), are the input of the process for elaborating the modal regulations for the safe transport of radioactive material.

♦ **Steps of the process** : The process incorporates 3 main steps :

Step 1 : Elaborating a set of IAEA recommendations : groups of experts and representatives of member states reach consensus on recommendations to improve safety taking into account the existing knowledge, the new technologies and a cost/benefit approach.

Step 2 : The United Nations Committee of Experts for the transport of dangerous goods defines a format for the modal regulations : the 11th edition of the regulations (or Orange Book) includes the ST-1 (or TS-R-1) recommendations, which are either provisions or recommendations.

Step 3 : The modal regulations (Technical Instructions of ICAO for world-wide air transport, IMDG Code of IMO for world-wide maritime transport, ADR of UN/WP15 for the regional road transport and RID of OTIF for the regional rail transport) are elaborated based on the UN Orange Book format which includes most of the ST-1 recommendations.



♦ **Members of the process** : The members for elaborating the following documents are :

- For ST-1 (or TS-R-1) : Class 7 experts and industrials, representatives of member states for Class 7 who attend various meetings organised by IAEA. The Board of Governors will approve the final document.
- For the Orange Book and for the modal regulations (as specified in step 3) : representatives of member states for Class 7 and/or for other dangerous goods classes, Class 7 experts,

representatives of international associations or non-governmental organisations or trade unions. The first draft is prepared by Class 7 experts and the final version will be approved by representatives of member states for all dangerous goods classes.

- **Output of the process** : The result of the process will provide an amendment of the modal regulations, which may be enforced world-wide or regionally.

2 – ORIGINS OF DEVIATIONS

The process for elaborating the modal regulations for the safe transport of radioactive material includes a large set of meetings which lead to an amendment of the original IAEA recommendations. The following notices on the process describe the reasons inducing deviations.

1st Notice : For each step of the process, the terms of reference of the meeting groups are different and almost all members of the groups are different. Then, after long discussions during IAEA meetings, an acceptable consensus on recommendations is reached by the represented member states. The point is that the same long discussions sometimes happen again in the different groups for elaborating the modal regulations. For instance, during the 3rd step of the process, the groups for elaborating modal regulations evaluate :

- if the IAEA recommendations are consistent for the concerned mode of transport, and,
- if the former provisions specific to this mode of transport should be maintained in the modal regulations.

2nd Notice : the nearer the IAEA recommendations in international or regional law are to becoming mandatory, fewer class 7 experts are represented in the group dealing with this text. As a consequence, some recommendations are introduced, amended or deleted.

3rd Notice : Some IAEA recommendations contain provisions applicable to competent authority. These recommendations have not been systematically incorporated in the modal regulations.

4th Notice : The new edition of the Regulations for the Safe Transport of Radioactive Materials is significantly mode oriented with recommendations specific to a mode of transport : the introduction of Type C package design, low dispersible material and requirements specific to fissile material transported by air increase the loss of multimodal recommendations : thus depending on the mode of transport, the set of requirements is extensively changed.

3 – TYPES OF MODIFICATIONS OF TS-R-1 TEXT

The IAEA Regulations for the Safe Transport of Radioactive Material, 2000 Edition (TS-R-1), were incorporated into the new structured modal regulations. The following part outlines the different types of IAEA recommendations, that the modal regulations do not incorporate.

1) Some of the recommendations of IAEA, which contain <u>provisions applicable to competent authorities</u>, have not been incorporated in modal regulations, except in the IMDG Code.
   For instance : the assessment of Radiation Protection Programme (TS-R-1, §304) ; Emergency Response (TS-R-1, § 308) and Compliance Assurance (TS-R-1, § 311).

2) The general recommendations defining the referential are rarely incorporated or are modified because they are not provisions but descriptions.
   For instance : the background and objectives and complementary guides (TS-R-1, §§ 101-105) ; precautions for implementation of other regulations (TS-R-1, § 108) and structure (TS-R-1, § 110). If the safety guide about emergency instructions is not actually integrated in the modal regulations, some emergency response measures have been specified in all modal regulations.
3) The mode of transport concerned by the IAEA recommendation has sometimes not been understood clearly :
   - the provisions related to postal transport are not transposed except in the ICAO-TI (TS-R-1, §§ 410, 515d, 535, 579 and 580) ; while transport by post could actually use any mode of transport if this is quick and fast.
   - the provisions of Type C are not uniformly incorporated : maritime and land transport regulations state more precisely by an additive note (before TS-R-1, § 417) : « Whilst Type C packages are not required for sea (land) transport of radioactive material [….] (Type B(U) or Type B(M) packages suffice), the following provisions are presented since such packages may also be transported by sea (land). » – Thus, IMDG Code incorporates the full provisions (except TS-R-1, § 412) related to Type C packages and Low dispersible material (LDM) when land transport just includes definitions, consignment procedures and approval and administrative requirements (TS-R-1, sections V and VIII) and deletes the material and package requirements (TS-R-1, §§ 605, 663 and 712 for LDM, §§ 617-619 for packages transported by air, §§ 667-670 for Type C and § 680 for fissile material transported by air) and the tests requirements (TS-R-1, §§ 730, 734-7).
   - the definition of multilateral approval varies for land or sea transport and air transport (TS-R-1, § 204);
   - the sea transport regulations incorporates all land transport provisions (namely TS-R-1, §§ 570-573).
4) The terminology differs from one mode of transport to another:
   - depending on the responsibilities of the persons involved in that mode of transport, for instance “carrier” or “operator” (TS-R-1, § 206), “consignor” or “shipper” (TS-R-1, § 212);
   - ADR/RID introduces a difference between small and large freight container and calls a freight container simply a “container” (TS-R-1, § 223);
   - in some cases, the IAEA definition differs from the UN definition, for instance “overpack” (TS-R-1, § 229) or “tank” (TS-R-1, § 242);
   - the definition of “vessel” (TS-R-1, § 248) is not incorporated in any modal regulation.
5) Some IAEA recommendations are not incorporated in any of the modal regulations (TS-R-1, §§ 505, 551 and 581) due to feasibility issues for these requirements or to customs authority issue.
6) Modal regulations include interdictions for some kinds of package and the corresponding recommendations are not included in the modal regulations :
   - for air transport, tanks (TS-R-1, §§ 504, 625, 626), intermediate bulk containers (TS-R-1, §§ 504 and 628), unpackaged material (TS-R-1, §§ 523, 540, 547) and intermittent venting of Type B(M) packages (TS-R-1, § 666) are forbidden.
   - for air transport, temperature limit on packages are required (TS-R-1, §§ 652 and 662).
7) The recommendations related to subsidiary risks are not applicable to modal regulations and are not included in the modal regulations (TS-R-1, §§ 109; 506, 507)

8) The requirements related to marking (TS-R-1, §§ 534-540), labelling (TS-R-1, §§ 541-545) and placarding (TS-R-1, §§ 546-547, 570-571) are sometimes modified in the content, at least strongly modified regarding form to take into account general provisions applicable to all classes.
9) The definition of the responsibilities in the transport of radioactive material is not uniformly incorporated (TS-R-1, § 548): the consignor declaration is incorporated in ADR/RID in transport document format (TS-R-1, §§ 550, 552 and 553).
10) Some administrative requirements are not incorporated in the air transport regulations, especially related to contents of applications for approval, contents of approval certificates and competent authority identification marks (TS-R-1, §§ 805b, 807, 810, 813, 822 and 825, 828 to 833).
11) Air transport regulations keeps the IAEA requirement (1990 edition), §517) for the pressure test with "packages containing liquid radioactive material capable of withstanding without leakage, an internal pressure which produces a pressure differential of not less than 95 kPa" when the IAEA requirement (1996 edition) concerns "a containment system able to withstand without leakage a reduction in ambient pressure to 5 kPa" (TS-R-1, § 619).

In conclusion, the modal regulations, which follow the UN format, include not all of the IAEA recommendations.

4 – APPLICABLE REQUIREMENTS NOT INCLUDED IN IAEA RECOMMENDATIONS

The present part deals, through examples, with the requirements included in the UN Orange Book and also in the modal regulations that are applicable to class 7 transport, even if these items are not included in the IAEA recommendations.
Note : In any case, the following is not a comprehensive list of the concerned items.

4.1 *Interference* of class 7 with other classes of dangerous goods

i) Precedence of classes

The UN Orange Book specifies the precedence of hazard characteristics, so that materials presenting many risks are able to be classified by identifying a major risk and subsidiary risks. Then "apart from radioactive material transported in excepted packages (where the other hazardous properties take precedence) radioactive material having other hazardous properties shall always be classified in Class 7 and the subsidiary risk shall also be identified" (UN-OB, 1999, §2.0.3.2). This requirement is completed by two Special Provisions (SP) in chapter 3.3 (UN-OB) : SP 290 for excepted packages and SP 172 for the other packages.
All modal regulations include also these two Special Provisions (as SP172 and SP290 for ADR/RID and IMDG Code; and as A78 and A130 for ICAO-TIs).
Attention should be paid to the limited quantities, which are defined for most classes of dangerous goods. A radioactive material presenting another risk cannot be classified under the class of this risk, except if the amount of material exceeds the limited quantities.

ii) Subsidiary risk

The renumbering of the UN numbers attributed to radioactive material in the 11th edition of UN Orange Book induces the loss of the information of the subsidiary risk for certain radioactive material (e.g. uranyl nitrate, pyrophoric uranium, …), except for UF_6 for which the former UN numbers have been kept.

ADR/RID kept the information that the solid thorium nitrate, the liquid hex hydrated uranyl nitrate and the solid uranyl nitrate are class 7 materials presenting a toxic subsidiary risk (ADR/RID : Special Provision 511, § 3.3.1).
Only IMDG Code kept the requirement related to pyrophoric radioactive materials, which "should be packaged in Type A, Type B(U), Type B(M) or Type C packages and should also be suitably inerted" (§ 4.1.9.1.6).

4.2 Forbidden radioactive material

All modal regulations include the same requirement : "Any substance which, as presented for transport, is liable to explode, dangerously react, produce a flame or dangerous evolution of heat or dangerous emission of toxic, corrosive or flammable gases or vapours under conditions normally encountered in transport" are forbidden from transport (UN-OB: § 1.1.3.1; ADR/RID §§ 2.2.x.2; IMDG Code : § 1.1.4.1; ICAO-TIs: § 1;2.1).
For air transport, specific provisions are added related to forbidden dangerous goods:
"Radioactive material with a subsidiary risk of Class 2.1 [Flammable gas] are forbidden from transport on passenger aircraft and radioactive material with a subsidiary risk of Class 2.3 [Toxic gas] are forbidden from transport on passenger or cargo aircraft except with the prior approval of the State of origin under the conditions established by the authority […]" (ICAO-TIs: A78 of 3;3).
The dangerous goods list of air transport regulations (ICAO-TIs: 3;2) indicates that all pyrophoric liquids or solids, alloys or metals, organic or inorganic, are forbidden from air transport.

4.3 Segregation and stowage requirements for class 7 packages

i) Stowage categories and stowage of goods of class 7 for sea transport

IMDG Code specifies stowage categories for the transport on ship (§ 7.1.1.2) : these categories depend on the type of ship, cargo or passenger, and on the total number of passengers on board. Five stowage categories are defined : A to E. The corresponding stowage category is defined in column 16 of the dangerous goods list (chapter 3.2). Radioactive material are concerned only by stowage categories A (on deck or under deck) and D (on deck only for cargo or passenger ships; prohibited on small passenger ships).

ii) Stowage in relation to undeveloped films and plates, and mailbags

Modal regulations include an information table, which defines the distance to be kept between radioactive cargo and photo sensitive films or plates, related to the total sum of transport indexes and the duration of the voyage/carriage (IMDG Code : §7.2.9.8 and Tables II or III; ADR/RID : 7.5.11 CV33 or CW33 and Table B; ICAO-TIs : 7;2.9.6.2 and Table 7-7).

iii) Stowage in relation to foodstuffs

Land and sea transport regulations require separation of radioactive material from foodstuffs (ADR/RID: 7.5.4 and 7.5.11 CV28; IMDG Code : 7.1.5.3).

iv) Stowage in relation to live animals

Only air transport regulations require separation of live animals from the II-yellow and III-yellow packages (ICAO-Tis : § 7;2.9.6.3).

v) Separation from persons

Modal regulations include an information table and/or limits, which define the distance related to the total sum of transport indexes and the duration of the voyage/carriage (ICAO-TIs : 7;2.9.6.1 and Tables 7-5 or 7-6; IMDG Code : 7.2.9.6 to 7.2.9.10 and Tables I, II or III; ADR/RID : 7.5.11 CV33 or CW33 and Table B).

vi) Segregation table (for packages containing dangerous goods of various classes)

Land and sea transport regulations include a segregation table between packages containing dangerous goods of various classes (ADR/RID 7.5.2.1; IMDG Code: 7.2.1.16). Transportation of packages bearing an explosive label is not allowed with packages bearing a radioactive label. Such a table is not included in air transport regulations.

Due to the size of the conveyance, the sea transport regulations include some specific requirements related to the segregation for the various means of transport (IMDG Code : 7.2.1.17) :

- "segregation of packages (IMDG Code : 7.2.2),
- segregation of cargo transport units on board container ships (IMDG Code : 7.2.3),
- segregation of cargo transport units on board roll-on/roll-off ships (IMDG Code : 7.2.4),
- segregation in shipborne barges and on board barge-carrying ships (IMDG Code : 7.2.5),
- segregation between bulk materials possessing chemical hazards and dangerous goods in packaged form (IMDG Code : 7.2.6)".

vii) General provisions on segregation (precedence of segregation)

"Where the Code indicates a single secondary risk (on subsidiary risk label), the segregation provisions applicable to that hazard should take precedence where they are more stringent than those of the primary hazard" (IMDG Code : 7.2.1.6.1). A similar requirement applies to land transport (ADR/RID: § 7.5.2.1; UN-OB : 7.1.2.3).

4.4 Training

The only IAEA recommendation dealing with training concerns radiation protection (TS-R-1, § 303). "Workers shall receive appropriate training concerning the radiation hazards involved and the precautions to be observed in order to ensure restriction of their exposure and that of other persons who might be affected by their actions".

UN Orange Book and modal regulations added important requirements related to the training of the persons involved in the transport. "Persons engaged in the transport of dangerous goods shall receive training in the contents of dangerous goods requirements commensurate with their responsibilities" (UN-OB: § 1.3.1; ICAO-TIs : § 1;4; ADR/RID: 1.3.2.4). The corresponding provision of IMDG Code: (§ 1.3) is not mandatory.

In addition, ADR/RID (§ 1.8.3) requires that every company involved in the transport of dangerous goods, the loading or unloading of such materials, shall have a safety adviser, who has successfully passed an exam, appointed by the director of the company and responsible for the following tasks :

- to ensure the respect of the dangerous goods transport requirements;
- to advise the company in all operations related to the transport of dangerous goods,
- to write an annual report on the activities related to the transport of dangerous goods.

4.5 Maximum exempted quantity permitted per transport

ADR/RID specifies five categories of transport related to the mass of transported dangerous goods (§ 1.1.3.6). An unlimited quantity of packages per transport unit (vehicle/wagon), is allowed for category "4", which corresponds to excepted packages (Nos UN 2908 to 2911). Even if the IAEA regulations may not forbid an unlimited quantity of excepted packages (except for fissile material), the categories of transport related to mass (for dangerous goods other than class 7 material) and to activity (for radioactive material) are not specified in IAEA regulations.

4.6 IBC and tank requirements

i) IBC requirements

The intermediate bulk containers (IBC) are common packages used as industrial packages for the transport of radioactive material. Most of the modal regulations include « General provisions applicable to all types of IBCs » which are presented in section 6.5.1 (UN-OB, IMDG Code, ADR/RID).

Note : IBCs are forbidden from air transport.

ii) Tank requirements

Tanks for the carriage of radioactive material shall meet the requirements of both IAEA regulations and UN Orange Book.

Most of the modal regulations include « General provisions for the use of portable tanks for the transport of substances of classes 3 to 9 » and « Application and general provisions for tanks » (respectively §§ 6.7.2 and 6.7.1.1 of UN-OB, IMDG Code, ADR and RID), which are completed by « general provisions for the use of portable tanks for the transport of substances of classes 3 to 9 » (section 4.2.1.1 to 4.2.1.9 and 4.2.1.15 of UN-OB, IMDG Code, ADR and RID ; and 4.2.1.18 of IMDG Code).

Specific requirements are applicable to road tank vehicles for sea transport for respectively long and short international voyages for substances of classes 3 to 9 (IMDG Code : §§ 6.8.2 and 6.8.3.1). These are completed by special provisions relating to tanks for the transport of solid substances (such as powdery or granulated substances) (IMDG Code : § 6.9).

Under UN numbers, tank requirements are indicated in the Dangerous Goods List in chapter 3.2 as "T5" and "TP4" for UN 2912, 2913 and 3321 (UN, IMDG Code, ADR/RID). Portable tank provisions and special provisions (like "T5" and "TP4") are presented in § 4.2.4 (UN, IMDG Code, ADR/RID).

Note : Tanks are forbidden from air transport.

4.7 Emergency response

These items are more or less covered by the TS-G.1.2 to be published.

i) Emergency schedules

The IMDG Code includes in the dangerous goods list a reference to the relevant emergency schedule.

The air transport regulations (ICAO-TIs § 7;4.8) quote the cross reference to the ICAO document "Emergency response guidance for aircraft incidents involving dangerous goods" (Doc. 9481).

ADR/RID adopted the system of instructions in writing for the driver, which are regulatory but shall be provided by the consignor. The consignor shall be responsible for the content of these instructions (ADR/RID, § 5.4.3).

ii) General provisions in the event of incidents and special provisions for incidents involving radioactive material

The modal regulations supplement the emergency schedules, if they exist, with General provisions in the event of incidents and Special provisions for incidents involving radioactive material (IMDG Code : §§ 7.3.1 and 7.3.4.4 and 7.3.4.6; ADR/RID : § 1.8.5.1; ICAO-TIs : 7;4).

iii) General fire precautions and Special fire precautions and fire fighting for class 7

IMDG Code developed special precautions for fire (§§ 7.3.5 and 7.3.9).

4.8 Samples

The transport of samples occurs when "the hazard class of a substance is uncertain and it is being transported for further testing. In that case, a tentative hazard class, proper shipping name and identification number shall be assigned on the basis of the consignor's knowledge of the substance and application of the classification criteria of the regulations and of the precedence of hazards." (UN-OB : § 2.0.4; ADR/RID : 2.1.4.2 (b); IMDG Code : § 2.0.4.2.2.; ICAO-TIs : 2;0.5).

This case is partly solved for radioactive material through the table II of TS-R-1 when the radionuclides are not well identified. With the evolution of the definition of radioactive material, the measuring of the specific activity in special laboratories could lead some consignors to use the samples to characterise the radioactive material to be transported.

4.9 Salvage packagings

The use of salvage packagings is foreseen by the modal regulations in the case of damaged, defective or leaking packages. A set of requirements are included in the modal regulations for the use (UN-OB : § 4.1.1.15; ADR/RID : § 4.1.1.17; IMDG Code : § 4.1.1.16) and the testing of such packagings (UN-OB, ADR/RID and IMDG Code : § 6.1.5.1.11). Some specific situation could lead a consignor, a carrier or a competent authority to have recourse to the use of salvage packagings for the transport of radioactive materials.

4.10 Dangerous goods packed in limited quantities

Supplementary requirements apply to excepted packages (UN-OB, IMDG Code, ADR/RID and ICAO-TIs : § 3.4) as dangerous goods packaged in limited quantities.

5 - CONCLUSION

The recommendations, as issued and approved by IAEA, follow a long process before being in force in national and international law relating to the transport of radioactive material. This process includes a first transcription into the United Nations Orange Book, and a second transcription into the modal regulations. As a result of these steps of the process, some of the IAEA recommendations are amended, modified and/or deleted. There are several reasons : among them, the applicable mode of transport is not systematically specified for the IAEA recommendations, the IAEA recommendations do not take into account the specificity and the existing general provisions of all the modes of transport.

On the one hand, the modal regulations, which follow the UN format, include only part of the IAEA recommendations. On the other hand, the requirements applicable to the safe transport of radioactive material are not restricted solely to the IAEA recommendations. Most of the general requirements in modal regulations are applicable to all classes and as such, these requirements do apply to the transport of radioactive materials.

It is recommended to enhance the coordination between IAEA and UN organisation toward a better harmonized regulation taking into account the specificity of the radioactive hazards and the commonalities of the hazards associated with the transport of dangerous goods of any class.