Radiation and Nuclear Safety Authority 117/0002/2016
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Guide YVL D.2, Transport of nuclear materials and nuclear waste

1 Introduction

Nuclear materials and nuclear waste are radioactive materials. The fundamental safety principle in the transport of radioactive materials is to protect people, property and the environment from the effects of radiation during the transport of radioactive materials. Radioactive materials constitute class 7 in the regulations governing the transportation of dangerous goods. The Act on the Transport of Dangerous Goods (719/1994) as well as the decrees and regulations issued thereunder (in road transports i.a. 194/2002 and TRAFICOM/82133/03.04.03.00/2019; in sea transports i.a. 666/1998; in rail transports i.a. 195/2002 and TRAFICOM/82134/03.04.02.00/2019; in air transports i.a. 210/1997 and OPS M1-18 / TRAFI/1359/03.04.00.00/2015) and other transportation regulations (in sea transport of spent fuel i.a. the INF regulations) set detailed requirements for the transport of radioactive materials, which are not repeated in Guide YVL D.2 since they are valid and binding as such.

The transport regulations for dangerous goods require approval for fissile material packaging designs by the competent authority of the countries of departure, transit and destination. According to the transport regulations for dangerous goods, fissile material shall include uranium isotopes 233 and 235 (U-233 and U-235), plutonium isotopes 239 and 241 (Pu-239 and Pu-241) and all materials that contain one of these. However, unirradiated natural uranium, depleted uranium or natural uranium or depleted uranium only irradiated in a thermal reactor shall not be considered fissile material under the transport regulations. The Radiation and Nuclear Safety Authority (STUK) is the competent authority for packaging design approval in Finland. Approval may be granted for a new packaging design or a packaging design approved by a foreign authority in which case STUK validates the approval certificate issued by the foreign authority.

The transport of nuclear materials and nuclear waste is use of nuclear energy as referred to in the Nuclear Energy Act (990/1987, Section 3), and is therefore subject to the safety principles stated in nuclear energy legislation (Nuclear Energy Act, Section 7 a) and to a licence (Nuclear Energy Act, Section 8; Nuclear Energy Decree 161/1988, Section 17), and shall be covered by sufficient nuclear security arrangements for protection against unlawful action (Nuclear Energy Act, Section 7). The Nuclear Liability Act (484/1972) applies to the transport of nuclear materials and nuclear waste. Nuclear liability is addressed in STUK Guide YVL A.1 “Regulatory oversight of safety in the use of nuclear energy”.

Under the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities (CPPNM, Finland’s Statute Book 72/1989) and its Amendment (513/2008), nuclear security arrangements shall be based on a graded (risk-informed) approach, taking into account the evaluation of the threat in question, the relative attractiveness and nature (characteristics) of the material as well as the potential consequences of unlawful action directed against nuclear materials. Guide YVL D.2 has been drawn up and shall be applied with regard to the graded, risk-informed approach. In the Guide,

the requirements are presented according to the material category, with a chapter dedicated to each category. The classification was made using criteria applicable to the aforementioned risk-informed approach. The concepts used in the CPPNM, including threat assessment, the relative attractiveness and nature of nuclear materials and the potential consequences of unlawful action directed at nuclear materials, have been included in the concepts of risk analysis and design basis threat in the Guide because these requirements are in accordance with the STUK provision (STUK Y/3/2016) on the security arrangements pertaining to the use of nuclear energy (the risk analysis includes concepts used in the CPPNM).

The operator shall be responsible for the safety as well as nuclear security and emergency arrangements of a nuclear material transport. For the purposes of this Guide, an operator shall primarily refer to a licence holder but, if no licence is required for a transport, the responsible entities shall be the consignor, carrier, or consignee, taking into account the responsibilities of the various parties arising from the regulations for the transport of dangerous goods. Licensee's responsibility is defined in Section 9 of the Nuclear Energy Act; the responsibility of other operators is defined in Section 3 of the Act on the Transport of Dangerous Goods (719/1994) as well as the regulations issued in accordance with the Act. A licence is required for a transport unless the quantity of the substance is below the limits referred to in Section 17 of the Nuclear Energy Decree. Under Section 115 of the Nuclear Energy Decree, *the transport cannot be commenced until STUK has ascertained that the transport equipment and transport arrangements and the arrangements for physical protection and emergency planning meet the requirements set for them.* Because of this, the plans related to certain transports are required to be submitted to STUK for approval.

The requirements pertaining to the safety of transporting radioactive material (incl. nuclear material and nuclear waste) are included in the IAEA publication Regulations for the Safe Transport of Radioactive Material, 2018 Edition, Specific Safety Requirements (No. SSR-6). The requirements of this IAEA publication have been moved to the UN's model rulebook ("UN Orange Book") from which they shall be moved to regulations governing specific transport modes. Of these regulations, road and rail transports are governed by "the European Agreement concerning the International Carriage of Dangerous Goods by Road" (ADR) and "the Convention concerning International Carriage by Rail, Appendix C Regulations for the International Transport of Dangerous Goods by Rail" (RID); sea transports are governed by "the International Maritime Dangerous Goods Code" (IMDG) and the "International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships" (INF); and air transports are governed by "the Technical Instructions for the Safe Transport of Dangerous Goods by Air" (ICAO-TI).

The aforementioned regulations include detailed requirements for the transport of all dangerous goods and radioactive materials in particular; because of this, a rather limited number of STUK's own transport safety requirements are presented in Guide YVL D.2. All aforementioned international regulations have been enacted in Finland as decrees. Furthermore, Finnish-language provisions TRAFICOM/82133/03.04.03.00/2019 and TRAFICOM/82134/03.04.02.00/2019, provided by the Ministry of Transport and Communications (TRAFICOM) and inclusive of the detailed requirements of the ADR and RID, are available for the first

two agreements. In practice, these documents are translations of the international regulations. International regulations governing sea and air transport, IMDG and INF, as well as ICAO-TI are valid in Finland as such through decrees 666/1998 and 210/1997.

The requirements for the security arrangements of transports of radioactive materials (incl. nuclear materials and nuclear waste) are based on the Nuclear Energy Act; Nuclear Energy Decree; STUK's regulation governing the security arrangements of the use of nuclear energy; the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities (CPPNM; Finland's Statute Book 72/1989); amendment to the Convention (513/2008); and IAEA instructions "Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (NSS 13 (INFCIRC/225/Rev.5))," "Security of Nuclear Material in Transport (NSS 26-G)" and "Security in the Transport of Radioactive Material (NSS 9)".

The requirements for security arrangements are very generic in the aforementioned international regulations on the transport of dangerous goods. Competent national authorities are obliged to enforce the requirements in their own instructions to ensure a correct level of safety, to take into account any national factors and to instruct operators.

STUK's duty is to impose detailed safety requirements for the implementation of the safety level in accordance with the Nuclear Energy Act (Nuclear Energy Act, Section 7 r). With regard to the transport of nuclear materials and nuclear waste, these requirements are included in Guide YVL D.2.

The requirements of Guide YVL D.2 are justified in this explanatory memorandum, with a particular focus on requirements that are new or deviate from the international standard.

2 Scope of application

Guide YVL D.2 sets out the requirements and oversight procedures for the transport arrangements of nuclear materials and nuclear waste as well as for the nuclear security and emergency arrangements pertaining to them. This Guide shall be applied in accordance with the graded, risk-informed approach referred to in requirement 102. The classification of nuclear materials and nuclear waste is given in Appendix A to the Guide.

3 Justifications of the requirements

3.1 Chapter 2 Scope of application

201–202. This chapter establishes the scope of application of the Guide. The requirements and procedures of the Guide shall be applied to 1) transports in the territory of Finland and 2) vessels and aircraft registered in Finland once they have entered international waters/airspace and the transport is connected to Finland (the transport either departed from or arrived in Finland). The operator shall apply the instruction in accordance with the graded, risk-informed approach, meaning that the requirements of the Guide must be followed with consideration for risk analysis and the design basis threat. If the design basis threat is not applicable to the operator and

activity (STUK has not delivered a design basis threat to the operator), the requirements shall be followed with consideration for risk analysis.

3.2 Chapter 3 Transport requirements

3.2.1 Chapter 3.1 General principles

301–305a. This chapter establishes the general transport principles. The operator is responsible for ensuring that the requirements of the Guide and other transport-related regulations are implemented. The SAHARA principle of the Nuclear Energy Act (Nuclear Energy Act, Section 7 a) shall be applied to transportations. Because the transport arrangements and security and emergency arrangements have a common goal as well as mutually beneficial and joint procedures, and because they are associated with potentially conflicting requirements, the transport security and emergency arrangements and nuclear safeguard arrangements shall be coordinated together. Risk analyses shall be used as the basis for planning the security arrangements. The design basis threat shall be used as the basis for planning transports that are subject to the design basis threat. STUK shall deliver the design basis threat to those who must use it. Application of the design basis threat shall not remove the need for risk analysis. Where applicable, transport-related risk analysis should be included in the operator's risk management processes and (safety) risks in different areas inspected as a continuous risk management process under the umbrella of safety management. Risk analysis involves the identification of risks and evaluation of their significance; determining, implementing, monitoring and assessing management procedures; evaluating the residual risk, and evaluating and developing the process itself. The design of security arrangements shall take into account different areas of security and their interdependencies in accordance with requirement 106 of the Guide. This means, for example, that the time required for response arrangements shall be taken into account in planning detection and delay. The Guide shall not set out exact descriptive requirements for the technical security arrangements of the conveyances or the transport-related safety organisation's number of personnel or equipment. The operator shall present these issues in the documents it submits to STUK. STUK shall then review them and, if necessary, set additional requirements to presented security arrangements.

Safety culture in requirement 305a refers to organisational culture which takes into account all the areas of nuclear and radiation safety ("overall safety"): safety, security arrangements, emergency response arrangements and safeguards of nuclear materials.

3.2.2 Chapter 3.2 General requirements for transportation of all nuclear materials and nuclear waste

306–318. The requirements apply to transportations of all nuclear materials and nuclear waste (306). The requirements are such that they can be considered part of typical, responsible transport operations. The requirements are based on Section 78 of the Nuclear Energy Act (309); Section 11 c of the Act on the Transport of Dangerous Goods 719/1994 (318); Government Decree on the Security in the Use of Nuclear Energy 734/2008 (318) as well as the IAEA publications NSS 9 (308, 310) and NSS 13 (308, 308a, 308b, 309, 311, 312, 313, 314, 315, 317).

In IAEA NSS 13 and NSS 9, the wording of requirement 308 is “the security arrangements must correspond with the requirements set for the use and storage of the material”. In Guide YVL D.2, this issue is expressed by giving reasons justified by the risk analysis. The approach highlights the operator’s responsibility and case-specific consideration.

In the final sentence of requirement 309, “confirmation” refers to the operator’s attempt to confirm data security measures in the transport-related “delivery chain” by means of, for example, agreements and, where applicable, assessments and audits.

Requirement 310 includes CPPNM requirements and recommendations from IAEA NSS 13 and NSS 9. In Guide YVL D.2, the requirement has been interpreted such that it constitutes a good practice in transportation of all nuclear material.

In IAEA NSS 13, requirement 316 is formulated in a way that allows for packages, whose weight exceeds a specific kg limit, to be transported in open conveyances under certain conditions. No justification is known for the strictly limited mass criterion, so it was not included in requirement 316 of Guide YVL D.2. For a justified reason, the operator may propose that a package containing nuclear materials and nuclear waste is transported in an open conveyance. In such a case, the operator must be able to demonstrate that the safety and security arrangement requirements can be met at least to the extent applicable to transportation in a closed conveyance. Closed conveyance refers to a solution similar to how a “closed container” is defined in the regulations governing the transport of dangerous goods. This means a fully closed container with a rigid roof, side walls, end walls and floor (see “container” – decree 369/2011, Appendix A, definitions, chapter 1.2).

The wordings “immediately” and “without delay”, used in requirement 318, comply with STUK Regulation Y/3/2016 and indicate that a notification to the authority responsible for primary response (emergency centre/112) shall take priority. STUK shall be notified as soon as possible while making sure that this does not delay the alarming of authority response.

3.2.3 Chapter 3.3 Low amounts of special fissionable materials

319–325b. The requirements apply to transports with a low amount of fissionable material if the quantity exceeds the quantity packed in a excepted package (319). The amounts of materials that can be transported in a excepted package are nuclide-specific activities and have been recorded in the regulations for the transport of dangerous goods as well as the IAEA instruction SSR-6 regarding transports. The requirements are based on IAEA NSS 9 (320, 321, 322, 323, 324, 325) and NSS 13 (325a).

Requirement 321 indicates that anything that can be expediently locked and sealed shall be locked and sealed to ensure the integrity of the nuclear material and to detect any unauthorised activity related to it. Transport packages as well as the other equipment and arrangements are all different, so it is not necessary to include a more detailed requirement in the Guide. Similarly, the starting point of requirement 322 is that any seals that can be inspected with practical and appropriate measures during different stages of the transport, such as during the transport-related transfer of responsibility, shall be inspected (“outer seals”). Requirement 323 shall be followed in

accordance with the graded approach in a manner and with the precision that is necessary according to the transport-specific risk analysis.

3.2.4 Chapter 3.4 Source material: natural uranium or thorium

326–339. The requirements apply to the transport of source material if the source material is, by consistency and purity, suitable to be used as raw material in nuclear fuel fabrication and the amount of uranium or thorium transported at any one time exceeds 10,000 kg (326). The title has been narrowed down to ensure that the chapter's requirements do not apply to depleted uranium. The purpose is to ensure that the requirements of this chapter are followed in large-scale (regular, taking place on an industrial scale) transport operations of source material that is suitable for use as raw material in nuclear fuel fabrication. The definition *suitable, by consistency and purity, to be used as raw material in nuclear fuel fabrication* refers to uranium oxides, such as "yellow cake". The chosen limit in the Guide is 10,000 kg because, according to Sections 2 and 8 of the Nuclear Energy Act and Sections 6 and 61 of the Nuclear Energy Decree, the fabrication, production, usage, processing or storage of nuclear material is considered large-scale if the intended storage capacity of the plant used for the purpose is over 1 effective kilogram of nuclear materials at a time (10,000 kg for natural uranium). Similarly, the annual production of more than 10,000 kg of uranium or thorium is regarded as mining and enrichment activity which requires a licence from the Finnish Government (Nuclear Energy Act, Section 8; Nuclear Energy Decree, Section 9 b). The limit is transport-specific in the Guide. In terms of the IAEA's nuclear safeguards, 10,000 kg also constitutes the significant quantity limit for natural uranium.

The Guide requires that, in addition to the notification referred to in requirement 307, detailed transport-related information is submitted to STUK (327). The requirement of detailed information is justified by the need to obtain information on the operator's transport arrangements relating to the large-scale transport of the source material. The other requirements are based on STUK regulation Y/3/2016, Section 15 (328); STUK decision 77/YS2/08 (safety graded, Act on the Openness of Government Activities 621/1999, Section 24(1)(7)) on transport security arrangements, given on 19 December 2008; the IAEA's NSS 13 (337, 338); and CPPNM (329).

The purpose of requirement 328 is to enhance collaboration between the operator and the authorities and to improve the planning of their operations: the operator has the opportunity to receive instructions and advice from the authority while the authority is able to obtain the necessary information regarding the transport operations.

The purpose of requirement 329 is to ensure that the transport falls, at every step, under the responsibility of an operator who is capable of ensuring safety as well as compliance with the regulations of the countries of departure, transit and destination, and to ensure that the operators are aware of their responsibilities.

In follow-up activities, as specified in requirement 333, communication systems or technical monitoring/positioning systems can be used as appropriate for each transport. The solution is affected by issues such as other transport arrangements: for example, how much and what kind of personnel are involved in the transport. Both

safety and data security aspects must be taken into consideration when making the choice. The purpose is to ensure that the operator knows about the location and status of the transport and that this information can be communicated to the authorities quickly and reliably, when necessary. On the other hand, unauthorised/improper disclosure and use of location data must be prevented.

Requirement 335 is based on an existing practice that has been tried and tested in the transport of fresh fuel; giving a notification of the departure and arrival of each transport is also considered justified in the context of large-scale transport of natural uranium. The purpose is that the operator establishes its notification practice in its plans (at which point of the transport shall the notifications be given) and STUK shall give its opinion as it approves the plans. Similarly, requirement 336 is regarded as a good practice. Time specifications (no unnecessary delays, within a reasonable time frame) refer to periods of time that can be followed with practical measures.

Content-wise, requirement 339 is related to a previously set requirement (325) regarding the organisation of transport-related training as well as the requirement (325a) concerning exercises. In the context of large-scale nuclear material transport operations, the relevant authorities shall also be given the opportunity to participate in these events which may, for example, involve discussion about the tasks and responsibilities of the various parties and how to act in a special situation.

3.2.5 Chapter 3.5 Fresh nuclear fuel

341–354. The requirements shall apply to the transport of fresh nuclear fuel, with the exception of fresh nuclear fuel belonging to Category 1, such as MOX fuel (341). The requirements are based on Sections 7 k (345), 7 l (347) and 7 n (348) of the Nuclear Energy Act; Section 115 (342) of the Nuclear Energy Decree; Section 3 (343) of the Government Decree on Security in the Use of Nuclear Energy 734/2008; STUK decision 77/YS2/08 (347, 352) on transport security arrangements, given on 19 December 2008; and IAEA NSS 9 (346) and NSS 13 (344, 349, 353a).

Based on Section 17 of the Nuclear Energy Decree, a licence shall be required for transports of fresh nuclear fuel if the quantity of Uranium exceeds 10 kg. In requirement 342, the intention has been that, with transports for which a transport plan and a transport security plan must be submitted for approval, no separate notification needs to be submitted to STUK under requirement 307.

The design basis threat, referred to in requirement 343, shall be submitted by STUK to any operators whose transport operations are subject to it. Based on the threat-related and situational information at each time, STUK may present necessary additional requirements for the transports. In addition to the design basis threat, the operator may have to take into account its own, current risk analysis.

Security clearances referred to in requirement 346 are regulated in the law; a clearance may only be requested on persons working in certain types of roles. According to Section 21 of the Security Clearance Act (726/2014) ”*A limited personal security clearance can be completed on a person selected to perform a service relationship or assignment or a person handling the service relationship or assignment, who: 5) participates in the transport of nuclear materials or has access to a nuclear facility; or, through access to the nuclear facility construction area, has*

access to information about factors that influence the security of the nuclear facility; or has access to a facility in which nuclear material is used or stored, or a facility in which the radiation source is used or stored and the amount of radioactive materials corresponds with or is higher than the activity level of sealed sources referred to in the radiation legislation;..."

The operator shall assess which persons participating in the transports require a security clearance under legal provisions, and it shall present the issue to STUK as part of its transport-specific plans.

Requirements 347 and 348 are based on the Nuclear Energy Act. It is natural that security personnel in nuclear facilities also safeguard transports. It is not practically possible to arrange security personnel for any transports that are not related to the operation of nuclear facilities. The personnel shall have special training concerning authorisations and the use of force, in addition to security guard qualifications. Through requirements 349 and 350, the purpose is to ensure a sufficient level of safety, as referred to in the Nuclear Energy Act (also in accordance with the recommendation of IAEA NSS 13), for transports that are not related to the operation of nuclear facilities and belong to the same nuclear material category by requiring the presence of guards who meet the requirements of the Private Security Services Act (1085/2015). In practice, the requirement might apply to transit transport, for instance.

3.2.6 Chapter 3.6 Spent nuclear fuel

355–362. The requirements in the chapter apply to the transport of spent nuclear fuel, with the exception of Category 1 spent nuclear fuel whose radiation level at a distance of 1 m does not exceed 1 Gy/h (355). The requirements are based on IAEA NSS 13 (358, 359, 359a) and CPPNM (362).

IAEA NSS 13 recommends procedures compliant with requirements 359, 359a and 360 explicitly for nuclear materials in Category 1. The classification of NSS 13 is based on the proliferation risk. The classification in Guide YVL D.2 also takes into account the risk related to radiation consequences. The starting point for requirements 359, 359a and 360 is that, in the planning of conveyances of spent fuel and communication centre arrangements, particular attention shall be paid to security aspects due to the high activity level of the transported material. "Technical special system" in requirement 359a refers to a technical system and/or device that is installed in addition to a regular vehicle immobiliser system. This helps prevent the unauthorised use or deployment of the vehicle as part of defence-in-depth and with consideration for traffic safety. Planning may also be affected by protection goals in accordance with the design basis threat. The INF regulations also set structural safety requirements for ships used to transport spent nuclear fuel.

Spent fuel is high-activity nuclear waste, and it is deemed appropriate to require the use of radiation measuring equipment while transporting it (361). A radiation dose rate meter is utilised in current transports of fresh nuclear fuel.

3.2.7 Chapter 3.7 Category 1

363–365. The requirements apply to nuclear materials and nuclear waste (363) in Category 1. Such materials are rarely transported in Finland at the time of writing the guide. The requirements are based on IAEA NSS 13 (364, 365).

IAEA NSS 13 recommends that Category 1 material should be the only load in the conveyance, but the recommendation is unclear in terms of sea transports. Requirement 365 addresses all modes of transport in the same way for the sake of clarity. With regard to this requirement and other ones, the operator may propose procedures deviating from the requirement if these help achieve a safety level that meets the requirement.

3.2.8 Chapter 3.8 Other nuclear materials or waste

367–368. The requirements of the chapter apply to nuclear materials or nuclear waste that are not included in the materials described in chapters 3.3–3.7. The purpose is to apply the requirements concerning fresh nuclear fuel to materials in Category 3 (367) and the requirements concerning spent nuclear fuel to materials in Category 2 (368).

3.3 Chapter 4 Transport-related licence applications, plans, notifications and reports

3.3.1 Chapter 4.1 Application for approval of transport packaging design

401–403. The chapter establishes the requirements for approval of transport packaging design as well as the contents and submission deadlines of documentation delivered to STUK for the purpose of approval. Requirements 401 and 402 concern the approval of a new transport container design in Finland by the competent authority in Finland, STUK. Requirement 403 concerns transport container designs approved in the country of origin and their validation in Finland. Detailed technical requirements for packaging are laid down in the transport regulations for dangerous goods.

The six-month time limit given in requirement 401 for the delivery of documentation related to a new transport packaging design does not refer to the processing period of the documentation. The processing period of the documentation depends on the documents delivered for approval as well as the inspection schedule of the manufacturing process of the new container type. If the licence applicant is planning to have a new transport packaging design approved in Finland, they should contact STUK about the issue as early as possible.

3.3.2 Chapter 4.2 Transport licence application

This chapter establishes the requirements for applying for a transport licence. The content of the transport licence application is defined in Sections 56–60 of the Nuclear Energy Decree, and a requirement for the application deadline is presented in this chapter, to be added to the copy.

3.3.3 Chapter 4.3 Transport plan

405–408. This chapter establishes the content requirements for an operator's transport plan (405). There are usually valid reasons for drawing up individual plans for each transport. Requirement 406 gives the operator an opportunity to prepare a general transport plan for its transport operations in case of similar recurrent transports. If this action is taken, the transport plan for transport operations shall be kept up-to-date and submitted to STUK for approval every time significant changes are made to it and for information after every change. The aim is to make it possible that transports related to the final disposal of spent fuel, for example, can be carried out based on a long-term plan.

A deadline has been set for the submission of the transport plan (407), and it must be followed to ensure a sufficiently long processing period. The aim of requirement 408 is to make it easier to draw up a transport plan; through the requirement, any information not known three months before the transport can be submitted to STUK just before the transport is started.

3.3.4 Chapter 4.4 Transport security plan

409–413. This chapter establishes the content requirements for a transport security plan prepared by the operator (409). The content requirements have been modified to correspond with the requirements of IAEA instruction NSS26-G. It is recommended to prepare a transport security plan for transport operations because the security arrangements are similar and recurrent for all transports (410). A deadline has been set for the submission of the security plan to ensure a sufficiently long processing period. The security plan shall be kept up to date and submitted to STUK for approval every time significant changes are made to it and for information after every change (412). Guide YVL D.2 highlights the operator's responsibility. The aim of requirement 413 is to make it easier to draw up a transport security plan; through the requirement, any information not known three months before the transport or information that has changed on a transport-specific basis can be submitted to STUK just before the transport is started, in accordance with the security plan approved by STUK.

3.3.5 Chapter 4.5 Transport emergency plan

414–421. The chapter establishes the requirements for an emergency plan. A deadline (418) is has been set for the submission of the emergency plan to ensure a sufficiently long processing period. Requirement 417 recommends that the operator prepare an emergency plan for transport operations in case of similar recurrent transports. If this action is taken, the emergency plan for transport operations shall be kept up to date and submitted to STUK for approval every time significant changes are made to it and for information after every change (419). The aim is to make it possible that transports related to the final disposal of spent fuel, for example, can be carried out based on a long-term emergency plan. The aim of requirement 420 is to make it easier to draw up an emergency plan; through the requirement, any information not known three months before the transport or information that has changed on a transport-specific basis shall be submitted to STUK just before the transport is started.

3.3.6 Chapter 4.6 Information to be submitted in connection with the nuclear facility's construction licence application and operating licence application

422–423. The chapter establishes a requirement for information to be submitted to STUK in connection with the nuclear facility's construction licence application and operating licence application. In connection with the construction licence application, the licence applicant shall submit to STUK preliminary analyses of the transport arrangements and transport security arrangements; for the operating licence application, the applicant shall submit analyses of the transport arrangements and transport security arrangements. With regard to transport arrangements, the requirements are based on Section 35(2) and Section 36(3) of the Nuclear Energy Decree; with regard to security arrangements, the requirements are based on Section 35(1) and Section 36(1) of the Nuclear Energy Decree. The analyses and plans referred to in the requirement shall not replace the transport-related licensing procedure wherein the transport licence application must be submitted three months before the transport. Transports of fresh and/or spent nuclear fuel are an essential part of a nuclear facility's operations. In some cases, factors such as the selected mode of transport and transport packaging may also affect the design of the plant. The aim is to ensure that it would not be necessary to propose the selection of the mode of transport in the preliminary analyses and plans; the modes of transport under consideration must be reviewed from the point of view of implementing transport and security arrangements. Through the processing of the analyses and plans, another aim is to ensure that STUK can, at this point, request statements from other authorities supervising the transports and participating in their security arrangements and submit the feedback obtained from the statements to the operator for use in further planning.

3.3.7 Chapter 4.7 Notification on transports exempt from a transport licence

424–425. This chapter establishes the content requirements for the notification referred to in requirement 327 (Nuclear Energy Act, Section 134 a(5)). The justification for this is given in connection with the discussion on requirement 327.

3.3.8 Chapter 4.8 Deviations from the plans

A requirement is presented in the chapter that STUK and any other authorities must be notified of a situation where deviations from the approved plans occur during transport. A deviation shall occur only for unexpected, compelling reasons.

3.3.9 Chapter 4.9 Summary of notifications and reports submitted to the authorities

427–439. In this chapter, a summary is presented of all requirements set forth in the previous chapters, concerning notifications and reports submitted to STUK and other authorities.

3.4 Chapter 5 Regulatory oversight by the Radiation and Nuclear Safety Authority

501–505. The chapter establishes the regulatory oversight of transports, performed by STUK.

3.5 Other highlights of the Guide

Definitions closely relevant to the Guide as well as a list of regulations and other publications relevant to the topic are presented in Guide YVL D.2. In Appendix A of the Guide, nuclear materials are classified on the basis of a table included in the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities (CPPNM, Finland's Statute Book 72/1989). The same table is also available in IAEA recommendation NSS 13. The table establishes nuclide-specific limits for nuclear materials, according to which the materials are divided into various protection categories. Nuclide-specific limits refer to the amount of nuclides (fissile isotope) referenced at each time, not to the total amount of nuclear material. For example, in the case of enriched uranium with a low concentration of U-235 (uranium whose concentration of isotope U-235 is higher than 0.71% but lower than 10%), protection category 3 comprises such a quantity of nuclear material that contains 10 kg or more of nuclide U-235.

If the material is a mixture of the nuclides referred to in the table, sum diagrams shall be used to determine the protection category, meaning that the total sum is calculated based on the actual amounts of various nuclides in the mixture and then divided with the nuclide limit values. The total sum is then compared with figure 1. For example: (Amount of nuclide A/limit of nuclide A) + (amount of nuclide B/limit of nuclide B)...< 1. If the total sum is below 1, the material does not belong to the protection category whose minimum limit it is being compared to.

The classification of CPPNM and NSS 13 is based on the proliferation risk. The classification in Guide YVL D.2 also takes into account the risk related to radiation consequences. The table has been amended on a national level so that the source material is included in the table (in CPPNM and NSS 13, it is specified in the footnote of the table and is included in the scope of application of CPPNM and NSS 13), while limiting values based on total activity have been determined for nuclear waste which does not contain any nuclear material. Total activity values are used because this is a clear way to establish the limits. When determining limiting values, the properties of various nuclides are taken into account so that, conservatively, the most limiting value or an equivalent value used in another context is selected as below.

In protection category 2 of the table, the minimum limit is 1,000 TBq. For any transports exceeding this activity limit, a separate emergency plan must be provided. The minimum limit in protection category 3 is 1 TBq. The activity limit is based on D values which describe the hazardousness of the radioactive material (IAEA Safety Standards, Categorization of Radioactive Sources, RS-G-1.9. IAEA, 2005). D values refer to a quantity of radioactive material which, when misused or badly protected, could cause permanent harm to a person handling it or staying in its immediate vicinity in a short space of time. D values are divided into D1 and D2 values. The former category describes the hazardousness of the radiation source when handled by a person unaware of the radiation, and the latter describes the hazardousness of the source if fine radioactive material is released into the environment in an accident situation or on purpose. Because nuclear waste is generally transported in large quantities, the D2 value can be considered more appropriate for setting the activity limit. Nuclear waste generally contains several radionuclides whose concentrations may vary greatly. The most significant nuclides are cobalt-60 (Co-60), strontium-90

(Sr-90) and caesium (Cs-137), whose corresponding D2 values are 30, 1 and 20 TBq. Based on the aforementioned factors, the most limiting D2 value, 1 TBq, has been chosen as the minimum limit of protection category 3.

4 International provisions concerning the scope of the Guide

4.1 International transport regulations

- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);
- Convention concerning International Carriage by Rail, Appendix C Regulations for the International Transport of Dangerous Goods by Rail (RID);
- International Maritime Dangerous Goods Code (IMDG Code);
- International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ship (INF);
- Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI)
- The Convention on the Physical Protection of Nuclear Material and Nuclear Facilities (SopS 72/1989) and its Amendment (513/2008).

4.2 5.2 IAEA instructions and recommendations

- Regulations for the Safe Transport of Radioactive Material, 2012 Edition, Specific Safety Requirements (No. SSR-6), IAEA (2012)
- Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nu-clear Facilities (INFCIRC/225/Rev.5), NSS No. 13, IAEA, 2011
- Security of Nuclear Material in Transport (NSS 26-G)
- Security in the Transport of Radioactive Material, NSS No. 9, IAEA (2008)

4.3 The relation of the Guide to international regulations

International transport regulations of dangerous goods include all the IAEA SSR-6 requirements for radioactive materials as such, and are therefore valid in Finland. It was not deemed necessary to repeat the detailed requirements of the transport regulations in Guide YVL D.2.

The requirements for security arrangements in Guide YVL D.2 are based on the Nuclear Energy Act; Nuclear Energy Decree; Government Decree on the Security in the Use of Nuclear Energy 734/2008; CPPNM; amendment to the agreement (513/2008); and the IAEA nuclear safety recommendations NSS 13 and NSS 9. The risk classification of nuclear materials, used in IAEA NSS 13, is based on the proliferation risk (how suitable the material would be for manufacturing a nuclear weapon). The risk classification of radioactive materials, used by IAEA NSS 9, is based on the activity of the material in comparison with its D value describing the hazardousness of the radioactive material (IAEA Safety Standards, Categorization of Radioactive Sources, RS-G-1.9, IAEA, 2005). D values refer to a quantity of radioactive material which, when misused or badly protected, could cause permanent harm to a person handling it or staying in its immediate vicinity in a short space of time. In Guide YVL D.2, the stricter recommendations for each category of nuclear materials have been used as the starting point. For the most part, the Guide

corresponds with the level of IAEA recommendations. Exceptions are presented in this explanatory memorandum.

5 Impacts of the Tepco Fukushima Dai-ichi accident

There was no need to make changes to Guide YVL D.2 on account of the Fukushima accident.

6 Needs for changes taken into account in the update

The needs for changes due to changes made to international and national laws/regulations and the change proposals made in connection with the preparation of the YVL Guide implementation decisions (SYLVI) together with others recorded in STUK's change proposal database have been considered when updating the requirements. In addition, the possibilities to reduce the so-called administrative burden have been considered.

The transport safety requirements were not changed other than by means of correcting a few spelling errors and updating the references to legislation, decrees and regulations.

In Guide YVL D.2, the requirements for security arrangements specific to each nuclear material category are based on a holistic, risk-informed, graded approach in accordance with CPPNM. With regard to the requirements for security arrangements, an assessment by an external specialist, commissioned by STUK in 2016, was taken into account while updating the Guide. The assessment criteria included the IAEA instructions on security arrangements, particularly IAEA NSS 13. Based on the assessment, old requirements have been amended and complemented and new requirements have been added. The changes apply to the following requirements: 106, 305a, 308a, 308b, 309, 325a, 325b, 338, 339, 352, 353a, 359a and 409.

The wording of requirement 106 was specified so that it now contains a clear reference to the obligation to prepare for the threat of larceny or sabotage. With the new requirement 305a, the aim is to highlight the fact that security culture must be maintained as part of the general safety culture. Requirements 308, 308a and 308b apply to the design basis of security arrangements and the development of security arrangements. The requirements help to demonstrate that security arrangements must be planned on the basis of the design basis threat and risk analysis and that corrective action must be taken immediately in case any deficiencies are observed in the security arrangements. Also relevant to transport security plans, a requirement for taking into account the safety risk posed by an "insider" has been added to the design requirements. Requirement 309 provides that the data security procedures of organisations participating in the processing of transport-related information are verified. Requirement 325a is new, requiring that special situations related to transportation are practised in advance. Requirement 325b (340) derives from chapter 3.4 *Source material: natural uranium or thorium.* It was moved to chapter 3.3 *Small amounts of special fissionable materials* to ensure that it shall apply to all transports of nuclear materials and nuclear waste. Requirements 338 and 339 have been specified particularly with regard to requirements related to cooperation with authorities. The licensee is obliged to help the authorities in a special situation,

particularly in order to prevent radiation consequences, and to provide the authorities with access to training and practice sessions related to special situations. Requirement 352 was used to specify the requirements related to communication systems. With the new requirement 353a, the licensee's obligations were also specified with regard to transport notification procedures. Requirement 359a (366), concerning the technical protection of transport vehicles, was expanded to cover spent fuel as well as materials in protection category 1 due to the radiation risk. Content requirements for the security plan, presented in requirement 409, were updated to correspond to the requirements set for security plans in IAEA instruction NSS 13:6.9.

All change proposals relating to Guide YVL D.2 were discussed. Spelling and similar errors were corrected. Other change proposals were left for further consideration during upcoming and more extensive update cycles.

The requirements of the Guide do not contain any possibilities for administrative burden reduction.