TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

APPROVED BY

Director of Nuclear Science & Engineering School
_____ / Oleg Yu. Dolmatov
"25" 06 2020

Course Name:
Safety and Security of Nuclear and Other Radioactive Materials in Transport

Field of Study: Nuclear Science and Technology

Programme name: Nuclear Science and Technology

Specialization: Nuclear Safety, Security and Non-Proliferation of Nuclear Materials

Level of Study: Master Degree Programme

Year of admission: 2020

Semester, year: semester 3, year 2

ECTS: 5

Total Hours: 180

Contact Hours: 64

- **Lectures:** 16
- **Practical experience:** 16
- **Labs:** 32

Self-study: 116

Assessment: Exam

Division: Nuclear Fuel Cycle

Director of Programme _____ / Vera V. Verkhoturova

Instructor _____ / Maxim E. Silaev

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Course name:
Safety and Security of Nuclear and Other Radioactive Materials in Transport

Course Overview

Course Objectives	The objective of the training course is to develop students' theoretical knowledge and practical skills, which are necessary to conduct professional activity in the fields related to safety and security of nuclear and radioactive materials shipment.
Learning Outcomes	**Upon completion of the course, a graduate will obtain the knowledge of:** – project development and implementation stages; – team building techniques; – principals of a report structuring and presentation preparation in a foreign language (English), adopted in international environments; – order and methods of preparation of different categories of nuclear and radioactive materials to a shipment; – technical means and characteristics of control systems for transportation of nuclear and radioactive materials; – regulation in fields of nuclear and radioactive materials shipment; – transportation procedures and requirements for physical protection of nuclear and radioactive materials. **Upon completion of the course, graduates are expected to develop the following skills:** – to explain objectives and develop tasks associated with the preparation and implementation of a project, to determine main stages and direction of activity; – to manage of a project at all stages of its life cycle; – to develop a plan of group and organizational communications during a process of a project preparation and implementation, to formulate personal tasks to team members for objectives achievement; – to compile and present technical and scientific information used in professional activities in the form of a presentation; – to prepare nuclear and radioactive materials for shipment, organize physical protection during transportation; – to use modern technical and informational tools to organize and conduct of transportation of nuclear and radioactive materials; – to determine transport package categories and requirements for them; – to carry out technical parameters control and to fill out accompanying documentation for the nuclear and radioactive materials shipment. **Upon completion of the course, graduates should acquire the practical experience in:** – using methods of assessment of resource requirements and project effectiveness; – analysis, design and organization of interpersonal communication in a team to achieve the set goal; – using speaking skills in a foreign language in accordance with the field of training. The performance of a speaker shall be justified and supported with

	auxiliary means (such as tables, graphs, charts, etc.); – application of a foreign language at a sufficient level for professional activities in future; – using methods of organizing a transportation of dangerous cargo (nuclear and radioactive materials, accounting, control and physical protection; – preparation of documentation and organizing transportation of nuclear and radioactive materials.
Course Outline	The training course is delivered through the following teaching modes: – 8 lectures; – 8 practical experiences; – 8 labs. The course consists of 2 sections, which are given below. **Section 1. Safety of nuclear and radioactive materials shipment.** **Section 2. Security of nuclear and radioactive materials shipment.** Each section includes several lectures, practical experiences and labs. The training course finishes with an exam. The course implies conducting of 2 intermediate colloquiums and a 8 lab defenses. Each colloquium is scored with the maximum of 20 points. The 8 lab defenses are scored with the maximum of 40 points.
Course Structure	The content of the course covers 2 topics. Each topic is studied through lectures, practical experiences and labs. **Section 1. Safety of nuclear and radioactive materials shipment** Cargo shipment is always a danger operation itself. The danger increases many times when transporting goods represent a threat to people health and life as well as can have a detrimental impact to environment. Such cargoes include nuclear and radioactive materials. When transporting nuclear and radioactive materials, a number of specific measures based on nuclear and radiation safety requirements must be implemented. The use of specific administrative measures and technical means is necessary for the transportation of nuclear and radioactive materials. **Section 2. Security of nuclear and radioactive materials shipment.** Physical protection measures are required during handling with nuclear and radioactive materials. Transportation of nuclear and radioactive materials is the most vulnerable stage of handling with them in terms of the possibility of theft or malicious use by an exterior adversary. Therefore, specific requirements, rules and precautions, including administrative and technical, are applied for physical protection of such cargo. Detection during transportation and control over the shipment of nuclear and radioactive materials in order to ensure their safety and security as well as the safety of the population and the environment protection is a separate complicated technical task.
Facilities and Equipment	1. Lecture Hall with multimedia equipment: 634050, Tomsk, Lenin ave., 2, building 10, room 340.
Grading Policy	In accordance with TPU rating system we use: – Current assessment which is performed on a regular basis during the semester by scoring the quality of mastering of theoretical material and the results of practical activities (performance tests, perform tasks, problem solving). Max

	score for current assessment is 80 points, min – 44 points. – Course final assessment (exam/ credit test) is performed at the end of the semester. Max score for course final assessment is 20 points, min – 11 points. The final rating is determined by summing the points of the current assessment during the semester and protection of the course project at the end of the semester. Maximum overall rating corresponds to 100 points, min pass score is 55.
Course Policy	Attendance is strictly controlled. All classes are obligatory for attendance.
Teaching Aids and Resources	**Compulsory Reading:** 1. Domenech, H. Radiation Safety. Management and Programs / H. Domenech. - Cham : Springer, 2017. - 332 p. - Текст: электронный // SpringerLink. – URL: https://link.springer.com/book/10.1007/978-3-319-42671-6 (дата обращения: 20.09.2020). – Режим доступа : по подписке. 2. Numerical Modeling of the Thermal State of a Metal-Concrete Container with Spent Nuclear Fuel during Its Transportation / Yu. E. Karyakin, V. M. Kuzin, A. A. Pletnev, E. D. Fedorovich. – Текст электронный // Journal of Engineering Physics and Thermophysics. – 2018. - Vol. 91, № 4. – P. 991-998. - URL: https://link.springer.com/article/10.1007/s10891-018-1825-9 (дата обращения: 20.09.2020). – Режим доступа : по подписке. **Additional reading:** 3. Pham H. Safety and Risk Modeling and Its Applications / H. Pham. – London : Springer-Verlag Ltd., 2011. – 429 p. – Текст: электронный // SpringerLink. – URL: https://link.springer.com/book/10.1007/978-0-85729-470-8 (дата обращения: 20.09.2020). – Режим доступа: из корпоративной сети ТПУ. 4. Nuclear Energy. A Volume in Encyclopedia of Sustainability Science and Technology Series / by editor N. Tsoulfanidis. - second edition. - New York : Springer. 2018. – 438 p. - Текст: электронный // SpringerLink. – URL: https://link.springer.com/referencework/10.1007/978-1-4939-6618-9 (дата обращения: 20.09.2020). – Режим доступа : по подписке.
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