TOMSK POLYTECHNIC UNIVERSITY | ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

APPROVED BY

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

Course Name: Physical Protection Technologies and Equipment

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 2, year 1

ECTS: 3

Total Hours: 108

Contact Hours: 48

- **Lectures:** 16
- **Practical experience:** 16
- **Laboratory experience:** 16

Self-study: 60

Assessment: Credit-test

Division: Nuclear Fuel Cycle

Director of Programme _____ / Vera V. Verkhoturova

Instructor _____ / Boris P. Stepanov

Course name: Physical Protection Technologies and Equipment

Course Overview

Course Objectives	The objective of the training course is to develop students' knowledge of and skills in security systems design at the operation of nuclear facilities and radiation sources, for the creation of systems ensuring nuclear and radiation safety at the operation of nuclear power facilities, development of measures on radiation risks reduction in accordance with regulatory requirements and laws.
Learning Outcomes	**Upon completion of the course, a graduate will obtain the knowledge of:** – fundamentals of report structuring and presentation preparation in English accepted in the international community; – main methods of project development and modern security systems design; – techniques for implementation and methods of analysis of process activities as an object of management in the field of nuclear energy use; – main properties and characteristics of phenomena and processes taking place at nuclear facilities; – purpose and functioning of the security systems main elements, features of their operation. **Upon completion of the course, graduates are expected to develop the following skills:** – to compile and present technical and scientific documentation used in the professional field in the form of presentation; – to find organizational and managerial solutions in non-routine situations and bear responsibility for them; – to use regulatory legal documents and technical documentation in the field of professional activity, design security systems, analyze technical solutions for improvement of nuclear materials physical protection, control and accounting system structure; – to create functional arrangements and models for the description of processes taking place at the enterprises of nuclear fuel cycle and nuclear facilities. **Upon completion of the course, graduates should acquire the practical experience in:** – monologue speaking in English on the profile of speciality in a well-argued manner with the use of supplementary tools (table, graphs, diagrams, etc.); – assessing the security systems structure during nuclear materials management, generating proposals on the improvement of security systems at a nuclear facility; – using main methods of project development and security systems design at nuclear power facilities; – creating functional arrangements and models for the description of processes taking place at nuclear facilities; – preparing statements of order on the creation of security systems, furnishing the project with devices and tools.
Course Outline	The training course is delivered through the following teaching modes: – 8 lectures; – 8 laboratory experiences;

	– 8 practical experiences. The course consists of 2 sections, which are given below. **Section 1. Fundamentals of security system organization** **Section 2. Security systems structure and functioning** Each section includes several lectures, laboratory and practical experiences. The training course finishes with a credit-test. In the course of study, students are to defend three reports on laboratory experiences which are scored with the maximum of 15 points each, perform a review which is scored with the maximum of 15 points and a group assignment which is scored with the maximum of 22 point. Besides, the course implies conducting a test which is scored with the maximum of 10 points.
Course Structure	The content of the course covers 2 topics. Each topic is studied through lectures, laboratory and practical experiences, as well as self-study. **Section 1. Fundamentals of security system organization** Modes and conditions of the nuclear power safe use. Structure of main federal, departmental rules and regulations related to the safety issues at the NFC enterprises. Main approaches during the security systems organization and functioning at nuclear power facilities. **Topics of lectures:** 1. Assurance of nuclear power safe use and development. 2. Main requirements, rules and regulations in the field of safety assurance at the NFC enterprises. 3. Conditions for implementing nuclear and radiation safety at nuclear facilities. 4. Purposes, performed functions, features of security systems. **Topics of practical experience tutorials:** 1. Selection of the security systems structure. 2. Features of application of federal rules and regulations in the field of nuclear energy use. 3. Generation of requirements and procedures for the organization of activities related to nuclear materials safe management. 4. Security systems devices and tools. **Topics of laboratory experiences:** 1. Access control system design at a nuclear facility. 2. Video recording and image analysis in security systems. **Section 2. Security systems structure and functioning** Security systems structure. Elements of security systems and their interrelation. Stages of security system design. Organization of procedures for nuclear material physical protection, control and accounting. Selection of the PPS structure at the NF. Procedures for NM control and accounting organization. **Topics of lectures:** 5. Security systems structure. 6. Functioning of control and information systems. 7. Complex IT systems, data collection and display systems. 8. Organization of procedures for nuclear material physical protection, control and accounting. **Topics of practical experience tutorials:** 5. Site security regulations and access control procedures at NPF. 6. Administrative procedures at security systems functioning. 7. Physical protection system design at a nuclear facility. 8. Elements and devices in the nuclear material control and accounting system.

	Topics of laboratory experiences: 3. Organization of fire and security alarm systems. The training course provides for the graduates' self-study of the following types and forms: – Study of lecture materials, search and review of literature and electronic information resources on the individually specified course topic; – Study of topics submitted for independent examination; – Information research, analysis, structuring, and presentation of information and data obtained; – Performance of assignments and tests; – Preparation for laboratory and practical experiences, seminars; – Analysis of scientific publications on the topic predetermined by the instructor; – Preparation for assessment activities.
Facilities and Equipment	1. Classrooms with multimedia equipment: Tomsk, Lenin ave. 2, build. 10, rooms 312, 313. 2. The complex of security and CCTV systems within the laboratory of security assurance methods and nuclear terrorism countering; 3. Training system for ensuring security and physical protection of nuclear facilities; 4. Engineering bench of fire and security alarm systems devices; 5. Engineering bench of access control means.
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. Physical Protection of Nuclear Material and Nuclear Facilities (Implementation of INFCIRC/225/Revision 5): implementing guide / International Atomic Energy Agency. - Viena : International Atomic Energy Agency, 2018. – [9], 120 p. – (IAEA Nuclear Security Series, No. 27-G). - URL: https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1760_web.pdf (дата обращения: 20.09.2020). – Режим доступа : свободный доступ из сети интернет. - Текст электронный. 2. Security of Radioactive Material in Use and Storage and of Associated Facilities: implementing guide / International Atomic Energy Agency. - Viena : International Atomic Energy Agency, 2019. – [9], 105 p. – (IAEA Nuclear Security Series, No. 11-G (Rev. 1)). - URL: https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1840_web.pdf (дата обращения: 20.09.2020). – Режим доступа: свободный доступ из сети интернет. - Текст электронный.

	3. Nuclear Power Plants: Innovative Technologies for Instrumentation and Control Systems. International Symposium on Software Reliability, Industrial Safety, Cyber Security and Physical Protection of Nuclear Power Plant / by editor Y Xu. — Singapore : Springer, 2017. — IX, 224 c. — Текст: электронный // SpringerLink. — URL: https://link.springer.com/book/10.1007/978-981-10-3361-2 (дата обращения: 10.04.2020). — Режим доступа : по подписке. **Additional reading:** 1. Kołowrocki, K. Reliability and Safety of Complex Technical Systems and Processes / K. Kołowrocki, J. Soszynska-Budny. – London : Springer, 2011. – 419 p. – Текст: электронный // SpringerLink. – URL: https://link.springer.com/book/10.1007/978-0-85729-694-8 (дата обращения: 20.09.2020). – Режим
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