

Education to a graduated engineer degree in the field of radiation protection in Saxony

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Abstract

In Saxony, a state of Germany, a special mode of education to a graduated engineer in the field of radiation protection exists. This so called "dual" degree consists of a theoretical part at the University of Cooperative Education Riesa and a practical part at the Nuclear Engineering and Analytics Rossendorf Inc..

The paper describes the content of the education at Riesa and Rossendorf including some titles of dissertation submitted for a diploma.

Some examples of assignment of the graduated engineers at the Nuclear Engineering and Analytics Rossendorf Inc. are added.

1. Introduction

In 1991, Saxony (state of Germany) launched a new project aimed at creating a fully integrated system of higher education on a tertiary educational level: BERUFSAKADEMIE/University of Cooperative Education. It took only a few years for the project in Saxony to develop this system of higher education with currently approximately 4,500 students in Saxony. Around 500 students are currently enrolled at the Berufsakademie in Riesa in the fields of Business Administration and Engineering. One kind of the academically qualified engineers (BA) is called engineer of radiation protection. The vocational training for this engineer has two learning places: the 'Studienakademien' Riesa (first two years)/Karlsruhe (last year) as the 'center for academic course work', and the company providing 'the center for on-the-job training'. One of the last mentioned companies is the Nuclear Engineering and Analytics Rossendorf Inc.

The three years at the Berufsakademie are divided into two phases: Basic education and training cover the first two years and lead to a first job qualification. The final qualification (the Degree - in German 'Diplom'), for which almost all students aim, is achieved after a third year of more specialized studies and training.

A student enrolled at Berufsakademie/University of Cooperative Education is both a *student and an employee*. Therefore, the Berufsakademie has two learning places: the 'Studienakademie' as the 'center for academic course work', and the company providing 'the center for on-the-job training'. Each partner bears the cost of the learning center that it controls. Phases of course work (theory) - normally of 12 weeks duration in a term of six months - alternate with periods of on-the-job-training of equal duration.

The requirement for studying at the Berufsakademie is the German university entrance examination ('Abitur'). In addition, a contract defines the conditions of the traineeship. Signing a standard training contract is a necessary condition of enrolment.

2. History

In 1992 launched the project "Berufsakademie/University of Cooperative Education" at the Rossendorf Nuclear Engineering and Analytics Inc. (VKTA) in the field of the practice-integrated study phase of engineer of radiation protection. This project was started in association with the Rossendorf Research Center (FZR). Until 1995 the theoretical part of the study was only placed at the University of Cooperative Education in Karlsruhe. Since 1996 the University of Cooperative Education Riesa received responsibility for the first two years of the science-referred study phase as economical reasons (Riesa is close to Rossendorf). The last year is furthermore placed in Karlsruhe (this location is more specialised in radiation protection). Since 1992 the company Rossendorf Nuclear Engineering and Analytics Inc. provided eleven students with an "on-the-job training". All of them got there final qualification (the Degree - in German 'Diplom'), for which almost all students aim.

3. Course contents

Theoretical phase:

Radiation protection is an interdisciplinary, application-oriented science composed of different fields of activity.

Accordingly study contents are aligned with:

Natural sciences, information and communication techniques, general engineering sciences, consolidation subjects (specialising subjects) and business management and jurisprudence.

An overview to all subjects is contained in table 1.

Most of the subjects are included with practical trainings in laboratories.

Subjects of study	Number of hours per semester					
	1	2	3	4	5	6
Mathematics	48	54	48			
Physics	72	54				
Biology / Microbiology	24	48				
Chemistry / Biochemistry	72	48	36	24		
Informatics / Presentation techniques	24	24	24	24		24
English (special)	24	24	24	24		
Apparatus engineering	60	24	24			
Electro-technology / Electronics		36	42			
Control engineering			36	36		
Process engineering			72	132	36	
General and radiation measuring technique	48	48	72	48	48	
Nuclear instrument technique					48	24
Nuclear large-scale installations					48	60
Radiation medicine				36	48	
Energy engineering					48	48
Radiochemistry / Radio ecology					24	48
Quality assurance						48
Economics / Marketing	24	24				
Law and safety					12	

Table 1 : Overview about subjects of study (theoretical part)

Practical phase:

Table 2 shows the fields of activities of the practice-integrated study phase at Rossendorf. Column two contains the training-departments which are responsible for the training during the time interval which are placed in column three. You can see, there are two departments located outside from Rossendorf, i.e. we use the Dresden University of Technology, especially the Faculty of Medicine Carl Gustav Carus and the regulatory of Saxony for the education in medicine and in the field of authority.

Subject of Study	responsible for this subject of study	Number of weeks for this subject
Introduction to nuclear large-scale installations (Rossendorf Research Reactor)	reactor department, VKTA	3 - 4
Environmental surveillance (meteorology, transport calculation, sample collection)	radiation protection department, VKTA	4
Waste management (transport, storage, treatment)	decommissioning and waste management department, VKTA	2 - 3
Incorporation monitoring (whole body counter, excretion analysis, dose assessments)	radiation protection department, VKTA	4
Clearance of low level radioactive materials for recycling or disposal	radiation protection department, VKTA	3
Measurement of activity and dose rate (room surveillance)	radiation protection department, VKTA	2
Apply for licence	conditions of Saxony	4 - 5
Treatment of liquid radioactive waste	decommissioning and waste management department, VKTA	3
Measurement of external exposures	radiation protection department	3
Activity measurement of filters and environmental samples	radiation protection department	2
Radiation protection in nuclear facilities, laboratories	decommissioning and waste management department	4
Shielding calculations	radiation protection department	2
Emergency management	radiation protection department	3

Table 2: Overview above course contents (practical phase)

During the last three months the student prepares his degree diploma.

Table 3 delivers an overview about all degree dissertations from 1995 to 2004.

Year	Title of degree dissertation submitted for diploma	Author	Report
1995	A computer aided expert system for interpretation of whole body counter results	Cordelia Hoinkis	VKTA report Nr. 29 Sept. 1995
1996	Preparation of Monte Carlo radiation transport program AMOS for simple shielding calculation	Sven Kowe	VKTA report Nr. 42 April 1997
1997	Investigation of usefulness of an in situ Gamma spectrometer for measuring gamma dose rate	Uwe Oehmichen	
1998	Quality assurance of contamination of persons and assessment of the influence of the contamination of the whole body counter result	Gregor Beger	
1999	Calculation of radiation dose for people of Rossendorf village using measured immission data	Sandra Reimann	
2000	Investigation of dependence of a Rossendorf whole body counter calibration to body mass and body length	Sven Jansen	VKTA report Nr. 67 March 2001
2001	Investigation of usefulness of a coincidence monitor for measurement the air activity concentration in a PET centre	Carina Reichelt	
2002	Examination of contamination pathways for contaminating the sediments of the	Isabel Grahl	

	Rosendorf river		
2003	Experimental investigations of the nuclide specific estimation of Gamma dose rates by using a Gamma spectrometer without knowledge of depth distribution of activity	Anke Rietzschel	
2004	Introduction of quality assurance into the drum measuring device at Rosendorf department of decommission	Falk Tillner	VKTA report Nr. 78 Sept. 2004

Table 3: Overview about the dissertations submitted for a diploma in Rosendorf

4. The graduate who has completed a course of radiation protection engineer at Rosendorf

Up to now seven graduated engineers got a job at Rosendorf. Because of the "on-the-job training" structure, the graduates are very acknowledged with the facilities at Rosendorf and no time-consuming period for establish an employee is necessary.

After get used to work fore same years as an engineer of radiation protection is it possible to work in positions in which one has great power and influence, for instance as production engineer at gathering station for radioactive waste of Saxony, at the Rosendorf research reactor or at the Rosendorf intermediate depot.

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