

## EXPERIENCE IN EDUCATION OF SANITARY ENGINEERS IN SLOVENIA

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### ABSTRACT

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The European Union accession provided our institution with an opportunity to review and evaluate the educational programme for Sanitary Engineering at the University of Ljubljana, Slovenia. Due to the specificity of the country there is a need to educate professionals with the broad environmental, ecological, epidemiological and hygienic knowledge for them to play an integrative role in finding the solutions to such problems by bringing together experts from various relevant fields. The increased awareness about the importance of the engineering in the above mentioned areas and the interdisciplinary approach lead towards establishing a four year sanitary engineering programme in 1993. Its distinctive multidisciplinary and rapid development in the field are the main reasons for the decision that selected course units are thought by professors and experts from both universities in Slovenia and other institutions as well as enterprises. The results of our last evaluation clearly shows that the programme needs to be modified in the field of ecological and natural sciences mainly because the area it covers is a very dynamic one in terms of scientific developments and in addition it tries to adjust to labour market demand.

Due to similar educational system in the South Eastern Europe in the past, ten years of experiences in Slovenia should be used as a model which could be, through the collaboration, adopted elsewhere in the region.

**Keywords:** sanitary engineering, environmental health, ecology, Slovenia

### Introduction

Great challenges are facing Slovene, European and world's educational systems in dealing with environmental and health problems to provide students with an adequate knowledge of engineering, ecological and health issues. In a survey carried out by WHO Regional Office for Europe in 1994 a list of professionals involved in areas related to environmental health in Europe was created. The list consists of 73 professions ranging from architects, biochemists, civil engineers and ecologists to the microbiologists, sanitary engineers and toxicologists (Fitzpatrick et al. 1999). Not all of the mentioned professionals are to be found in every European state, the fact which is dependent on different factors such as number of inhabitants in the state and organisation of educational as well as political and economic system. As a general rule in larger countries a broader range of specialists can be found in comparison with the smaller states, where generalists are more frequent.

Slovenia with merely 2 million of inhabitants has 192 municipalities and over half of the Slovenian population (66 %) lives in the 127 municipalities with less than 7 500 inhabitants (Statistical Office of the Re-

public of Slovenia 2002). Population of Slovenia is therefore dispersal populated, forming mainly smaller communities.

Due to the specificity of the country the need was recognised to educate professionals with the broad environmental, ecological, epidemiological and hygienic knowledge who can play an integrative role in finding the solutions to such problems. Sanitary engineers have an advantage over other engineers since their knowledge encompass not only technical aspects of given environmental problem but also ecological and health aspects. The main objective of educational programme for graduate sanitary engineers is therefore a multidisciplinary approach aiming at the identification of environmental problems, assessment of environmental health hazards and risks to human health and environment and searching for solutions which lead towards reduction of the adverse effects of the environmental pollution.

### A brief history of the programme

The two years course started at the Department for „Higher“ Sanitary Technicians in 1964. The study pro-

gramme was always dynamic and it tried to follow changes in demands for the profession as well as those in the social and economic system. With the increased awareness about the importance of the engineering in the area of public and environmental health and the recognition of the importance of interdisciplinary approach it became evident that the programme needs to be upgraded. Therefore in 1992 the department received its new name - Department of Sanitary Engineering and in the following year it started with the implementation of four years programme started (Likar 1995; Likar et al. 1992, 1994). With such programme, sanitary engineer became equal to other engineers. Even now the Department of Sanitary Engineering at the College of Health Studies, University of Ljubljana, is still the only one of this kind in Slovenia.

Distinctive programme's multidisciplinary and rapid development in the field are the main reasons for the decision that selected course units are thought by professors and experts from the University of Ljubljana, University of Maribor and other institutions as well as enterprises.

### **Curriculum structure**

Learning objectives of the programme are designed to set out what a future sanitary engineer should know, understand and finally be capable to fulfil all the requirements for the independent professional work.

Tab. 1 shows that Curriculum includes number of course units whose load is distributed between different types of organised educational training in individual course unit such as: contact hours of lectures, seminars, practical classes, training in the field and other forms of training (Likar et al. 1996). In addition students are required to carry out independent study for every course unit. The courses are designed in a way to provide a student with sufficient professional knowledge to qualify him/her for the implementation of various tasks to be executed by the sanitary engineer.

The hours ratio of lectures and seminars to practical classes is 61,2 % to 38,8%. According to the FEANI (European Federation of National Engineering Associations), programme consists approximately of 33% basic sciences, 47% engineering sciences and 20% non-technical sciences. Programme therefore encompass a broad range of disciplines such as natural sciences (chemistry, physics, mathematics, medicine, etc.), engineering sciences (civil engineering, meteorology, industrial hygiene, etc.) as well as social and other non-technical sciences (sociology, law, etc.).

After a satisfactory completion of all programme obligations the student can start with diploma work. Diploma thesis should be a direct attempt to use theoretical and practical knowledge obtained during the study period to solve a specific problem in the specif-

ic area of sanitary engineering. Thesis must be completed in 6 months after the topic is approved by the Department of Sanitary Engineering. Defence of the diploma thesis is public.

The graduate with BSc diploma can start with an independent work after he/she obtained 1 year of professional experience and has successfully passed a professional state examination (Official Gazette RS, No. 63/1998).

### **Profile of BSc graduate in sanitary engineering**

In Slovenia sanitary engineer with a BSc diploma has an integrative role in finding the solutions of social, medical, ecological, epidemiological and hygienic problems and situations. To fulfil these tasks sanitary engineer must have a technical and engineering knowledge of most ecological activities concerning environmental and public health, appropriate attitudes and skills (Likar et al., 1996). Sanitary engineer has professional competence for work independently or in the team, especially in the field of:

- environmental quality management and control;
- safety and quality of food, drinking water and other goods used by general public;
- environmental epidemiology;
- health, occupational safety, food and environmental inspection and control;
- independent management of enterprises and institutions in the field of public and environmental health;
- research and teaching in environmental and public health.

Due to their interdisciplinary knowledge after the completion of the course the graduates can find their position in: public health and other types of institutes, enterprises involved in planning and construction, enterprises which by technological processes influence on the environment, enterprises from the food processing industry and its distribution, enterprises involved in sanitation, cleaning, disinfection and pest control activities and also toxic compounds and chemicals management, facilities such as kindergartens, schools, homes for elderly, student dormitories, public bathing facilities and thermal baths, educational institutions, enterprises and public institutes involved in providing public services (waste water treatment, drinking water supply, waste treatment, etc.) and public administration (national and local).

### **Evaluation of the existing programme**

The „spine“ of the European Union single market consist on the idea of „4 freedoms of movement“ - for goods, services, people and capital. People are able to move within the EU more freely for work,

Tab. 1. Curriculum structure.

No.	Subject	Hours			
		L	S	PW	Total
<b>YEAR 1</b>					
1.	Anatomy and Physiology	60	/	30	90
2.	Chemistry and Technology	105	/	90	195
3.	Technical Physics with Mathematics	70	10	30	110
4.	Microbiology and Parasitology	60	/	30	90
5.	Health and Ecology Legislation	60	/	15	75
6.	Sociology	30	/	30	60
7.	Social Medicine and Health Statistics	45	15	15	75
8.	Health Education	30	/	30	60
	Working Practice	/	/	80	80
<b>Total</b>		<b>460</b>	<b>25</b>	<b>350</b>	<b>835</b>
<b>YEAR 2</b>					
9.	Food Hygiene and Technology	30	5	/	35
10.	Public Health in Emergencies and First Aid	45	/	30	75
11.	Occupational Safety Management	45	20	30	95
12.	General and Municipal Hygiene	90	5	100	195
13.	Sanitary Control with Administrative Procedures	75	/	55	130
14.	Social Psychology	15	/	15	30
15.	Working Environment	40	10	30	80
16.	Biochemistry	60	/	15	75
17.	Foreign Language	30	15	/	45
<b>Total</b>		<b>430</b>	<b>55</b>	<b>275</b>	<b>760</b>
<b>YEAR 3</b>					
18.	Housing Environment	40	10	30	80
19.	Sanitary Technology and Project Design	45	/	30	75
20.	Philosophy and Ethics	30	/	/	30
21.	Epidemiology	90	30	60	180
22.	Informatics and Computer Science	30	15	30	75
23.	Methods in Sanitary Control	60	10	100	170
24.	Legislation in Public Health and Ecology	45	10	/	55
25.	Microbiology and Virology in Public Health	60	15	15	90
	Working Practice	/	/	80	80
<b>Total</b>		<b>400</b>	<b>90</b>	<b>345</b>	<b>835</b>
<b>YEAR 4</b>					
26.	Hygiene and Human Environment	45	15	15	75
27.	Food Safety and Quality	60	5	75	140
28.	Research in Environmental Epidemiology	30	15	45	90
29.	Air Pollution	45	15	15	75
30.	Energy and Environment	45	15	15	75
31.	Urbanisation and Planning	30	15	30	75
32.	Waste Management	50	20	30	100
33.	Drinking Water and Prevention of Water Pollution	60	10	30	100
<b>Total</b>		<b>365</b>	<b>110</b>	<b>255</b>	<b>730</b>
<b>TOTAL (4 years)</b>		<b>1655</b>	<b>280</b>	<b>1225</b>	<b>3160</b>

L - Lectures, S - Seminars, PW - Practical Work

because member states recognise many of each other's academic and professional qualifications. Therefore the EU accession provided us with an opportunity to review and evaluate the educational programme for Sanitary Engineering at the University of Ljubljana. The main goal of the evaluation was to establish whether programme is comparable to the similar programmes in the EU member states in the terms of knowledge and skills obtained during studies and if it

is structured according to the demands established by FEANI. The first step of evaluation process was the analysis of similar educational programmes and accurate study of demands for achieving the title „European Engineer“. The second step was administrative evaluation of the existing programme performed by the Department of Sanitary Engineering. The results shows that the programme is suitably structured for the specific social and economic situation in Slo-

venia, but it nevertheless needs some adjustments. On the basis of results obtained, some changes have been proposed, such as rearrangement of the students work load from some non-technical subjects for students to gain more time for ecological, informational and other natural sciences. The other change proposed is reorganisation of the existing curriculum into the modular study, which should enable students to choose between more elective subjects in the last two years of study.

### Conclusions

The results of our last evaluation clearly show that the programme for Sanitary Engineering needs to be modified in the field of ecological and natural sciences. The modifications are needed mainly as the covered area is a very dynamic one in terms of scientific development and in additionally it tries to follow demands on the labour market. The main changes proposed are therefore reorganisation of topics and creation of the thematic modules with the objective to achieve the recognition of our study programme by the other EU member states.

Due to similar educational system in the South Eastern Europe in the past, ten years of experiences in Slovenia should be used as a model, which could be, through the collaboration, adopted elsewhere in the region. In this way the ecological, environmental and

environmental health education could be improved in a much more efficient manner.

### References

- Fitzpatrick, M., Bonnefoy, X. (1999). *Environmental Health Services in Europe 4: Guidance on the development of educational and training curricula*. Copenhagen: World Health Organization, Regional Office for Europe.
- Likar, K., Bauer, M., Likar, M. (1992). *Vzgojnoizobraževalni program sanitarno inženirstvo*. Ljubljana: Univerza v Ljubljani. Višja šola za zdravstvene delavce.
- Likar, K., Bauer, M., Likar, M. (1994). *Educational programme for BSc in Sanitary engineering in Slovenia*. Ljubljana: Univerza v Ljubljani. Visoka šola za zdravstvo.
- Likar, K. (1995). 30 let izobraževanja višjih sanitarnih tehnikov. *Zeleno okno*. 3: 4-10.
- Likar, K., Bauer, M., Lubej M., Horvat J. (1996). *Visokošolski strokovni študijski program sanitarno inženirstvo*. Ljubljana: Univerza v Ljubljani. Visoka šola za zdravstvo.
- Program pripravništva in strokovnega izpita za poklic diplomirani sanitarni inženir. *Official Gazette RS*, No. 63/1998.
- Statistical Office of the Republic of Slovenia (2002). *Statistical yearbook 2002*, Ljubljana, Slovenia