

Higher Education Quality Assessment Centre of Estonia

## Joint Final Report

# Tallinn Technical University

Institution Assessed

Department of Mining at the Faculty of Power Engineering

Visit Dates

1-5 October 2002

Expert Team

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# Part I

## General Overview

### **Introductory remarks**

The Estonian Higher Education Accreditation Centre (EHEAC) invited three experts from England, Finland and France to Estonia for the period 1-6 October 2002. According to the assignment, the Expert Team (hereinafter called Team) was given the task of evaluating mining and applied geology research at the Tallinn University of Technology (Tallinn Tehnikaülikool).

The evaluation was carried out through an examination of the self-evaluation report and visits to the Department on 2-3 October 2002 for discussions of the on-going research with the research staff. The Team also had access to the M.Sc and D.Sc. theses written at the University as well as to all published papers and to a number of proprietary reports written by the researchers of the Department. The Team also had the opportunity to discuss the research work of the Department with representatives of the mining industry. Thus the Team was able to gather information about the staff, resources, publications, ongoing research projects and other related activities and external funding concerning research.

During the visits to the Department the Team discussed projects separately with different categories of staff and representatives of different research groups. In this way the Team was able to assess the volume of activity in relation to the available infrastructure and external funding.

### **The Team's approach to the Estonian Mining and Applied Geology Research**

The evaluators were asked to evaluate the quality of the work of the active research staff of the Mining Department and to rate the Department according to comparative international standards. Research work done to satisfy the needs of the Estonian society is, according to the instructions, included in the activities to be evaluated.

One of the starting points of the Team was the published mission statement of the Tallinn University of Technology; that the University is to provide educational, research and innovation services in the field of engineering and entrepreneurship, which are internationally competitive and significant for Estonia's sustained development. The University shall exhibit more flexibility in responding to society's expectations and needs by launching new programmes, research topics, development work and continuing education courses as well as by offering expert evaluations in issues of national importance; provide solutions to the problems of key interest to society and the capital city of Tallinn, in the framework of short- and long-term projects.

Throughout the visit the Team interchanged ideas frankly with the staff of the Department, and it is felt that many of the suggestions in this document will have their support.

What follows are the findings of the Team (Part II), its accreditation conclusions (Part III), and its recommendations (Part IV). In Part II, the findings are relative to the "Development plan of TTU 2001-2005" approved by the University Council "Principles and Criteria for Evaluation of Research and Development Institutions" (Approved by the regulation of the Government of the Republic No 83 of 21 April 1998 RT\*I 1998, 38, 569), and the "Guidelines for Experts for the Research Evaluation" provided by EHEAC.

## Part II

### Findings

#### **Institutional Structure**

The Department of Mining belongs to the Faculty of Power Engineering. The Department has two chairs (down from three from 1.9.2002). The chairs are Applied Geology and Mining Technology. The applied geology group consists of four persons, as is the group of mining engineering. There are three research posts in the Department.

#### *The strengths and the weaknesses of the unit*

##### *Strengths*

The Department is a small unit. One of its major strengths is the direct contact between researchers and the fulfilment of the ideal of Humboldt that research and teaching must be interconnected. The Team found this the most important prerequisite for the future development of the Department. The Team found also that the researchers have strong motivation to work and had understood the mission statement of the University.

The Team is of the opinion that the Department is doing good development work by international standards. The Department is also successful in technology transfer. We qualify this work also as being of a high standard. This is partly because of the Department has very good relationships with the industry and partly the source of those good relationships. It is however not fully clear to the Team how innovative this technology transfer has been in international terms.

The emphasis of basic research has been on applied geology research where the Department has contributed some very interesting results.

##### *Weaknesses*

The size of the Department results in the total number of man-hours available for research being constrained. The teaching load of many of the Faculty members seems to be quite high inhibiting much research. This hinders the capability of the Department to participate in larger, academically more demanding research projects. It also creates a situation where the balance between consultative development work and long-term basic applied research is, in the opinion of the Team, tilted too far away from fundamental mining research. We acknowledge the fact that the financial constraints are severe and that to change the aforesaid balance needs many years of work. The seeking of this balance is a well-known challenge in any university. A constraint in this respect is also the overwhelming role of one big enterprise. It is difficult to maintain enough academic independence in such a situation.

However, the tradition of fundamental research in mining at present is not strong enough.

The resources and publishing policies as well as international cooperation are discussed later but contribute to the list of weaknesses.

## **Research Activities**

### ***Resources***

#### *Personnel*

The number of people doing research in the Department is small. There are only three full time researchers and nine other academic staff all of whom have also high teaching loads.

The age distribution of the personnel of the Department is still critical. There is improvement as young assistant professors have been appointed. The Department has experienced the retirement of two senior professors, who fortunately still work as emeritus professors at the Department. The chair of applied geology is vacant at the moment. A new professor is to be appointed in the near future.

The Department forms a closely-knit unit of dedicated people with a good working atmosphere and good interactive and interdisciplinary capability.

#### *Equipment*

The equipment available at the Department is adequate for teaching with the help of field-work at the near by quarries. However the equipment is not adequate for fundamental or applied mining research. The Department has inadequate laboratory space and equipment for scientific experimental testing of rock specimens. There is no adequate laboratory (test-rig) for ventilation. The soil mechanics laboratory at Civil Engineering is a student laboratory and cannot help in soil mechanics research for open pit mining. No hydrogeology laboratory is available. The Team understands that a new building for the Faculty and for the Department on the main campus will start to be constructed in the very near future. It is hoped that this indeed happens, as the move to the main campus, which is planned, should take place as soon as practical. It is recommended that this opportunity be taken to ensure that the new laboratories for the Department are equipped to international standards for the discipline. The University should consider a special fund being set aside for this purpose.

Special software for mine planning and rock mechanics is available, but will need updating in the coming years.

#### *Technical Support*

The Team gained the impression that the general technical support for research (i.e. computers, common software etc) is adequate. However the opinion of the Team is that the Department does not yet have adequate access to international research results. There is access to recent publications via databases like Science-Direct, but some of the most important journals in the field of mining are not available in such databases. The extensive use of the databases also leaves out most of the older publications. The Team also recommends a concerted action to obtain monographs in the relevant fields.

#### *Funding*

The funding of the Department forms a major constraint. In total the research funding has been about 1,7 million EEK. The Department has not been successful in the applications for target oriented Science Council money. The main reason has been the lack of competent (Dr. level) researchers, which the Department is trying to correct. The Team was shown new applications, which still seemed to be short of doctoral researchers.

The Department personnel have been more successful in applying for individual grants from the Estonian Science Foundation. The level of that funding has increased slightly during the last four years.

The Department has been most successful in obtaining research money from the industry. The amounts have fluctuated substantially indicating short research contracts. In 2002 the amount will be over 1,3 million EEK.

### ***Dissemination of the results***

#### *Publications*

The Department is actively involved in publishing of an international peer reviewed journal *Oil Shale* published by Estonian Academy of Sciences. One of the members of the editorial board is one of the professors of the Department (recently emerited). The advisory board consists of members from several countries. The journal represents a major effort in publishing Estonian mining and applied geology research.

The volume of the peer reviewed publications of the unit is growing and has achieved a level that is adequate taking into account the number of man-years available for research. However the Team expresses its concern about the journals chosen. Most of the papers have understandably been published in their "own" journal *Oil Shale*. This journal does not have a very wide circulation internationally and the researchers are advised to publish in other peer reviewed international journals as well. This changed practice would bring the results to a wider audience and this would improve the ability of the researchers, increase the possibilities of making international research contacts and perhaps lead to them becoming members of international research groups.

#### *Technology Transfer*

In the discussions between the Team and the representatives of the industry it became clear that the Department has excelled in technology transfer and has been instrumental in bringing in new mining technologies to Estonia.

The Team feels that this activity has been very valuable and should be continued in the best interests of the Republic of Estonia.

## Part III

### Evaluation Conclusions

#### Quality of research

The Team has evaluated the research according to the guidelines set by the Estonian Accreditation Centre. It was felt that an important issue in the assessment is the probability of Estonia joining the EU in the coming years.

The Team found that the quality of much of the research was at a good international level, but that the rest of the work really only attained a fair international level. On this basis the Team finds that the quality rating is **Good to Satisfactory**.

#### Overall capability of the research unit

##### *Originality/novelty of research*

###### *Past research*

The research has had two distinct focal areas. In the research of applied geology there is internationally good quality work that can be graded to be novel.

However in the area of mining the work has previously been very development oriented and does not merit very high points on novelty.

###### *New research*

The new research proposals and the work started in the Department shows a continuation of the work that has been done in the field of applied geology. There is a healthy tradition for basic and applied basic research in this field.

The applications for mining research show a striving to change the balance between fundamentally oriented and development oriented research. The applications shown to the Team show an adequate quality of originality.

###### *Rating*

The rating of the Team is that there is some novelty in the research (**Grade 1**).

##### *The strategy and perspective of research*

In the discussions with the senior members of the Department, it did not become very clear to the Team, if there was a general plan of research. On the other hand the assistant professor level expressed quite clear ideas how the research should be conducted and what the most important research areas should be. Those plans were, in the opinion of the Team, sound and achievable, and had an ambition level that will take the Department to a new phase and level of research quality and international co-operation.

###### *Rating*

The rating of the Team is that there is a fair strategy perspective in the research (**Grade 1**).

### ***Multidisciplinarity and relevance to other areas***

The research in the Department of Mining is vital to the well being of the Estonian society as a whole.

The Department has made and is poised to make more, major contributions to the sustainable use of the oil shale. The sustainability includes here the technical, economic and the environmental aspects. This sustainability will continue to be one of the backbones of the Estonian economy for several years to come. The Department has also contributed to the production of all aggregates, dimension stone and other mineral based products in the country.

Especially in respect of environmental sustainability the Department has performed research together with other units within the university and also with units outside the university. The Department has strengthened its knowledge base by hiring a hydrogeologist as a member of its junior faculty. The joint capability and the excellent relations between the mining and the applied geology experts (including the newly appointed hydrogeologist) gives a good multidisciplinary research potential which should be relevant for various research fields including environmental protection.

#### *Rating*

The Team rates this point as very good (**Grade 2**).

### ***Competence of research groups***

The competence of the research groups is extremely high in applied research and in technology transfer.

#### *Rating*

The rating of the Team is that the research groups are very competent (**Grade 2**).

### ***National and International co-operation***

The co-operation of the Department is in transition. Earlier the emphasis of the co-operation has been more on the personal level and is changing towards formal co-operation between Institutes. The Department has good relations with several high quality Mining Schools, but only a few joint research projects. They are all in the field of applied geology. At the national level the question must be addressed under the multidisciplinary viewpoint, as there is no other Mining Department in the country. From the reports and publications provided there is a very adequate national co-operation.

#### *Rating*

In its rating the Team has recognised that the international co-operation is not at a desired level when concerning institutional co-operation. The rating of the Team is that there is good national co-operation and some international co-operation (**Grade 1**).

### ***Success in applying grants***

The Team evaluated the success rate in two parts. As discussed earlier the Department has not been very successful in their public grant applications and there are some concerns that it will not be successful in the near future either. We rate this part as unsatisfactory (**Grade 0**). The Department has on the other hand had great success in applying for and getting industrial research funding. We rate this part as very good (**Grade 2**).

#### *Rating*

The rating of the Team for the overall success is satisfactory (**Grade 1**).

### **Overall capability**

The overall rating of the Team is **Good** (eight out of twelve).

### **Implementation opportunities**

Modern society relies on products that are based on minerals or products derived from them and on services that are related to applied geology and mining. Estonia has of course the oil shale resources that are important for the national economy, but are not very important on an international scale if no technological break-through is achieved and the vast majority of the oil shale resources are used for other ends than power generation.

Estonia also has further substantial mineral based resources that will need applied geology and mining knowledge for beneficiation.

The Department will be able to contribute to the sustainable development of the Estonian society in the fields of environmental control, hydrogeology and in underground construction technology.

## **Part V**

### **Recommendations**

#### **Issues to address**

- The opinion of the Team is that the Department needs to develop research co-operation on an Institutional level with some selected Mining Schools from different parts of the world with emphasis on Schools within the EU. The co-operation partners should be selected so that they strengthen the knowledge base of the Department.
- For the strengthening of the international co-operation the Team proposes that the Department gives major attention to doctoral studies. The Doctoral students should do a part of their studies at the Institutes the Department is co-operating with. European mobility funds should be applied for for this activity.
- The publication policy of the Department should be reconsidered. A larger part of the research results should be published in refereed international journals of good standing.

#### **Recommendations**

The Team offers the following recommendations to the Department and the University. The parties should view these recommendations as suggestions from colleagues and adjunct to, but not part of, its official findings mentioned in Part II. The Team has not given these recommendations in any order of priority and the Department and the University may consider them for the general improvement of its research.

- The Team realises that an important challenge for the development of Estonia is harmonious and environmentally friendly development of mining. It is vital for the development of Estonia that the industry is backed by a strong publicly financed research and education sector. A master plan for development endorsed by the University, the relevant ministries and the most important enterprises, should be developed.
- It is recommended that the University and the Faculty allocate funds for the building of international quality laboratories, which will also allow the development of fundamental research.
- To attract a larger number of doctoral students and to encourage them to have co-operative research with top quality foreign partners would be a powerful tool in the search the sustainable development of the mining sector in Estonia.

## **Part VI**

### **Final remarks**

The general impression of the Team is positive. The Staff are dedicated and knowledgeable and the research collaboration between the two chairs of the Department is very good. The Department is in the middle of a generation change, which has in some extent impaired the research ability of the Department. The Department has however taken actions and a new active and able generation of researchers and tenured faculty is taking over the research responsibility and leadership.

The Department has a good potential for important multidisciplinary research work benefiting the Estonian society.

In the international frame of reference the Team evaluated the research as good (8/12). If the research is assessed in a strictly national frame of reference, the result is even more positive. The department has excellent international results in applied geology. It is very successful in fruitful technology transfer in the industrial (mining) sector. Being in an period of change, with new younger staff coming on and a move to new and better facilities in the offing, it is getting ready for a new era with still better achievements on both the national and the international scale.