

THIRD INTERNATIONAL DISPOSAL CONFERENCE.
KARLSKOGA, SWEDEN 2003

"EUExcert"

A European pilot project within the Leonardo da Vinci programme for

Developing and Maintaining Skills and Competencies

among Personnel in the European Explosives Sector

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Abstract

Explosives accidents have claimed the lives of more than a thousand people around the world since the turn of the Millennium. Added to the loss of life has been the significant loss of material value, production resources and capability. Many of the accidents have been caused, not by failure of design, but by human failure. Much of the human failure can be attributed to the lack of the necessary competence, skills and training of the people concerned. This paper describes some of the initiatives being taken in Sweden and in the Leonardo da Vinci programme of the European Union to ensure that workers at all levels in the explosives' community in the EU have the skills and competencies required to safely sustain activities involving explosives. The paper describes the development and evolution of a range of explosives competencies and the training and qualifications framework being developed to generate and maintain the competencies. Finally, the paper will refer to some of the novel training approaches, which are being applied in Sweden.

Background

Handling explosives is connected with large risks. The "effects" are often violent, sometimes fatal – and unexpected –, while the "causes" may be hard to find. Qualified personnel with good knowledge are the best preventive measure. This calls for effective and qualified teaching and training, a need that is magnified by the fact that downsizing, competition, budget cuts, retirement, etc., have drained the explosives industry of experienced people. This is also in line with the EU-initiative for preventing large-scale accidents, *i.e.*, the "Seveso II" programme, which emphasises skill and qualifications of personnel employed in the industry.

Almost all accidents that have occurred since the turn of the Millennium have happened before and this indicates a loss of expertise in the sector. Every incident has

been well rehearsed. As mishaps resulting in explosions happen infrequently they must be classified as "low probability-high risk" phenomena and they are scarcely hard to predict by risk studies. Accepting the fact that handling explosives is a dangerous activity we can also state

- It is one of the oldest industries
- It is one of the most hazardous
- It is based on very unforgiving products and processes
- It has generated an enormous amount of knowledge related to the safety on the products and processes.
- Much of this important knowledge is lost as a result of a rapidly changing world.
- Due to retirement, a new generation of explosives' specialists must be educated and take over the knowledge.

What are we doing in Sweden today to meet the actual situation

There is a great need for qualified people in today's explosives industry. A great number of people with substantial competence have retired or been traded to other industries during the downsizing that has affected the explosives industry in recent years. In order to break this negative trend, an educational programme has been envisaged and put together, and tested at Nammo Vingåkersverken at Vingåker, Sweden. The Swedish explosives industry is geographically widespread and located outside the large town areas, so a necessity for this kind of education is modern Information Technology, IT.

Therefore, in the newspaper advertisements about this education opportunity it was made clear that the Nammo Company was searching for people with modern IT knowledge and experience. Among more than a hundred applicants, only fifteen were selected; six came from the Nammo Company and nine from outside. An important issue was that the students should represent different backgrounds and ages. A fundamental principle of the education was that it should be a well-amalgamated combination of theoretical study and practical training. The knowledge needed in the industry changes all the time, and it is therefore necessary to pursue the studies in the same industrial environment where the acquired knowledge should be put into practice later.

One of the goals of the education strategy was to create a starting point for "A life-long learning situation at the factory". Because of the need for specific industry-related knowledge, a great part of the education had to be compulsory and related to the special demands on knowledge and competence required at Vingåkersverken. The voluntary part of the education was entirely chosen by the students themselves. There were a number of theoretical subjects, which the students could choose from. An important issue was that every student should have something to do all the time; for example, a student who worked faster with the compulsory part could manage to do more voluntary courses.

The courses the students took were equivalent to an upper secondary school level. The students received upper secondary school grades after each completed course. The learning process in the production was called PLIP – Practical Learning in Production. In the production, the students could apply the theoretical knowledge they had acquired at the learning centre. The students were studying theory in the mornings and then practice

in the afternoons. It was popular among the students to have it that way, and it turned out to demonstrate the strength of this kind of education compared to old school models.

The learning centre, as the classroom was called, contained all kinds of IT equipment. For example, access to the Internet, a videoconference facility, video and live TV-picture, and Conference telephones. The teachers in every subject were accessible on the Internet or over the videoconferences system, but at the start of a course the teacher appeared personally at the learning centre. Here he introduced the subject and held the first lesson. In this way good personal contact was established and then maintained when the students met the teacher on the TV or Internet.

New Opportunities through New Technology

These days technological capabilities exist for flexible forms of training. New technology is continually developing and thereby provides an increasingly improved training environment. Thanks to computer communications and multimedia, skills formation can be successfully undertaken directly at the workplace. The tried and tested ways of training through distance methods are thus easily adaptable in a new setting.

In this way organisations can benefit from training programmes that are relevant for organisational and individual development. This also provides continuity in the permanently necessary and increasingly important role of skills formation in working life. This way of working will become a significant element of life-long learning.

Implementing Training at the Workplace

The flexibility in the model of training at the workplace not only implies greater freedom in time and space but also in terms of training levels, content and arrangements. Flexible working can imply either more or fewer elements of the contemporary methods available for distance learning.

The training takes place directly at the workplace or in close proximity to it. The method also implies that theoretical training can be acquired directly by learning through practical work. Most training is thus undertaken directly at the workplace supported by some form of computer communication combined with tutoring in situ. The trainers, engaged through a Learning centre, impart knowledge, instruct, and support with the help of various methods. They communicate over distances or through 'local meetings' and are thus in effect 'permanently accessible'. A local tutor is also selected as a contact person for the training programme.

Workplace-based training involves the active quest for knowledge as a way of working. It also has many requirements beyond the important activity of student tutoring. This way of working also needs access to various databases. These 'knowledge banks' can, for example, be materials accessible via the Internet. This is a fantastic instrument that, if used properly, is a really effective tool for active knowledge searches.

Naturally, the knowledge banks can also consist of encyclopaedias and other information sources that are also in the form of multimedia or books and newspapers.

MINI-LEARNING CENTRES AND EQUIPMENT

A small training building or designated room serves as a meeting point for those undertaking the workplace training. We call this a mini-learning centre. It is equipped with computers and the equipment required for communication. Laptop computers are particularly useful to enable the greatest possible mobility. At the current time this does not involve any major investment.

This meeting point is important for the training participants. They can walk from their workplace and work on training projects either themselves or together with their group. It is also possible to connect to the Internet in the mini-Learning centre.

THE MODERN INDUSTRY OPERATOR HANDLING EXPLOSIVES

Now, in the beginning of the 21st century, the organisation of the explosives industry is rapidly changing. Process-orientated, target-focused operators using standardised systems such as ISO or OSHA take many new roles in flexible, modern workplaces with flat organisation. Computers and industrial robots are constantly replacing white- and blue-collar employees. The new global market means that new ways for communication are necessary. Information is gleaned from the Internet and from large open or restricted databases.

PC terminals or hand-held terminals are spreading new information all over the factory areas. Organisations have to accept a new situation, and see that continuous training of its personnel is taking place in order to meet new market situations. Inarguably, the search for excellence in Safety is the most fundamental aspect for the explosives industry. Well-educated and experienced personnel on all levels are the fundament upon which a safe industry will meet the 21st century. Career counselling guidance for all personnel is a tool that can be used to meet the need for attractive working positions.

The World has changed dramatically since the end of the Cold War. We now have a new situation where handling of explosive materials also means demilitarisation. Environmental aspects are focused in a new manner. The new Swedish education programme includes at the moment courses as below. The process of development of new courses and material specially designated for distance education continues. Please find below a specification of what material that will be used in the course starting now.

COURSE CONTENT (mandatory)

Natural and technical Science	3 weeks
Technical English	2 weeks
Reporting, orally or in writing	1 week
Fundamentals of PC and using of the computer as a tool	1 week
Quality systems as ISO 9000, ISO 14000 and OHSA 18000	1 week
Teamwork and teambuilding	1 week
Explosive materials, basic	3 weeks
Flammable materials	4 weeks
Integrated occupational health and safety	1 week
Dangerous Goods (ADR)	1 week
Production economy	1 week
Support systems for material and planning	1 week
Protection against accidents	1 week
Deviation and accident analysis (Risk Office)	2 weeks
Training in production environment	13 weeks
Writing a Final examination report	2 weeks

Totally 40 weeks

Voluntary Subjects:

Mathematics

English
Swedish
Language (own choice)
Chemistry

Technology

Natural Science
Corporation finance
ECDL. European Computer Driving Licence

EXAMPLE OF COURSE MATERIAL

The material for the course Explosive Materials is based on a CD-ROM package combined with books and lectures and intended to give the student a basic knowledge about Explosives.

Explosives are dangerous substances, which can cause severe personal injuries and significant damage to buildings and surroundings. Access to explosives has for a long time been related to political power. Therefore, since the Middle Ages, only a small group of people, normally controlled directly by the government, were allowed access to explosives – and in that case exclusively for military use.

Matters have changed since the old times, but not too much. Every country still regulates the use of explosives – only a moderate number of certified persons may handle explosives. Contrary to before, civilian use of explosives is allowed since a couple of hundred years ago for hunting, mining, excavation, and, for the past 50 years, also for space applications. The number of people involved in all sorts of handling of explosives has increased accordingly and is in Sweden today of the order of 20 thousand, excluding hunters.

Teaching professional people within the explosives industry how explosives behave and work, how they can be brought to explosion, how far the risk circles go, how to protect people, buildings, and environment is of course of vital importance. It is even written in the Swedish Act on Explosives that an employer has to provide adequate education on explosives for his employees.

For many years, FOI, The Swedish Defence Research Agency, has been engaged in teaching explosives Science, starting at the Swedish Military Academy in the fifties and expanding into the Scandinavian explosives industry in the seventies. Acknowledged courses, known as FEX, ALEX and SOEX, respectively, are held annually for managers, foremen, and safety representatives.

FOI was contracted to produce a basic educational package in Explosives Science for every person employed by a Swedish explosives company. The starting level will be compatible with the compulsory nine-year school education. The course is a part of the upper secondary school education. The Swedish Employers' Confederation together with the Swedish Trade Union Confederation sponsored the educational package.

The way of learning is modern. At his place of work, the student uses a PC with CD-ROMs instead of textbooks. He has access to a teaching centre for lessons via picture television and training tasks via e-mail. He will also have a personal supervisor at his own company.

FOI has produced CD-ROMs, textbooks, and OH materials for the local supervisors. The CD-ROMs contain text, speech, figures, and films and are organised in 10 chapters:

1. Basic definitions
2. Deflagration and detonation
3. Primary and secondary explosives
4. Propellants and pyrotechnic mixtures
5. Risks

6. Protection
7. Environmental aspects
8. Quality
9. Storage and transportation
10. Blasting fundamentals

The use of the CD-ROM is straightforward; just click the mouse on standardised buttons to select menus, sub-menus, films, questionnaires, etc.

The questionnaires are designed for self-testing; you get questions drawn at random from a database. Every question has a number of suggestions as to the answer, and you will have to select one of those. If you select the correct answer you get the next question, if you are wrong you are directed to the page where you can learn more.

ABOUT THE MASUGNEN LEARNING CENTRE

The Masugnen Learning Centre is a co-ordinator for competence development through distance education, where much of the available information is brought in by means of modern IT and new teaching methods. The co-operation of many training co-ordinators makes this possible. Competence development then becomes possible for companies and personnel on their own conditions.

Competence development can be achieved in several different ways:

- With usual training groups in different subjects. For example, training courses for companies and the unemployed.
- Training courses at a distance using data and video communication.
- Distance training where the learning centre provides the course instructions but everything else is accomplished by computer communication.
- The use of private study rooms and multimedia stations for private study, using computers, books, CD-ROM, video films, etc.
- Searching for information using databases such as the Internet.
- Studies using only computer communication. In this case the courses and instructions are transmitted via the computer communication system and all contacts are made in this way.
- The use of the learning centre and council libraries for studies using books and reference media. This is carried out today, mainly by the use of databases and CD-ROM.
- For the unemployed – IT via the computer systems, which can also be combined with other training, forms as above.

- By the arrangement of lectures and seminars.

A learning centre shall therefore be a place where information and knowledge can be exchanged between all categories of people such as those active in competence development during work time, local citizens in their free time and the unemployed on vocational training courses, etc. A learning centre uses modern IT and modern teaching methods for imparting knowledge.

Building a trans-national European co-operation for education of explosives specialists; EUExcert.

Founded upon the experiences gained in Sweden, KCEM was actively searching for transnational partnerships. At the DoD Explosives Safety Seminar, Atlanta, August 2002 we presented the situation in Sweden and announced our interest in finding partners for co-operation. In June 2003 the EUExcert pilot project was formed with partners from Finland, Italy, Norway, Sweden and UK.

The manufacture and use of explosives, propellants and pyrotechnics underpins a significant part of EU economic and industrial activity. An understanding of explosives Science and technology, and the competence to harness it is central to maintaining European Explosives capability, national security, and in sustaining a competitive European industry. A consequence of eroding this competence is the increased likelihood of explosives accidents. These are often catastrophic as demonstrated by accidents in Nigeria, Russia, Toulouse and in Enschede where 1000, 118, 31 and 21 people died respectively since the start of the millennium. In addition to the serious loss of life there was the very significant damage to homes, domestic and industrial infrastructure and to the environment at a cost of many millions of euros.

There is a perception and some evidence that in Europe competence in this key technological area is being eroded. In several member nations a high proportion of the most experienced and knowledgeable personnel are retiring or nearing retirement. Urgent efforts are therefore underway in some partner nations to replenish this expertise.

The aim of this pilot project is to establish a training and education programme aimed at restoring and maintaining the competence of workers engaged in European explosive business. The programme places increased emphasis on improving the quality of the educational material and in improving access to training through use of workplace and e-learning. Improvement in competence and skills will enhance the status of explosives workers, improve worker and public safety and improve European industrial competitiveness through greater worker mobility and the ability to react rapidly to a fast changing economic and industrial environment.

To achieve this aim the partners in the programme will conduct a comprehensive analysis of explosive business conducted throughout the EU. It will identify for each member state, the size and scope of the explosives worker community, from top management level, to technician and process worker level. It will identify the

competencies and skills required by these workers, in order to successfully prosecute the full scope of explosives business. This will be accomplished through close consultation with stakeholder organisations in each of the member nations. An inclusive framework illustrating all of the required competencies will be established.

The training and educational needs of the community of explosive workers will then be determined in relation to the required competencies. A comprehensive programme of education and training will be developed utilising the widest range of training and educational methods, ranging from traditional classroom-based teaching, workplace Learning and electronic Learning. These will be developed and delivered by a range of educational establishments, including universities and higher education institutions, professional bodies, trade union organisations and specialist further educational authorities. Pilot training and education programmes will be developed and tested in several member nations. Proposals will be presented outlining the need for a range of transferable qualifications for workers in this specialist field.

The results of the work will be widely disseminated through a programme of reports, demonstrations and presentations to stakeholder groups in the member nations. A network of interested individuals and organisations will be encouraged to promote the concept of a world class European explosives community.

Interested persons are welcome to find project progress reports on our home page www.euexcert.org.

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