

# **DEVELOPMENTS IN TRAINING FOR WORKERS IN THE EXPLOSIVES SECTOR IN THE UK**

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## **ABSTRACT**

Over the past three years the UK together with Sweden, Norway, Finland, Italy have been taking part in a EU funded Leonardo Da Vinci programme. More recently EFEE have participated in the project known as the EU Excert project which is aimed at addressing the perceived loss of explosives expertise in several EU nations. This could have implications for explosives safety and industrial competitiveness. The paper outlines the work that has so far been done in phase 1 and describes the work planned for the second phase of the project. The paper will describe work in the UK to develop competencies for all explosives workers in both the civil and defence sectors. These competencies in the form of National Occupational Standards have now been approved in the UK and are accompanied by a range of 24 new National Vocational Qualifications launched in May 2006. The paper will show how the standards define knowledge and skills and how these form the basis for vocational qualifications as well as higher education awards and professional qualifications. This UK initiative is now being considered in other EU countries and the project has now been extended to also include Germany, France, Spain, Poland, Czech Republic and Estonia. To support the occupational standards and qualifications work is also being carried out to improve learning provision in the explosives area. In addition to formal educational and conventional training courses a series of workplace learning initiatives are being pursued as well as internet learning packages. Examples of these initiatives will be given.

## **1 INTRODUCTION**

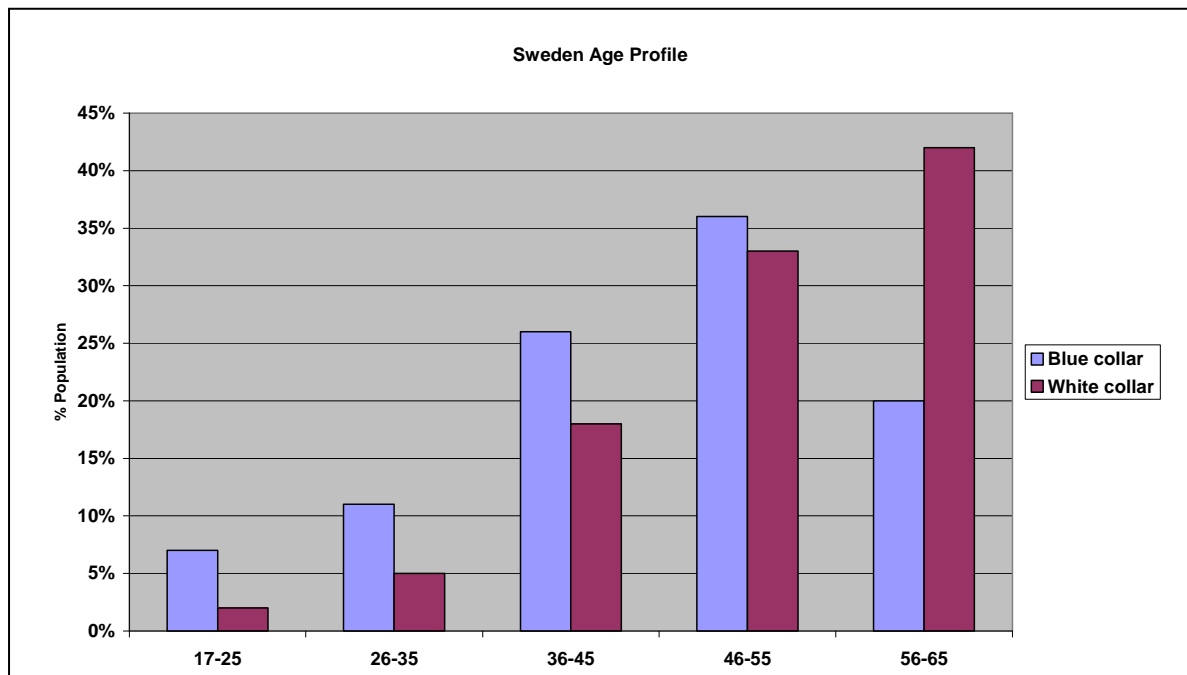
Since the turn of the Millennium there have been a number of well publicised explosives accidents around the world. One of the characteristics of these accidents is that they frequently have catastrophic consequences. In Lagos, Nigeria an ammunition dump exploded, the explosion created mass panic which subsequently led to the death of nearly 1000 people, most of whom were children. Another explosives accident aboard the Russian submarine led to the loss of 118 sailors, a loss of significant defence capability and serious political destabilisation of the Putin Government. In Holland an explosion involving fireworks destroyed 200 houses and killed 22 people, whilst in France an explosion involving ammonium nitrate destroyed a major industrial facility, killed 30 people and injured around 2000. The consequence of explosives accidents is frequently serious in human, economic and political terms.

Examining the cause of explosives accidents invariably reveals that human error or failure is a major contributory factor. The Enschede incident in Holland was initiated by a deliberate act by a malcontent. However the catastrophic consequences were also a result of management failure, breaches of the explosives regulations and a failure to understand that storing fireworks inside steel iso-containers generates sufficient confinement to maximise the violence of the event.

One of the torpedos loaded on the Kursk is known to have been dropped prior to embarkation and this may be linked to the torpedo explosion which, the official report suggests, led to the loss of the submarine and its crew. In both cases it was the actions of individuals or the failure to act in an appropriate way which contributed to the accident. Effective explosives safety depends on people making the right decisions at the right time. It depends upon people having the necessary competence to carry out their jobs properly. The concept of competence is well recognised in UK safety management. Much of UK safety legislation calls for “competent people” in roles that affect safety. In the case of explosives, this will be in all stages of life, from the formulation of new explosives in the laboratory, through manufacture, storage, transportation, use and disposal.

Whilst the stovepiping of organisations in the European and UK explosives business has had an impact on the breadth of experience, the general contraction of the explosives business in Europe and the UK has had a major impact on the numbers of skilled specialists. Added to this many of the specialists were recruited in during a growth period in defence science and technology in the 1970s and are approaching retirement. A lack of recruitment in the late 1970s and 1980s has left a demographic trough, wherein there are insufficient skilled explosives specialists to replace those who will be leaving government service in the next few years. Figure 1 illustrates the typical problems faced by the European countries with respect to the loss of expertise, if you assume that the ‘experts’ are those who are of the age 50+.

**Figure 1 Age profile of White and Blue Collar workers in the explosives industry in Sweden**



## **2 EUEXCERT**

Four years ago Cranfield University together with KCEM, a Scandinavian explosives competence organisation, joined with other EU partners in a project funded by the European Union Leonardo da Vinci programme. This programme of work (called EUExcert) was aimed at replenishing explosives expertise, through vocational training and education across the EU with a view to setting up a European qualifications framework in order to award a European certificate for workers in the explosives sector. The purpose was not only to ensure the supply of specialists in key explosives safety functions, but also to maintain European competitiveness in the ordnance and explosives industrial sector. At the last EFEE conference which was held in the UK in 2005, the following objectives were identified as the keys aims of EUExcert:

1. Identify the competencies required to sustain a safe and competitive explosives industry in the EU.
2. Establish the current and future needs for these competencies in the EU.
3. Develop training and educational programmes designed to develop this range of competencies.
4. Develop a range of novel education and training packages that form part of the programme.
5. Develop explosives qualifications which will be recognised and accepted across Europe.
6. Reverse the decline in expertise, knowledge and skill in European explosives business.

In October 2006 the first phase of EUExcert was completed with the submission of a final report to the Leonardo da Vinci programme office. All the objectives above were achieved except for objective '6' which will take some time to achieve. Below are highlights of some of these achievements.

### **2.1 Competencies**

A functional map and competency framework was developed in the UK for workers in the explosives sector. 12 key roles were identified and 440 National Occupational Standards (NOS) were written and validated in the UK (5 key roles were validated by the European partners). From these 440 NOS; 24 National Vocational Qualifications (NVQs) were developed. Table 1 gives details of the 12 key roles, details of the 440 competencies can be found on the following web link <http://www.qca.org.uk/610.html> under explosives substances and articles (ESA).

### **2.2 Current and Future Needs**

Details of existing education programmes in explosives which are provided by training organisations in the EUExcert partners were identified. There was found to be no external training courses for workers in explosives in Finland and Norway, it is possible that their training is either carried out in-house or supplied by the other Scandinavian countries. A catalogue of existing training and education provision material for the UK, Sweden and Italy is given in table 2.

**Table 1 Twelve key roles for workers in the explosives sector**

<b>Key Role</b>	
1	Research, design and develop explosive substances and articles
2	Safety management of explosive substances and articles
3	Test and evaluation of explosive substances and articles
4	Manufacture of explosive substances and articles
5	Maintenance of explosive substances and articles
6	Procurement of explosive substances and articles
7	Storage of explosive substances and articles
8	Transport of explosive substances and articles
9	Engineering and entertainment of explosive substances and articles
10	Enable the public and armed services to continue their regular activities in peace and war by controlling and removing munition threats
11	Disposal of explosive substances and articles
12	Support the explosive substances and articles

**Table 2 Details of existing education programmes in explosives within EUExcert partner countries**

<b>Country</b>	<b>Training Provider</b>
UK	<a href="http://www.cranfield.ac.uk/prospectus/shrivenham/index.cfm">http://www.cranfield.ac.uk/prospectus/shrivenham/index.cfm</a>
	<a href="http://www.issee.co.uk/explosives.php">http://www.issee.co.uk/explosives.php</a>
	<a href="http://www.ribbands.co.uk/svcpages/training.htm">http://www.ribbands.co.uk/svcpages/training.htm</a>
	<a href="http://www.isee.org/education/default.htm">http://www.isee.org/education/default.htm</a>
	<a href="http://www.uec.ac.uk/csm/short-courses/quarry/shotfiring-explosives-supervisor.shtml">http://www.uec.ac.uk/csm/short-courses/quarry/shotfiring-explosives-supervisor.shtml</a>
	<a href="http://www.chss.info/ourcourses.html#sho">http://www.chss.info/ourcourses.html#sho</a>
	<a href="http://www.don.ac.uk/Default.aspx?page=652">http://www.don.ac.uk/Default.aspx?page=652</a>
	<a href="http://www.epicltd.com/page_view.asp?InfoID=209">http://www.epicltd.com/page_view.asp?InfoID=209</a>
Sweden	<a href="http://www.masugnen.se/utbildning/kurser/ky.htm">http://www.masugnen.se/utbildning/kurser/ky.htm</a>
	<a href="http://www.fex.se/default.asp">http://www.fex.se/default.asp</a>
	<a href="http://www.srv.se/templates/SRV_Page_672.aspx">http://www.srv.se/templates/SRV_Page_672.aspx</a>
Italy	<a href="http://www.nitrex.it/corsi/index.asp">http://www.nitrex.it/corsi/index.asp</a>

### 2.3 Qualification Framework

A qualification framework has been developed in the UK incorporating the 24 NVQs and 440 competencies. These qualifications are divided into 3 levels. Level 2 is the operator level, level 3 is the supervisor level and level 4 is the manager level. Details of this framework is presented in table 3.

**Table 3 Details of the qualification framework**

<b>Key Role</b>	<b>Description</b>	<b>NVQ level</b>
Research, Design and Development	Research into Explosive Substances and/or Articles	Level 4
	Design and/or Development of Explosive Substances and/or Articles	Level 4
	Research, Design and Development of Explosive Substances and/or Articles	Level 3
Safety Management	Explosives Safety Management and/or Advice and/or Regulation	Level 4
Test & Evaluation	Test and Evaluation Management of Explosive Substances and/or Articles	Level 4
	Test and Evaluation Supervision of Explosive Substances and/or Articles	Level 3
	Test and Evaluation Operations of Explosive Substances and/or Articles	Level 2
Manufacture	Explosive Substances and Articles Manufacturing Management	Level 4
	Explosive Substances and Articles Manufacturing Supervision	Level 3
	Explosive Substances and Articles Manufacturing Operations	Level 2
Maintenance	Explosives Maintenance Management	Level 4
	Explosives Maintenance Supervision	Level 3
	Explosives Maintenance Operations	Level 2
Procurement	Explosive Substances and/or Articles Procurement Management	Level 4
	Explosive Substances and Articles Procurement	Level 3
Storage	Explosives Storage Management	Level 4
	Explosives Storage Supervision	Level 3
	Explosives Storage Operations	Level 2
Transport	Explosives Transport Supervision	Level 3
	Explosives Road Transport Operations	Level 2
Disposal	Explosive Substances and/or Articles Disposal Management	Level 4
	Explosive Substances and/or Articles Disposal Supervision/Operations	Level 3
	Explosive Substances and/or Articles Disposal Operations	Level 2
Hybrids	General Explosives Operations	Level 2

## 2.4 Education and Training

The 24 NVQ qualifications have been underpinned by a flexible educational and training programme, with vocational training as the main part of the learning objectives together with workplace training and e-learning based on CD-Rom and the internet. On-line e-learning lessons have been developed in 'Introduction to Explosives', 'Burning and Detonation', 'Initiation' and 'Management and Legislation'.

### 3 EUEXCERT AND THE FUTURE

The Leonardo da Vinci programme office recently awarded EUExcert with a further two years funding in order to continue this programme of work. The objectives of this new programme of work is to improve the skills and competencies of workers in the explosives industries by building on the work completed in the previous EUExcert project on competencies and qualifications, and transferring this to a European competency and qualification framework for the explosive sector. It is intended to set-up a Foundation which will be able to regulate this new European competency and qualification framework and also provide a degree of transparency for an EU wide EUExcert certificate. In order to deliver this qualification, the educational material needs to be developed. The education will be through vocational training using flexible learning and the promotion of social dialogue.

In the longer term this programme of work will increase the opportunities for career development; improve the knowledge, skills, employability and mobility of the beneficiaries and target groups. The timetable for these objectives is given in table 4.

**Table 4 Timetable for objectives**

<b>Objective</b>	<b>Completion date</b>
Validate competencies	May 2007
Qualifications framework	November 2007
Educational material	May 2008
Establish foundation	November 2007
Network	July 2007
Exchange of students	January 2006 (Mobility programme)
Glossary	November 2008
EUExcert first Certificates	January 2008

Details of the objectives are given below:

#### 3.1 Competencies and Qualifications

The competency framework in conjunction with the qualification framework is an excellent tool for measuring competencies and can be used for career progression of employees. Table 3 summarizes the competencies together with the qualification framework developed in the UK during the first EUExcert project. The results from this project will be transferred to this new programme of work and developed into a European vocational qualification. More competencies may be developed for the European market. It is intended to award 7 certificates at the Introductory level (operator), 8 certificates at the Intermediate level (supervisor) and 9 certificates at the Advanced level (manager) although this number may increase. In order to be awarded these certificates the students must have completed a study of training at their place of work and assessed by an Internal assessor.

### **3.2 European Partners**

At the present time the number of participating countries in EUExcert has risen from 5 to 11, these are UK, Sweden, Norway, Finland, Italy, Spain, Portugal, France, Germany, Estonia, and the Czech Republic. Poland and Lithuania have recently expressed an interest in joining EUExcert and will become associated partners. It is also important to note that EFEE is a member of EUExcert which represents 19 countries. In order to increase this number of participating countries, it is intended to widely disseminate the work undertaken in the programme by spreading knowledge about the competence framework to the explosive sector in Europe and the rest of the world by presenting papers and posters on the outcomes of the EUExcert project at national and international conferences, seminars etc.

### **3.3 Regulatory Organisation**

At the present time there is no European regulating board to either access or impose competencies in the explosive sector. Therefore there is a strong driving force by workers in the European explosive sector to continually improve the safety of handling explosives by ensuring that all workers are competent. This project will be one way of improving this situation by delivering a European Explosive certificate regulated by a Foundation, which will be created through this project for organisations in the explosives sector. The certificate is aimed at workers in the explosives sector who are required to be competent. The impact of this certification will be of great benefit to the employers and employees. It will lead to an increase in mobility and employability of workers across Europe and it will also lead to an increase in the awareness of the hazardous nature of the explosive materials which, in the long term, will lead to fewer accidents.

In order to transfer and advance the qualification framework in forming a European vocational qualification a regulatory organisation needs to be established. This organisation will be responsible for the validation and accreditation of the qualification and the issuing of EUExcert certificates. Discussions have been undertaken with the Foundation for the ECDL (European Computer Driving License) qualification with the view to setting up a similar Foundation for the EUExcert qualification. This vocational qualification will be transnational between partner countries and in the longer term be recognised throughout Europe.

It is intended for the Foundation to be self-funding after the project has ended. Members of the Foundation steering group will be represented by one partner from each European country who is a member of the EUExcert partnership. The Foundation will be similar to the Foundation which is responsible for the European Computer Driving Licence (which also started as a Leonardo da Vinci project). The Foundation will issue European certificates to competent workers in the explosive sectors. These certificates will have a cost associated with them. The Foundation will also contain a European membership in order to self finance their work – where the members pay a fee. In the future the membership may expand to incorporate most European countries at first and then to expand to other countries outside the EU.

### **3.4 Educational Materials**

Workplace learning will be explored for this type of vocational training system due to the hazardous nature of the industry. Methods of delivery will be via video conferencing, e-based learning, modern technology, and flexible learning. The target groups will be adult workers in the explosive industries and will want to undertake their training at their place of work. It is intended to use partner groups to deliver some of the training via video conferencing. This type of activity has already taken place between the UK and Sweden where the lesson was given in the UK to a group of students in Sweden via video conferencing. This joint venture between Sweden and the UK will be transferred to this new proposal and expanded to incorporate other partner countries.

The language for the development of the curriculum and study material will be in English; however the educational and assessment material will be prepared for translation to other languages. The educational material will be adapted for flexible learning and to work based training. For example learning centres will be set-up in companies where the students will have access to computers, video conferencing, study facilities and training aids. An example of this type of learning centre is the Learning Centre at Masugnen in Sweden. Other methods of delivering training will also be explored particularly for countries where learning centres may be difficult to set-up. Here the training may be a combination of work-base and web-base training, where the student may be required to attend educational establishments for a short period of time.

### **3.5 Network of Industries and Institutions in the Explosives Sector**

In order to improve the network capability and capacity of our partners, collaboration with other European institutions and agencies will be paramount for the program to succeed. This new network will consist of a database of organisations and institutions who are interested in this programme of work. The members of the network will receive regular newsletters and updates of EUExcert activities. Their views and comments will be sought when setting up the Foundation, validating the competencies and qualifications, and writing the glossary for explosive terminology. This will be a living network. The network will also provide a platform for the harmonisation of legislation and practice in the explosives sector. Currently there are 183 people registered with an interest in explosives from which 10 are outside the European community. Registration can be carried out by logging on to the EUExcert website at [www.euexcert.org](http://www.euexcert.org).

### **3.6 Glossary**

During the 4 years of working within the EUExcert project it was evident that there were serious problems associated with incorrect translations of terminology within the explosives sector. A basic glossary of terms for the European explosive sector is being compiled using the information supplied by the web addresses given in table 5.

**Table 5 Reference details of the basis for the glossary of terminology**

<b>Web-addresses for reference material for glossary</b>
<a href="http://www.fas.org/man/dod-101/sys/land/glossary.htm">http://www.fas.org/man/dod-101/sys/land/glossary.htm</a>
<a href="http://www.glossary.oilfield.slb.com/Display.cfm?Term=high%20explosive">http://www.glossary.oilfield.slb.com/Display.cfm?Term=high%20explosive</a>
<a href="http://fermat.nap.edu/openbook.php?record_id=10998&amp;page=126">http://fermat.nap.edu/openbook.php?record_id=10998&amp;page=126</a>
<a href="http://www.mi5.gov.uk/output/Page137.html#b">http://www.mi5.gov.uk/output/Page137.html#b</a>
<a href="http://www.americanpyro.com/Safety%20Info/glossary.html">http://www.americanpyro.com/Safety%20Info/glossary.html</a>
<a href="http://www.globalsecurity.org/military/systems/munitions/glossary.htm">http://www.globalsecurity.org/military/systems/munitions/glossary.htm</a>
<a href="http://www.army.mil.nz/footer-links/default.htm">http://www.army.mil.nz/footer-links/default.htm</a>
<a href="http://lanl.gov/history/hbombon/glossary.shtml">http://lanl.gov/history/hbombon/glossary.shtml</a>
<a href="http://www.eod-solutions.com/glossary.htm">http://www.eod-solutions.com/glossary.htm</a>
<a href="http://www.newsweekeducation.com/extras/landmines5.php">http://www.newsweekeducation.com/extras/landmines5.php</a>
<a href="http://www.flbgr.org/project/glossary.html">http://www.flbgr.org/project/glossary.html</a>
<a href="http://www.middlepowers.org/dpe/glossary.html">http://www.middlepowers.org/dpe/glossary.html</a>
<a href="http://www.explosives.com/glossary/a-e.htm">http://www.explosives.com/glossary/a-e.htm</a>
<a href="http://www.psemc.com/references.asp">http://www.psemc.com/references.asp</a>
<a href="http://www.dep.state.pa.us/dep/deputate/minres/Districts/Blasting/glossary.htm">http://www.dep.state.pa.us/dep/deputate/minres/Districts/Blasting/glossary.htm</a>
<a href="http://www.missilethreat.com/overview/glossary.html">http://www.missilethreat.com/overview/glossary.html</a>

### **3.7 Student Exchange Programme**

Exchange of students or distance education between partner countries will be set-up via a separate programme i.e. the Mobility programme. Students who will be registered for the EUExcert will be able to study in one of the partner countries. For example Cranfield University will be responsible for the students who want to study in the UK. Cranfield University will seek placements for the students. These placements will be in companies who are affiliated to the Foundation and have the infrastructure to assess and award NVQ's. The Foundation will then award the equivalent EUExcert certificates which will be recognised in all the European countries.

## **4 CONCLUSIONS**

EUExcert has been so successful that recently it was nominated as one of the Leonardo da Vinci projects for best practice. On assessing phase 1 of the project the Leonardo da Vinci Swedish programme office states that 'the pilot project has fulfilled its commitments and the project has reached even further than that. It is characterized by its innovative work.'

The next phase of EUExcert will build upon the goals delivered in the 1<sup>st</sup> phase. This is just the beginning and hopefully by 2009 there will be a European recognised certification for workers in the explosives sector.