

Deliverable Report D.5.1

The future of testing security related products

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Executive Summary

This document is the final deliverable of the Creatif consortium. It represents a consolidated summary of all the work that has been completed to date. But there is more to it. It has our idea for the roadmap for the future of the testing of security devices and in particular CBRNE detection systems. Furthermore, the issue of the testing facilities within the European Union are discussed in light of a joint testing facility. Finally, it covers some international aspects or concerns as they pertain especially to mutual recognition.

In the first chapter is where CREATIF summarises the work that was completed for the stakeholder assessment. Given the nature of the four threats: chemical, biological, radiological, nuclear, and explosives, the chapter is partitioned accordingly. Each section gives estimations on the level of standardisation for testing of detection systems, ideas about the benefits of the CREATIF network and possible obstacles for participation. Finally, a look to the future of testing CBRNE detection systems is done. This offers the reader a means to compare each of the threats. For the author, the last section, the future of testing is perhaps the most interesting as it may show us the way forward.

Chapter two is CREATIF's overall vision of the roadmap for the future of testing. It lays out the general roadmap which is:

- Stakeholder assessment
- Fundamental standards (terminology definitions and system description)
- Analysis and trial standards
- Performance standards
- Organisational standards

Along the way, we show what has been done already. If it hasn't been done, or well understood, we attempt to clarify things. Throughout, attempts are made to give possible solutions to the given stages of the roadmap. For example, a possible way of describing the systems to be tested is made by using a biological methodology for the definition of species. As a final point, we take a stab at placing the four threats along the roadmap. This is interesting to see the difference between threats, the non linear aspect of the roadmap, as well as to show just how much work is left to complete.

Next, we put to rest in chapter 3, the concept of a joint testing facility. But we don't leave it there. We go on to show the laboratories that we have found. We also speak about the necessity of greater cooperation between laboratories given that there isn't a joint facility. We end the chapter with brief discussion of the testing facilities in one of Europe's greatest trading partners and competitors, the United States. The discussion is focused on the GRaDer project and its implications.

How does Europe compete? How do we get recognition worldwide for our quality laboratories? Is it possible to level the playing field? These are the questions that are addressed in Chapter 4. We cover topics and programs such as:

- Relevant national, regional, and international organisations for standards
- Development of European Union (then worldwide) standards
- Mutual recognition (EU – US)

- The United States NVALP program
- And the United States Safety Act

By the end of the chapter, hopefully the reader has a better idea of the possibilities of answering the questions raised and more with respect to standardisation.

Finally, there are the conclusions. These are the conclusions that we as the Creatif consortium have identified during the last 30 months of work. Luckily, any journey begins with the first steps, and we have made it for the community. We have also suggested what may need to be done and the possible solutions to the questions raised.

In brief, the main conclusions can be listed as such:

- The current situation with respect to the testing of security products is not an ideal one. The market is disjointed. The testing procedures are not harmonised. In many fields, there is no standardisation. The work from outside of Europe is not being considered. The accreditation scheme for laboratories is not commonly used for testing facilities.
- All threats (CBRNE) are at a different point of development with respect to their detection systems as well as their testing protocols and standardisation.
- A program towards the development of EU wide testing standards is required. Followed by either international standardisation or full mutual recognition of the standards.
- Both military and civilian organisations and all relevant EU programmes (like NDE network, ERN-CIP) need to work together
- There is a need for three types of testing: laboratory, human factors, and operational testing. To get a more precise estimate of overall performance all three testing results need to be considered.
- Scenario based testing may prove to be the most effective form of testing.
- Round robin exercises could be proposed as a tool to compare test results from different laboratories and provide a means of quality assurance for testing.
- There is an insufficient amount of discussion between manufacturers and end-users. A greater inclusion of all stakeholders is required.
- For RN-detection, there are suitable standards (ANSI) for testing detection systems, so don't reinvent the wheel, only a transfer to international (IEC or CENELEC) standards is desirable.
- There needs to be increased cooperation between national, regional, and international standards bodies such as: ANSI, CEN, CENELEC, IEC, IAEA, ISO, etc.
- Accreditation of the testing facilities and the worldwide acceptance of the accreditation is a final goal. It is possible to have different levels of accreditation based on the capabilities of the laboratory.

- The proposed roadmap for testing should be considered:
 - Stakeholder assessments
 - Terminology definitions
 - System descriptions
 - Assessment of means and methods
 - Performances
 - Certification and accreditation
- The joint testing facility concept has not been accepted by the stakeholder community due to different reasons. Therefore, identifying, contacting and including all of the laboratories are even more crucial to provide a good coverage of testing services throughout Europe.
- A medium term goal would be to gain mutual recognition of the testing protocols and laboratories between US and Europe. Some of the methods that are available are US Safety Act, the NVLAP program, and bilateral or multilateral mutual recognition agreements through organisations such as ILAC.

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1 Summary of results from expert networks

1.1 Chemical detection

Currently most European chemical (warfare) agent detection systems are based on requirements derived from military (NATO) standards and military scenarios concerning almost single-threats like the limited number of chemicals used in (military) chemical weapons of mass destruction (WMD). Because of the growing concern for the threat of the release of other high-risk chemicals the scope has to be widened. European Union level efforts concerning the use of detection equipment for CBRNE materials will concentrate on developing minimum detection standards to be applied across the entire EU, establishing trialling, testing and certification schemes for CBRNE detection and improving the exchange of good practices on the detection of CBRNE materials. Related to this effort the EU CREATIF project established a network of testing facilities for CBRNE related detection equipment. The networking strategy is aimed at strengthening the cooperation and knowledge exchange within Europe. The stakeholders of the network identified several practical issues concerning the optimisation of CBRNE detection for use within EU homeland security and safety applications. Between all stakeholders there is agreement over lack of mutually agreed, comprehensive and specific standards applicable to the detection systems. The standards would target the usability of chemical detection systems for specific EU homeland security and safety applications.

The definition of standards and requirements and how they can be introduced, certified and the equipment tested (and by whom) can be a topic of discussion within the CREATIF network. To support this, a follow up project to CREATIF will be probably needed to push this forward towards a certification system for CBRNE detection products. Obviously a certification system will only work if it is supported by all of the member states. Therefore, a lot of effort will be needed to strive for cooperation with all of the EU member states.

1.1.1 Conclusions

The need for development of new and the harmonisation of currently available (national) standards and protocols towards EU standardisation and if possible also globally has been identified by all stakeholders.

There is little or no feedback between end-users and manufacturers about the detection equipment they use or have to acquire. Often end-users seem convinced their detection problem is unique and may be difficult to solve. They have a hard time putting up the correct requirements for the detector they want to acquire. Standardisation can be introduced and will be supported but there exists a strong need to first optimise the communication between the different parties involved: end-users, decision makers, providers and manufacturers and testers. The end-users urge to include human factors and operational characteristics within the testing protocols. Most testing is based on lab testing which has obvious limitations, in technical setup as well as being constricted in time and budget. Often lab results do provide a valuable amount of results and knowledge about the detector, but the knowledge about e.g. the ease of use or misuse and how usable it is in the field is not tested extensively.

The specialised testing centers for this kind of detection equipment may obtain a leading role to provide guidance to the stakeholders within this optimisation process.

1.1.2 Benefits of the network

The network can be used to exchange knowledge between stakeholders. It proves to be difficult for an end-user or decision maker to find a chemical detector suitable for a certain task. They can use the network to exchange views with other end-users and / or manufacturers. The network can be used to discuss what one expects of a detector. It is observed that currently there is not much feedback from end-users (or decision makers) to manufacturers. This gap may be closed by communication between the stakeholders across the network.

The development of EU-wide standards is a cost-effective and efficient way of improving the much needed detection capabilities. Such standards could ensure a similar level of safety and security across the EU. It would also allow for benchmarking of detection solutions. It is the goal of CREATIF to let this benchmarking take place within a certified group of test centers within the EU. The test centers should ideally spread the available workload instead of competing among each other and thus resulting in a lower cost of testing for all stakeholders.

It is identified there is an obvious need for continuous development of standardisation criteria because of the complex and changing chemical threat to the citizens of the EU. This leads to shifting requirements for chemical detectors over time. The currently available chemical detection technologies are far from perfect. Therefore, the detection capabilities of the current generation of chemical detectors are significantly limited.

A well laid out certification scheme and a comprehensive set of equipment requirements will provide a clear view on equipment highlights. It will result in the correct feedback to drive technical innovation by the manufacturers to overcome the shortcomings.

1.1.3 Obstacles to participation

The development of standards is a cost-effective and efficient means of improving detection capabilities. Such standards could ensure a similar level of safety and security across the EU, and allow benchmarking of detection solutions. This is a difficult task because the chemical threat is complex and changing all the time.

Furthermore there may be political, security and economical issues which hamper, inhibit or delay the introduction or agreement on standardisation. Prominent manufacturers e.g. may be reluctant to open up their favourable position in the security market: usually they can afford to have their equipment tested in every member state if needed, while for smaller manufacturers this will be too costly.

1.1.4 Expectation of stakeholders

A sufficient level of standardisation is necessary to develop a reliable set of testing and evaluation protocols to test these (standardised) detectors for the suitability for certain applications.

End-users emphasize the need for improved protocols integrating the human factors values of using the detection equipment and including operational testing. Most of the current testing is focussed on lab testing only, which often does not provide enough coverage of the operational aspects of the equipment.

The protocols, methodology and use of standard and reference materials and equipment should be explicit enough to enable any lab or test center to obtain similar evaluation results if they use the prescribed set of guidelines for testing and evaluation. An effort will have to be made to provide a way to certify a test center or laboratory and determine the sufficient level of proven quality needed to obtain not only comparable but reliable results. The results should be acceptable within all EU member states. Round robin exercises may help to improve reliability and comparability between testing centers.

Whatever is the final protocol or procedure of testing and evaluation chosen, the results will be summarised in a test and evaluation specification sheet which will illustrate a specification of a given output parameter of the detector as a function of varying chemical physical or environmental parameters.

1.1.5 What is the future for testing (stakeholders' perception)?

The road towards developing harmonised standards in the field of protocols for testing and evaluation to provide the basis for a reliable validation procedure of chemical detection systems is long and winding. The wide choice in equipment requirements and testing guidelines to be decided upon, may lead to conflicts of interest among member states due to political, tactical, security and other issues. But a high degree of collaboration between the EU member states is necessary to reach the goal of this EU driven standardisation. Because of these considerations a possible road map comprises a set of clearly defined building blocks. This approach tries to avoid large blocks which may contain too many barriers resulting in a long and difficult process before any progress can be made. It would seem better to focus on a series of smaller steps to prove and show a slow but continued progress.

The workshops on standardisation and certification between all kinds of stakeholders concluded that a road map should take at least the following agreed conclusions and recommendations into account:

- Develop and agree on the requirements for chemical detectors and the parameters for testing.
- Define or improve standards for testing of detection systems based on the requirements.
- Testing protocols should be broad and go beyond lab based testing only and e.g. should include human factors and include more operational testing.

- Discuss best practises of testing – first use current testing methodology based on military standards as a basis to develop homeland security standards
- Starting with the detection of chemical warfare agents (CWAs) adding other chemical agents of concern like toxic industrial chemicals (TICs) and toxic industrial materials (TIMs) later on in the testing protocols.
- Need to agree on the range and selection of chemical agents and interferences for testing and realise that the chemical threat is complex and changing
- Recognised need for comparable testing, so a comparison is needed of:
 - Procedures – Protocols - Facilities
- Use inter laboratory comparison of testing to harmonise and develop common or mutually agreed protocols
- Promote international testing cooperation on regular basis e.g. by round robin exercises to appoint and certify a group of test centers

1.2 Biological detection

Biodetectors are devices which are designed to provide an alarm if there is a presence of a (potentially) hazardous level of biological substance as an aerosol in the air. Typically, the requirements are that the detector can operate continuously and provide a (near) real-time warning and/or as a trigger to start air sampling for further analysis. Biodetectors can be divided in “point” detectors and “stand-off” detectors. The former is analysing the air through an inlet directly into the device. A stand-off detector is able to read the signature of an aerosol cloud from a distance, through an active irradiation by a certain laser wavelength for instance. In many cases a response from a “generic” biodetector is rather un-specific and a second step, which involves a sampling of the aerosol and subsequent analysis, is required to get reliable information to be used by the decision-makers. The nature of a biological aerosol is rather complex and there are challenging problems to get a good signature for classification of the biological threat. Different spectroscopic principles such as fluorescence, emission spectrometry or mass-spectrometry are used for B detection.

1.2.1 Conclusions on standardisation of testing B detectors

The purpose of introducing standardised testing of B detectors should be to enable comparison of results from test and evaluation between different test organisations.

The work in Creatif has concluded that, for biological detectors, there are no common published standards how to test and evaluate biological detectors. However, the test facilities examined has established internal protocols that are used within their own facility. These internal protocols do have a similarity between each other as the general concept is fairly common (i.e. exposing the detector for a controlled bioaerosol challenge). Different types of facilities (aerosol chambers of different sizes, wind tunnel or open air facilities) also lead to differences between the test protocols. There are many variables that will affect the outcome

of a testing procedure and all of them have to be addressed properly to provide a harmonised testing routine. In Creatif report D.2.2.3 many of them are discussed in more detail. Some of which are the reference material, method of dissemination and verification of the test aerosol. Round robin tests were proposed as a tool to compare test results from different laboratories. The evaluation should focus on reproducibility of results from each laboratory and to compare results between laboratories. Round robin is focused on in Creatif D.2.2.4, where it is suggested that standardisation of methods and protocols should be introduced iteratively to diminish the divergence of test results.

The issues of testing and evaluating B-detectors has also been addressed in other constellations and two of the most obvious activities are the Bio EDEP programme within EDA and its corresponding proposals for supporting projects and the activities within the NATO DIM SG¹, both of which, has interaction with the Creatif network.

1.2.2 Benefits of the network / Obstacles to participation

The Creatif network and especially the workshop event has pointed out that there is a general need for establishing some kind of standardised testing of B-detectors. The Creatif project and its network can serve as a good starting point. The input from the different stakeholders has been very fruitful and it has provided a good basis for further work. The T&E community has to some extent already some exchange of information, but the structure created has taken that further. Ideas and concerns have been discussed openly. The good connection with producers and end users in the workshop discussions has also verified that all stakeholders look similarly on the problems. The database of test centres is a good start but it has been realised that it lacks some facilities and details.

As concluded in the first workshop discussions, there are many questions and points of view how to continue the development of standardised B-detector testing. Even, if methods do exist at the different test facilities, lot of work has to be done to make sure the procedures and output from the test centres can be harmonised. This includes everything from defining a reference test substance; define the method of generating the test aerosol and how to verify that the test environment is controlled. It is also concluded that detector for different purposes may require different test protocols.

1.2.3 Expectations of stakeholders

End-users and buyers would appreciate that detectors were certificated for a specific purpose. Their goal is to be able to guarantee CBRN capabilities with the use of detectors, methodology and proper training. Since B detectors are being sold in small numbers, certification is not commercially attractive. Currently, detectors are tested according to requirements from each procuring agency. This has resulted in that detectors are being custom-built to some extent, which adds a risk for the manufacturer and a cost for the buyer.

All stakeholders would like to trust detector specifications. However, most of them suspect that the figures might be uncertain. Some of the uncertainties come from the use of different test agents and how they are produced (different simulants with different purity), but also

¹ NATO Detection, Identification and Monitoring Sub Group

spraying techniques and referee methods may have a significant contribution to the test results.

Test experts admitted that standardisation of B detector testing is demanding, but that if correct actions are taken there might be a big improvement with a limited effort. Test experts do not benefit much from standardisation if it doesn't imply a demand of more tests or that funding is directed specifically towards standardisation.

1.2.4 What is the future for testing (stakeholders' perception)?

If the final goal is to obtain certificates for B detectors, a standardisation process is inevitable. The standardisation can be divided in three components; standardised test conditions, test and evaluation methods, and operational testing. The test conditions include standard test material, techniques and methods for dissemination and for refereeing the results. Methods for test and evaluation include experiments designed to obtain detector limit of detection, false alarm rate, detection sensitivity and response times; but also methods to obtain and interpret the test results.

The technical specifications obtained from laboratory testing gives a measure of a detector's best performance in a controlled and fairly stable environment. In real world there are variations in aerosol background, temperature, wind speed and humidity that a detector should handle. Operational testing or open air field-trials are used to verify that a detector can be used in a specific environment. Performance metrics to determine are alarm limits, specificity (false alarm rates), response times and operability in different environmental conditions (weather, location, interferences).

Laboratory and operational testing results can be used to estimate capabilities obtainable with the use of a specific detector. The most authentic outcome is acquired if end-users are performing the practical tasks according to their standard operational procedures. Creatif work package 3 dealt specifically with operational testing.

1.3 Radiation and nuclear detection

In comparison to the other threats, the development and civil use of RN detectors has a long-lasting history, mainly due to the needs from nuclear energy industry and military applications. The definition of protocols for RN detection instruments has been fostered by the International Atomic Energy Agency (IAEA), after 9/11 also the US increased activities in this field.

1.3.1 Conclusions on standardisation of testing RN detectors

As summarised in D.2.3.3, for the testing of radiation detection equipment the US has already developed a number of suitable standards (ANSI, American National Standards Institute) and the testing of new products is done on a regular basis. In recent time, also IEC standards have become available for the testing of most common groups of RN detection systems. Therefore, the necessary knowledge is already available and there is no need to "reinvent the wheel" by developing new testing standards.

The Dresden Agreement² regulates on a formal basis the cooperation between IEC and CENELEC in order to avoid duplication of standardisation work and an adoption of IEC standards by CENELEC (with or without jointly developed revisions) is a frequent and welcomed practice.

Without having signed any formal agreement, CEN, CENELEC, and ETSI hold more or less regular meetings (every 18 months) with ANSI - American National Standards Institute³. Moreover, ANSI (and other national standardisation bodies) has official cooperation agreements with the international standardisation organisations (ISO, IEC); therefore the way forward from ANSI to IEC and further to CENELEC standards is well defined. It is only a question of the appropriate allocation of resources, how long it will take to transfer the existing testing standards to European ones.

A much more controversial point will be, whether the European Union follows the American example to have testing of CBRN equipment, newly released to the market on a voluntary but regular basis. The Graduated Radiation/Nuclear Detector Evaluation and Reporting (GRaDERSM) Program, launched by the Department of Homeland Security provides a suitable means of independently testing and evaluating (T&E) commercially available radiological and nuclear (Rad/Nuc) detection equipment against ANSI N42 performance standards to ensure that only high-quality radiation detector capabilities are funded by government procurement and grant programs⁴. In November 2010 Carolyn Perdue, GRaDER programme manager gave an overview on the newly established cooperation between US and EU on RN detection equipment testing⁵.

To conclude, the development of European standards for the testing of radiation detection equipment is possible within a few years given the necessary financial support. In fact, no new standards have to be drafted, but can be adopted from IEC and IAEA. Also, all the other components necessary for the certification of products are already available in Europe (accredited laboratories, certifying body to issue the certificates), so it is a question of political will to bring forward the process.

1.3.2 Benefits of the network / Obstacles to participation

Up to now we have received good feedback. Especially manufacturers are interested to take part in the discussion about standardisation and certification to shape the process. Events organised by the Creatif project turned out to be a good opportunity for direct contacts and exchange of opinions between end-users and manufacturers. End-users and also testing experts have appreciated the discussion on user needs. The main benefit of the network for end-users could be the exchange of information on testing and performance results for different detection systems, only big end-user organisations can afford the costs to have detectors tested in a procurement process, most end-users have to rely on information provided by manufacturers.

² Agreement on common planning of new work and parallel voting. IEC website: <http://www.iec.ch/about/partners/agreements/cenelec-e.htm>

³ CEN: <http://www.cen.eu/cen/AboutUs/CENnetwork/Relations/MoUs/Pages/default.aspx>

⁴ DNDO GRaDER Guidance for Users. http://www.dhs.gov/files/programs/gc_1218653295313.shtm

⁵ <http://publicaa.ansi.org/sites/apdl/Documents/Standards%20Activities/Homeland%20Security%20Standards%20Panel/ANSI-HSSP%20Ninth%20Annual%20Plenary%20Meeting/Panel%203%20-%20Conformity%20Assessment%20Systems/Purdy%20Panel%203.pdf>

So, the main obstacle for the development of the network seems the lack of funding for carrying out testing exercises of detection equipment. As a direct outcome, testing results in most cases remain unpublished, and the activities of the network remain theoretical – a real inter-comparison of the performance of testing facilities will only be possible, if funds are available to cover the costs for institutions taking part in round-robin exercises. This is mainly due to the fact that testing of equipment is not regulated or compulsory, so the market for testing services is small, and the competition between testing facilities to attract new customers is not a significant issue.

1.3.3 Expectations of stakeholders

Expectations of stakeholders are difficult to generalise. Up to now we have received very positive feed-back to the Creatif workshops, so it seems there is a strong interest for having organised workshops, where stakeholders can meet personally and discuss on the topic of CBRNE detection systems and testing of such equipment. Standardisation of testing seems to be a generally accepted need, while certification of testing facilities can be seen as a benefit, but many stakeholders can live without it.

1.3.4 What is the future for testing (stakeholders perception)

The stakeholder expectations have been collected in the first Creatif Workshop. In D.2.3.2, following topics were pointed out as a summary of the stakeholder discussions:

- The topic of standardisation of testing includes a huge complexity covering a lot of sub-topics (usability and operational aspects, quality assurance, comparability of testing results; definition of minimum requirements of instruments dependent on intended use; define relevant scenarios for testing, etc.). Finally, stakeholders agreed that a structured discussion is needed to elaborate a consolidated view on all the relevant topics linked to the testing of RN equipment. It will not be possible, and therefore, should not be attempted to find global solutions on testing.
- Testing the laboratories is our topic, not the testing of equipment. This has to be kept separately; otherwise the discussion is too much focussed on detectors' specifications. The network should focus on the exchange of best practise to allow comparability of results and quality assurance to support the reliability of testing results. This is especially important for end-users in the procurement process. So, it is suggested, to agree on a quality assurance system for testing centres and harmonisation of protocols.
- Testing experts agreed that it is desirable to produce added value for end-users with round-robin exercises (test new technologies, test different brands of the same device, test the RN library of devices by using different test sources). For such round robin exercises, available standards should be used, which are suited to the selected detection equipment.
- The definition of inter-comparison exercises for testing facilities should follow a layered approach. There should be a core list of minimum testing parameters to be covered, and facilities who want to make more effort (tests with alternative radionuclide sources, SNM) are welcome to do so with additional protocols.

- Both laboratory testing and field testing are desirable, where field tests (as they are not so common at the moment) can be addressed in a second phase.
- Use CIRCA web-service or other secure internet-platforms to share testing results as far as available and to offer discussion groups on selected topics.

For the near future, the expectations linked to the ITRAP+10 project are high – it will be a large testing campaign, so especially for end-users a lot of useful information is expected to be produced and publicly available on the performance of specific RN detection systems. The protocols used in this project can be seen as a very good starting point for the development of harmonised testing standards. In addition, the cooperation between US and EU within this project points to the future of testing, where there should be mutual agreement of testing results based on harmonised protocols / standards irrespective whether the tests were carried out in Europe or the United States.

1.4 Explosives Detection

The EU has adopted “Strategic Orientations and Priority Measures on Enhancing the Security of Explosives in the European Union” and further on the “Explosives Action Plan”. It is stated that “...the illegal acquisition and use of explosives poses a serious threat to the citizens of the European Union, and that terrorists and other criminals take advantage of the devastating effects of explosives to carry out attacks intended to kill and injure persons, destroy property and disrupt societal functions.”⁶ Different to CBRN threats, the malevolent use of explosives is very common and the threat has a high probability. Therefore, a lot of effort is put on the improvement of preventive actions as well as on improvement of detection systems, both for bulk and trace detection, and systems are deployed to protect critical infrastructure like airports/airplanes and large venues. Most partners of the Creatif Explosives working group are also partners in the NDE Network on the Detection of Explosives⁷, dedicated to support the EU and the Commission in the tasks related to the implementation of the EU 'Action plan on enhancing security of explosives', particularly of its detection section. So, partly there is an overlap with CREATIF objectives, but NDE is focussed to explosives without a link to CBRN threats.

1.4.1 Conclusions

From CREATIF workshops, some conclusions have been drawn related to the testing of explosives detection instruments. It has been stated that scenarios for testing should be developed and linked to testing protocols. Manufacturers need adapted facilities to assess their equipment, with real explosives. At the moment, in most cases testing is mainly done by using stimulants. A focus on liquid explosives and their components (duty free products, cosmetics) is recommended; tests are needed to indentify / characterise them. Still it is difficult to characterise new explosives. For this purpose, a lot of tests are necessary, but only few facilities are able to do that, so there seems to be a need for increased activities.

⁶ Council of the European Union, Brussels, 23 November 2007, 15618/07, CATS 135, ENFOPOL 199
<http://register.consilium.europa.eu/pdf/en/07/st15/st15618.en07.pdf>

⁷ <http://www.nde-information.eu/>

In the CREATIF explosives working group, it was agreed to share work of information collection among the group members. Following tasks were identified:

- Establish the list of available standards and protocols, send it around to be upgraded by participants
- Identify who can do what (list of the laboratories and their capabilities) and which standards to follow or to create.
- Necessity to have graduated tests (e.g. A : threshold level, B : statistical tests, C : field tests) related to the detection capability of equipments
- explore possibilities to make available ECAC protocols and threat list (restricted information) (at least meta-information describing the content of these documents could be provided)
- Manufactures have difficulties to obtain these protocols, threat list, test results.

In the group there has been agreement that harmonisation/standardisation is needed (e.g. intercomparison exercises). One successful example is the standard for mm wave imaging systems; it was published by the Industry Wireless Packaging Consortium (IWPC), and is now commonly accepted.

1.4.2 Benefits of the network

The most obvious benefit of the network is the exchange of knowledge and experiences of experts from different threat domains. Chemical detection and explosives trace detection can make use of the same detection technologies/principles. In addition, mixed threat scenarios, like dirty bombs (RN/E) can be discussed with experts from both domains, which helps to have a comprehensive view, especially end-users often cannot discriminate between threats, but have to deal with all kind of threats in case of an incident.

1.4.3 Obstacles to participation / Expectations of stakeholders

In the field of explosives detection many activities concerning the testing of detection equipment are carried by the European Civil Aviation Conference or military testing centres. Both players have very strict policies on the confidentiality of information in order to keep levels of security high. This makes it difficult to exchange information in the framework of a “research” project, and limits the possibility of participation in workshops to those having the necessary level of security clearances.

1.4.4 What is the future for testing (stakeholders perception)

The continuation of the NDE network (end of first period is June 2011) is planned. On the other hand, it is not clear, whether new calls related to the standardisation of testing of CBRN(E) detectors will cover both CBRN and E threats or leave it separately. There are good arguments for both alternatives. In any case there is a need for further work into the direction of testing standards development; also the need for inter-comparison exercises has been expressed from both end-users and manufacturers in the CREATIF network.

2 Roadmap for the future of testing

There is a need for harmonisation of testing rules (from the military and civilian domains), and to increase the cooperation of governmental organisations, as they are mostly in charge of organizing CBRNE Preparedness and protection. Cooperation can be facilitated by the development of broadly (internationally) accepted testing standards, which need to be developed. There is also a need for a Certification council, dealing with the quality of detection systems and issuing certificates after successful testing. This council should be an independent board that is tasked to survey new developments, guidelines, and can take over the responsibility of developing testing standards.

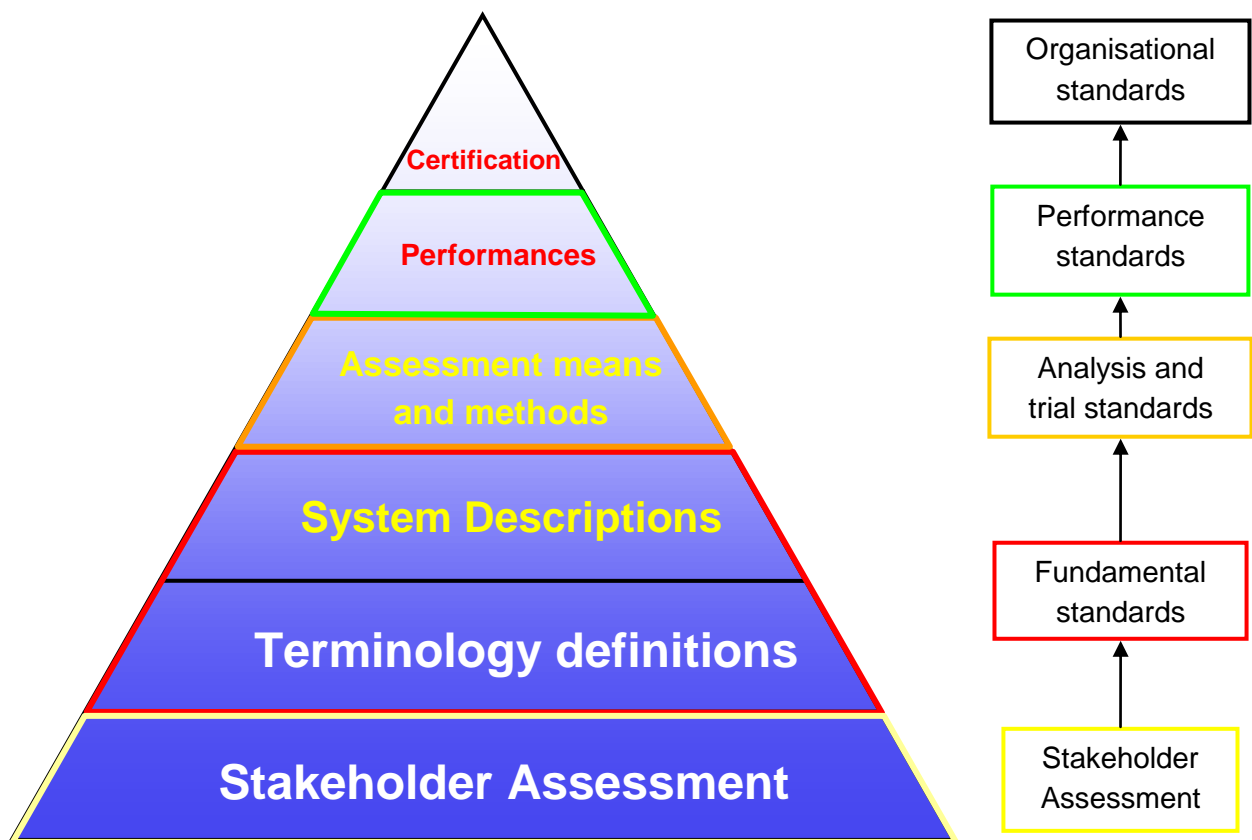


Figure 1: Pyramid of normalisation

There are four types of normalised standards and one initial assessment:

- **Stakeholder Assessment:** to assess all those individual, groups, organisations that have a vested interest in CBRNE detection systems and their testing. Also, to create a network whereby they can communicate.
- **Fundamental standards:** they provide the rules as far as terminology, acronyms, symbols, and metrology is concerned. An example would be the ISO 31: Quantities and units standard.

- **Analysis and trial standards:** they indicate the methods and means for the achievement of a test on a product. For example: ISO 6506-1: metallic materials - Testing of Brinell hardness - Part 1: test method.
- **Performance standards:** they indicate the characteristics, the thresholds of performance of a product or service. An example could be the IN 2076-2: Series aerospace - Ingots and castings alloys of aluminium and magnesium - Technical Specification - Part 2 - Ingots for re-melting. Performance standards may also include the reporting and rating schemes for performance data.
- **Organisation standards:** they describe the functions and organisational relationships within an entity. For example: ISO 9001: management systems of the quality – requirements or ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories.

Figure 1 is a graphic representation of the process of normalisation, i.e. drafting standards. The first step is to assess the stakeholders' needs for CBRNE detection systems and their testing. Following that is the agreement on fundamental standards that define, in the case of T&E standards, the terminology and the systems as a set of specifications. Only after this second step, there can be agreement on the appropriate "analysis and trial standards", that we defined in chapter 2.2.2 as ST&ER (standard testing & evaluation "Reference guide"). Then, one option is to add a normalised performance grid to ensure a better reading of the performances by the consumer or even minimal performances required to access to a label. Finally, the last step consists in developing organisation standards which will define the appropriate certification bodies that will ensure the proper application of the whole pyramid of standardisation and will be able to deliver final certificates for the evaluated detection systems. Each of these steps will be discussed in greater detail in the next chapters below.

2.1 Stakeholder Assessment

Before one can proceed with a project of harmonisation, improvement, and/or standardisation one has to consider the stakeholders involved. Stakeholders are all those people, groups, organisations, corporations, regulators, etc, that have a vested interest in the outcome of such a project. For example, manufacturers could be concerned with increased testing as it might affect their bottom line and costs for the development of new products. Of course governments at the national and regional levels are very interested in CBRNE threats and the evaluation of counter-terrorism equipment, i.e. CBRNE detectors, as they are usually responsible for the planning of preventive strategies to cope terrorist attacks.

One might be inclined to only consider laboratories and their staff. This is however only the tip of the iceberg. There are numerous others that need to be considered such as:

- National governments
- Regional governments
- CBRNE detection system manufacturers
- National laboratories
- Procurement officers

- National standards organisations
- International standards organisations
- Accreditation bodies
- First responders
- Military officials

It is not an understatement to say that the lack of inclusion of as many stakeholders as possible as soon as possible in such a project would certainly doom it to failure. As a reflection of the importance of the stakeholders, CREATIF work packages 1, 2, 6, and to a lesser degree work package 3 have focused on identifying the stakeholders and making plans to maintain contact with them. Furthermore, its placement as the base of our development triangle reinforces the concept of it being a fundamental activity.

Certainly, not every stakeholder has been identified at this point. However, a large number of stakeholders have been identified and it should be seen as a good starting point. Stakeholder assessment should in fact be an ongoing task for future projects to maintain and expand the network developed by Creatif.

2.2 Fundamental Standards

2.2.1 Terminology Definitions

It is important to distinguish the different levels of “standardisation” that a set of rationalised data / protocols can fulfil. When compiled in a list, the set of protocols used by a Test and Evaluation (T&E) center can either be considered as:

- A “**Reference guide**” which means a set of formalised data / protocols which is used for any activity. **Example:** The “lonely planet” tourist guides give a number of advices and rules to visit a country.
- “**De facto Standards**” which are “*Reference guides*” proposed by a single partner or administration which is robust enough (in time, space and efficiency) to be automatically adopted by other partners without preliminary consultation: one speaks then of *de facto standard*. **Example:** Blue Ray is a de facto standard (issued by one industrial player) that can be adopted by editors for the distribution of their media.
- “**Normalised Standards**” which are “*Reference Guides*” prepared and approved by a large expert community as a robust tool for the protection of the end user. For example: Norm ISO 9001 is a norm that protects the client by ensuring the quality of management of an organisation.

To be considered as a “**Normalised standard**”, a “**Reference guide**” must fulfil two conditions:

- be robust (in terms of space, time and efficiency)
- be recognised and validated by a large community including governmental agencies and published by a standardisation body (e.g. DIN, ANSI, ISO, CEN or any other national body)

2.2.2 Preliminary definitions in the case of T&E (testing and evaluation)

In the case of T&E standardisation, one should also agree on a subset of fundamental definitions such as:

1. **Specification:** measurable characteristic of a system reacting to a given environment i.e.: a set of environmental parameters.
2. **Type of system:** set of specifications that meet the same need.
3. **Test:** List of means, with or without consumables, of protocols and operating procedures to evaluate a specification.
4. **Test Plan (TP):** list of necessary tests needed to assess a given system
5. **Test and Evaluation “Reference guide” (T&ER):** set of tests recommended for the evaluation of a type of system by any expert.
6. **Standard Test and Evaluation “Reference guide” (ST&ER):** set of tests that has been proven to be "robust" (in time, space and efficiency).
7. **Normalised standards (NS):** ST&ER recognised by a set of governmental agencies and published by a standardisation body making reference to stakeholders (test and evaluation, but also buyers, users, legislative bodies).

As a remark, only ST&ER can lead to *de facto standards*. It is also important to point out that it is almost impossible to build a Reference guide and as a consequence *de facto* or normalised standards without a clear definition of the type of systems and their associated specifications. This will be detailed in section 2.2.3.

2.2.3 System Description

Before we get into a possible methodology for describing the system, we need to define the problem. An example can be taken from biological detection systems. At present it is possible to have two different systems that have the same name (e.g. biocollector) while the functionality as well as the applied technologies could be completely different. In Creatif we had similar issues in that we agreed on a detector class but not on technical parameters or the methods used for testing respective detection systems; e.g. for explosives detection, in order to limit the possible range of systems we only focussed to trace detection and left out all the technologies for bulk detection. In general the decision, which detection technologies

have been considered in the framework of Creatif project (and which not) was based more on democratic agreement within the consortium than on a systematic list of specifications.

Perhaps the most straightforward way to solve the problem of system description is to take a page from the biological classification of animals. Therein, one goes from a very broad definition (kingdom) to a very specific definition (species). Each stage of classification has associated with it a set of specifications. At the very end of the classification is a well defined group of animals that is essentially the sum of all of the specifications. An example would be that of the classification of a polar bear. Figure 2, aptly illustrates the classification process.

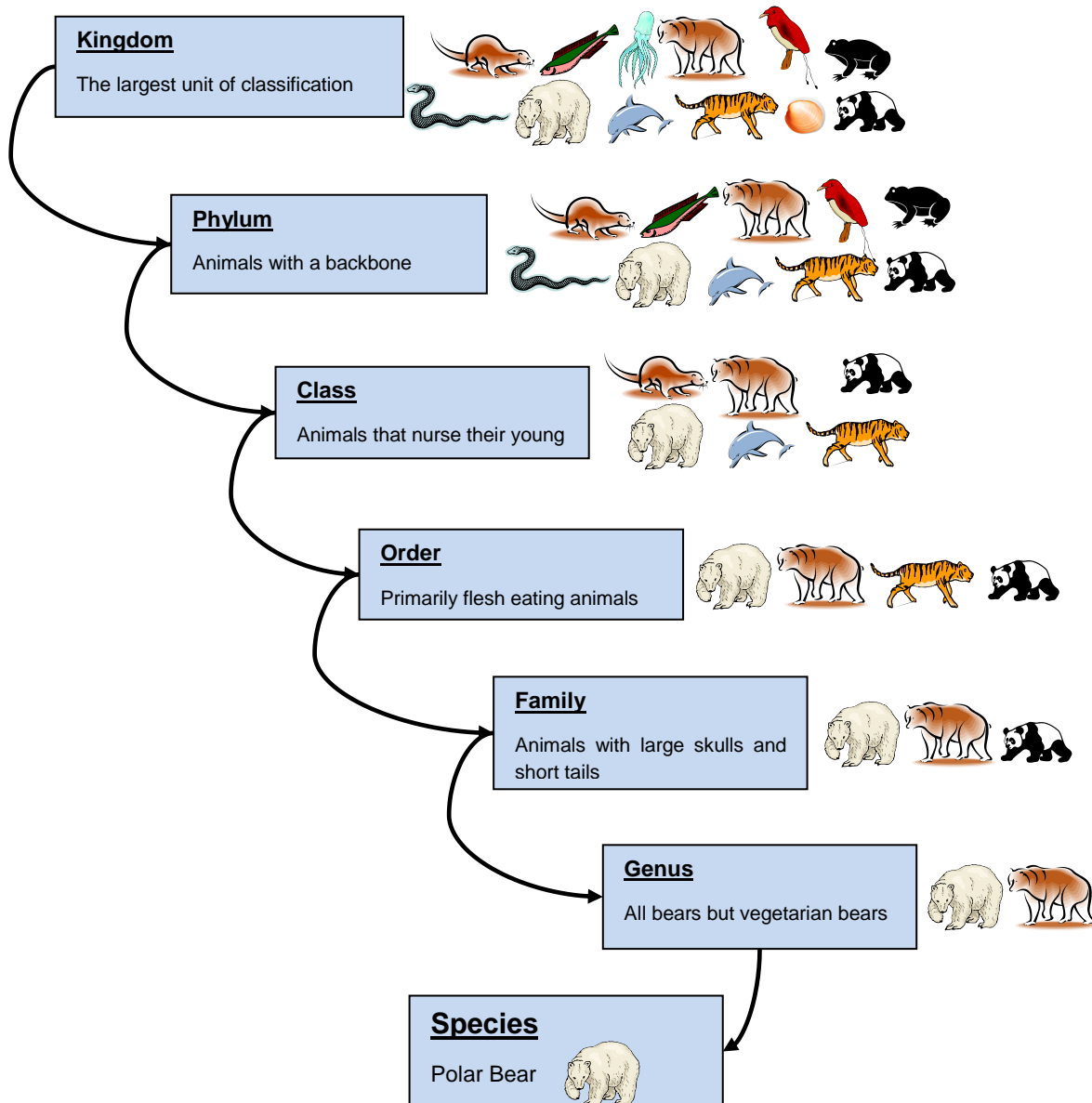


Figure 2: Biological classification of a polar bear

A similar process could be done for the CBRNE detection systems. We could go from the very broad (CBRNE detector), through a something like a class level (biodetector) to a species (a very specific biodetector using a specific method of sample collection and

analysis). At each stage a well-balanced group of stakeholders would create a specification that is representative of that level. Ideally, in the end, this system would not only make clear the naming convention of the detection systems but also go far to defining what specifications there are to be tested.

2.3 Analysis and Trial Standards

2.3.1 Application of Normalised Standards (NS) in a Testing and Evaluation (T&E) center

An important issue is to understand the relation between an eventual global European Union Normalised Standard (EU NS) and the different internal protocols that can be used by a T&E center. Figure 3 illustrates the inclusion of normalised standards in the robust core of the ST&ER (Standard Test and Evaluation Reference guide) of an expert center.

It is important to notice that the complete reference guide of a T&E center (T&ER) can be much wider than the restricted set of protocols which have shown to be robust with regard to time, space and efficiency. For example, if the rate of false positives is evaluated for an alert detector (the number of alert given by a system while there is no real threat) given the local natural background, it is obvious that this evaluation will depend on the location and the season of the evaluation campaign. It does not mean that it is not valuable to integrate such a test in a test plan (TP), but it prevents its use for a normalised evaluation.

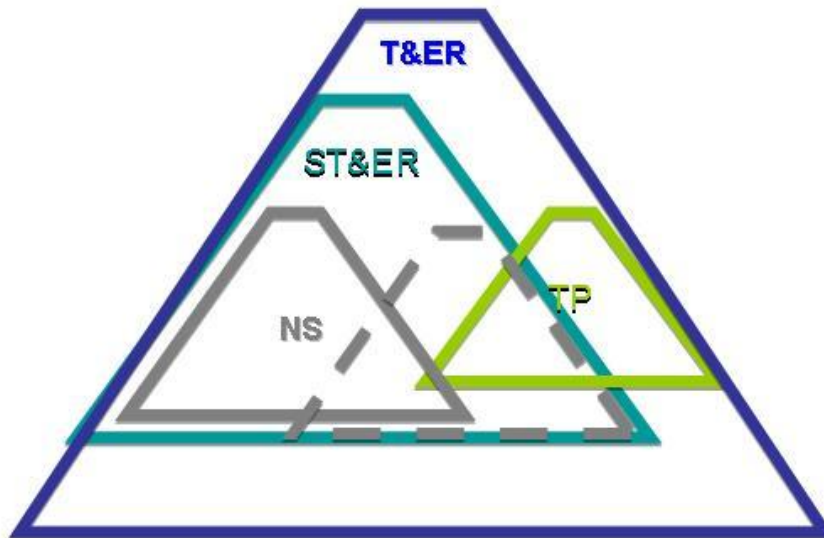


Figure 3: Relationship between TP, T&ER, ST&ER, and NS for a single T&E center

As a remark, one can expect that a T&E center could include more than one normalised standard (NS) in its ST&ER (standard test and evaluation reference guide; see second NS in dotted line in **Figure 3**). For example, if a civil NS and a military NS are developed for the same system, the T&E center will have the choice to develop the capability to apply both NS or not.

Finally, it is also important to point out that the evaluation of a commercial of the shelf system (COTS) can be performed by any protocol, even if it is not robust. If the consumers that ask for the evaluation agree on the test protocol (TP), there is no need that the test protocols belong to a ST&ER. On the contrary, if a system is evaluated in order to validate a contract of development, the test of the final demonstrator will have to belong to a ST&ER. This ensures the juristical validity of the evaluation results and can give the proof, that the development contract has been successfully fulfilled.

2.3.2 European Normative Standards (EU NS) to be derived from standard test and evaluation “Reference guide” (ST&ER) of individual Testing & Evaluation centers

Figure 4 sums up the difficulty to agree on the basic core of a global EU NS. Indeed, most of the T&E centers have developed their own internal protocols. In this example, the 3 CREATIF partners of the biodetection group (FOI, TNO and DGA MNRBC) are represented. As shown in Figure 4, only a very small part of ST&ERs are actually converging, but served as basis for preliminary discussions during the WP2, where the consortium spoke about standards for testing biodetectors

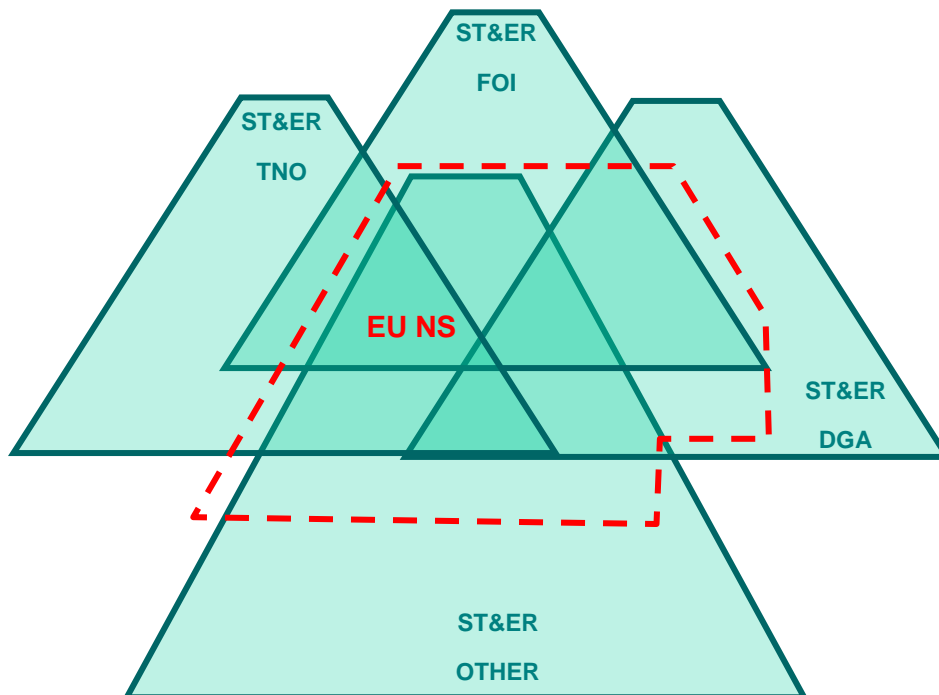


Figure 4: Relationship between a global European Normative Standard (EU NS) and the testing and evaluation “Reference guide” (ST&ER) used by individual Testing & Evaluation centers

The main difficulty in defining global EU Normative Standards will be to discuss the frontier (red dotted line) of these NS. One major question is: do we limit the NS to protocols that are

shared by all testing centers? By at least 2 testing centers? Or do we accept that a protocol that is only mastered by one single T&E center should also be accepted by the community?

If the number of T&E centers using the same protocol for testing is high, this will ensure a more robust evaluation and broad acceptance of the normative standard, but it will also limit the extension of the evaluation in excluding other approaches for testing. Concerning biodetectors, for example, it is not guaranteed today that one protocol could be shared by FOI, TNO and DGA MNRBC at the same time (because of available testing facilities or metrology, biological materials, etc.).

When the overlapping of single ST&ER is poor, the strategy should then rely on the definition of a generic envelop for the future global Normative Standard that is poorly shared at the beginning, but will be progressively developed by the partners.

2.3.3 End-users as the final target group of Normative Standards

It is first important to keep in mind that a NS requires the validation of governmental agencies (e.g. national standardisation bodies). This “political intrusion” is fundamental as it clearly defines the NS as a tool for the protection of the final consumer / end-user. In the case of CBNRE detectors, the final consumer can be the EU civilian first responders but it can also be the EU military forces. There is probably other consumers as industrial companies (pharmaceutical or food industries who require biodetectors to measure and limit bacterial contaminations), that could be taken into account in the global EU NS (see Figure 5).

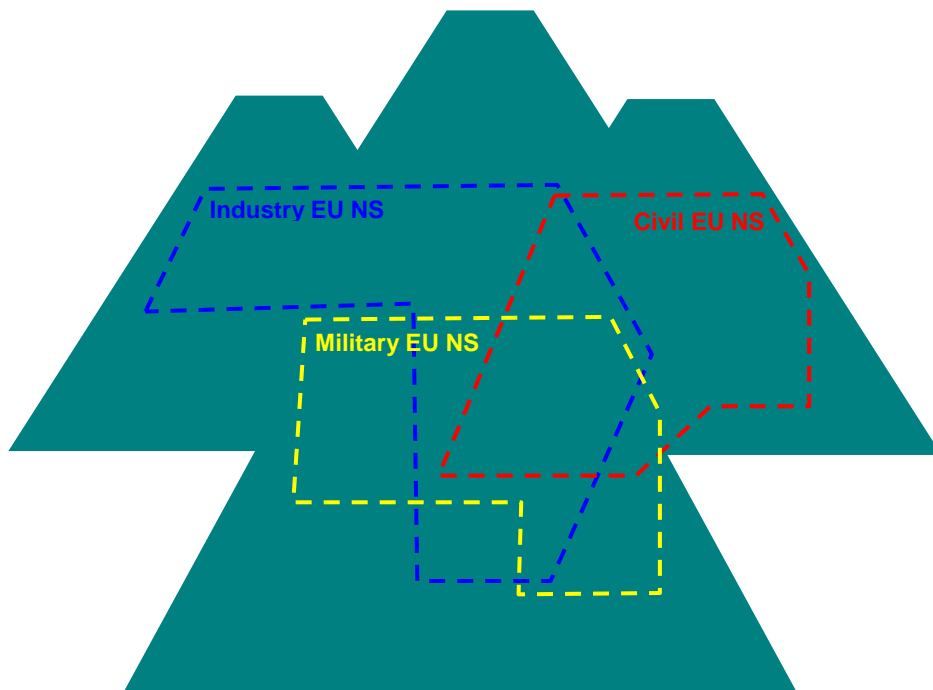


Figure 5: Global NS with respect to the final customer.

The needs of these different end users are sometimes diverging. For example, pharmaceutical applications will only require a very low detection threshold, but will not care about

the specificity of the detectors (any bacterial contamination is a problem). On the other hand, security issues will require a very low false positive rate, so that it will be necessary to investigate if the system can discriminate between background bacteria from threatening agents.

It is clear that the frontier of the NS defined on individual ST&ER in Figure 4, will depend on the consumer that we chose to protect. It is also clear that the larger the population which is targeted by the NS is the more difficult and expensive will be the standardisation process. As a result, it seems very important, to agree already at the beginning of a standardisation project, on the “consumer needs” that the normative standard should answer.

The important indicators that should be taken into account in this preliminary perimeter definition are:

- The future market size of a system type (from a consumer and provider point of view): if there are no (or very few) consumers for a system type, or no (or few) industrial providers of such systems, the cost of NS could be too high in relation to the estimated need. For example, in biodetectors, the market of liquid or powder detectors is probably higher than the market of bioaerosol detectors as no bioaerosol attack has been registered in the last decades.
- The intrinsic need associated to a system type: the higher the impact of a “wrong” evaluation of a system is the stronger will be the need for normative standards (NS). For example, even if the “market” of biological counters (not necessarily pathogen agents) is larger than the market of bio-threat detectors (system that discriminates a real pathogen), the absence of NS can be considered as more critical in the second case.
- The technical capability of the T&E centers to provide a significant ST&ER (or the cost to develop one). Even if the two previous indicators suggest that a normative standard for testing should be provided for a biodetector type, the cost for development of standard protocols could be too high to be invested by T&E centers or national bodies. Indeed, even if every testing center has developed internal protocols, it can be very difficult to provide “robust” generalised protocols that can be adapted to every testing facility.

2.3.4 Military vs. Civilian market

We pointed out in chapter 2.3.3 that the final perimeter of the EU NS will depend on the final consumer that will be chosen. Nevertheless, we can expect that even if different, the ST&ER that will be generated for two given consumers could share a significant number of T&E protocols.

In the case of biodetectors, today the industry is focused to cover the military demand. A number of European equipment programs are under development at national scale, but also on a more global level. The BioEDEP program for example, is a project led by the EDA (European defence agency) that groups together more than 10 countries to specify a global biodefence system composed of 15 different biodetectors and a global integrated detection system. This program will then probably be transferred to OCCAR that will ensure the management of this huge program (budget around 200 million Euros) so that European industries develop a demonstrator before 2020.

This system should be evaluated at a European level, which requires developing a specific ST&ER until 2015. This is the purpose of an ongoing EDA project named “T&E BioDIM project”, that aims at defining EDA standards for all types of biodetection systems (biocollectors, aerosol biocollectors, liquid identification systems, surface contamination detectors, etc.). One could think that this EDA standard testing & evaluation reference guide (ST&ER) could be used for a future EU NS. However, the purpose of this system is to provide a global protection system for the military forces during external operations. As a consequence, the detection system will be optimised for military needs and the ST&ER will be defined with regard to this use. There is no reason that this system will completely fulfil civilian security purposes and that the adopted ST&ER will also meet civil requirements. For example, the main objective of the EDA ST&ER will be to ensure a good protection of a battalion of 400 soldiers distributed in a field of outdoor operations, while civilian standards will probably be more interested in ensuring the protection of buildings or quasi indoor spaces (like transport nodes, mall centers or stadium).

As a final remark, the BioEDEP project can be understood as the “European market survey” for military needs. That is why the initial perimeter of the EDA ST&ER is already defined, while the initial perimeter for an EU security ST&ER is still not clearly defined.

2.3.5 Conclusion on the methodology to develop a complete normalised standard from existing T&E protocols

As a result of the above arguments, the different steps that will lead to valuable European normalised standards consist in:

- First, T&E experts must construct the fundamental norms (agree on definitions of the terminology and system types)
- Then, we must define the preliminary parameter of the future NS according to consumer needs, T&E criticality (impact of a « wrong » evaluation) and T&E capabilities (is it possible from a scientific or economic point of view).
- Finally we can construct the analysis and trials norms (global ST&ER) on the basis of individual ST&ER.
- As an extension, performance and organisation norms can be developed to consolidate the whole normalisation process and provide a “label”.

2.4 Different dimensions (test types) for the evaluation of detection systems

2.4.1 Laboratory Testing

Laboratory testing is the most common form of testing. In fact laboratory testing has been conducted from the development phase of a product until its final release to the market. Also later, as part of the procurement process, in many cases laboratory testing is performed to find out, whether specifications in the manufacturer’s product performance description are

valid or whether a given product (e.g. CBRNE detection system) can fulfil the specific end-user needs for the intended use of operation.

2.4.2 Operational Testing

In CREATIF workpackage 3, operational testing and its possible benefits have been elaborated in many details. Results can be found in CREATIF deliverable report D.3.1⁸. A brief summary is given below:

Today, the testing of CBRNE detection equipment is confined mostly to laboratory testing. This testing is conducted in highly controlled or ideal conditions. Therefore, the results of such testing should be considered the upper bounds of a given device characteristic. For example, the probability of detection for a specific compound by a handheld chemical detector yielded from a laboratory test should be used as the best possible result and not a “use-case” result.

According to end-users, what is needed is an additional testing protocol that can yield this use case result. Operational testing is the only way to provide this data. In this type of testing the device under test is placed in situations that closely mimic the real world conditions that would be present when the device was actually used in a CBRNE incident. Variables such as temperature, humidity, altitude, and interferences should all be measured and controlled to ensure valid and reproducible results.

The bench testing is done by technically skilled personnel in a very controlled manner and environment to simplify technical considerations. The end-user is often required to handle various tasks, where using detectors is primarily for personal protection and not a main duty. The detectors may be used in different and varying environments.

Finally, operational testing should include end-user specific parameters (human factors like skill level etc.); a realistic environment and conditions for the test defined in a close to real scenario, and the results from operational testing should provide information on capabilities obtained with the equipment at the test.

Bench testing is done to obtain the detectors best performance in an ideal environment. Operational testing is performed to understand the capability obtained by the end-user.

General objectives of operational testing

The specifications obtained during bench tests are not inherently valid in an operational environment. Sometimes the specifications are valid but the performance in the field can differ significantly. This difference would be of an academic nature if all CBRNE equipment behaves similarly, but that is not the case. In fact, the differences can be large. The detector performance is dependent upon aspects like selected detection technique, sampling method, engineering skill, analysis method and on which substances are to be detected.

⁸ Myers, P.; Wästerby, P.; Strelb, F.; Kieboom, J. (2010): Operational Testing Framework. CREATIF deliverable report D.3.1. 87 pp.

Often manufacturers demonstrate detector performance with compounds for which the detector has good sensitivity and selectivity rather than a broad range of compounds. If this is not known by the customer, generalisations extended to other compounds and comparisons made to other instruments can be incorrect. The result may be that the customers' expectations of the product will be unwarrantedly high and they may become disappointed when the equipment is put into operation. A bad acceptance by the end-user may result in that the equipment won't be used as intended and that the expected capability will be omitted. The procurement may also be considered unfair by the competing manufacturers who may do broader testing. In both cases there will be a waste of time and money.

Objectives of operational testing for procurement organisations

The procurement process is often a result of a growing demand for a new or improved capability. This capability may be achieved in several ways; by procurement of a new detector, by improving the operational proceedings with the present equipment, by education and training of end-users and/or on a management level. In some cases a new detector is not enough to obtain the wanted capability. However, this is difficult to realise from reading the specifications from manufacturers. The procurement of CBRNE detection systems often is done by a purchasing department or sometimes by a different governmental agency, sometimes having limited knowledge in the usage of the equipment and in technological matters.

Operational testing could be done prior to procurement to evaluate why the capability desired can't be obtained with the existing equipment. It could also be very valuable if new equipment has been tested in an operational environment to demonstrate that the claimed detector performance is not only obtained at bench tests, but in real usage of the equipment as well.

Objectives of operational testing for end-users

The end-users have different demands on CBRNE equipment depending on their tasks. Some end-users need equipment for personal protection and some to ensure public safety. The operational environment can vary from fixed sites indoors to mobile outdoor environments.

Fortunately, first responders do not experience CBRNE threats very often. But that makes it even more important to put very high demands on CBRNE detection equipment by making them easy to use and preventing them from being an obstacle in the daily work. If and when a CBRNE event occurs it will have serious consequences that force the end-user to make difficult decisions and to do potentially life threatening tasks. Thus, it is important that the end-user have confidence that they will obtain the required capabilities with their CBRNE equipment to do the work.

Objectives of operational testing for manufacturers

A manufacturer's first objective is to make money on their product. However, customer relations and feedback are also critical elements to a successful business. Often manufacturers have difficulty in obtaining the end-users opinions on product performance under operational conditions. There are examples of manufacturers forming user groups where questions are raised and the feedback used by the company to improve product capabilities and services. Because procurement is based on product specification, not on obtainable end-user capability, this feedback is important. In the long run, it will be important to learn more about end-user needs and operational testing can be one way to obtain it.

2.4.3 Human Factors Testing

Definition of human factors

Human Factors, is a discipline of study that deals with human-machine interface. Human Factors deals with the psychological, social, physical, biological, and safety characteristics of a user and the system the user is in⁹. In the discussions led during CREATIF project, human factors were seen as one component of operational testing, as the influence of human behaviour and suboptimal use of a detection system by the operator can make a big difference in the final system performance as observed in a specific operational scenario. More details on these interdependencies can be found in CREATIF deliverable report D.3.1¹⁰.

Definition of human factors testing and evaluation

Human factors testing and evaluation (HFTE), is a set of methodologies to characterise, measure, assess, and evaluate the technical merit and operational effectiveness and suitability of any human-system interface¹¹. During the period from 1914 – 1945, the foundation of modern HFTE was laid. The driving force behind the boom in research was the emergence of aircraft in warfare and the automobile for the private sector. A great deal of research was done regarding the impact of human intelligence, special aptitude testing, test and measurement methods, development of training aids, human perception, motoric behaviour, and complex reaction times just to name a few.

The current application of human factors testing and evaluation is focused on the system development and is an internal activity of the product developer. The focus is to maximise the synergy between the operator and the machine and is usually done long before the system ever makes it to production.

In our case, the situation is quite different. First, the CBRNE detectors to be tested have already been designed and have made it to market. Second, the developer of the detection

⁹ Adams, C., (2010) Human Factors [online] Available at:

<http://ergonomics.about.com/od/glossary/g/defhumanfactors.htm>

¹⁰ Myers, P.; Wästerby, P.; Strebl, F.; Kieboom, J. (2010): Operational Testing Framework. CREATIF deliverable report D.3.1. 87 pp.

¹¹ O'brien, T. Charlton S., 2002. Handbook of Human Factors Testing and Evaluation. 2nd ed. New Jersey: Mahwah.

system is not a member of the testing team. Therefore, our human factors test and evaluation plan will be used as an evaluation tool for third parties, in particular, the end-user community who will actually be using the device. The goal is to place the CBRNE detector in a realistic operational environment, conduct operations, and make an assessment based on a standardised rating scheme to be developed.

2.5 Performance Standards

Measuring performance is what testing is all about. Once the community has created the relevant normalised standards for the testing of detection systems, we will need to come up with a scheme to quantify and qualify the results obtained.

It should be borne in mind that we could have three different types of normalised testing standards: laboratory, operational, and human factors. Each of these in turn could have their own NS of performance.

These could be:

- Laboratory Performance Standards
- Operational Performance Standards
- Human factors Performance Standards

There are several issues that need to be sorted out in the creation of the NS.

The questions that have to be answered include:

- Who is the target audience of the report
- Rating schemes: How do we quantify or qualify performance
- Device specification: what performances are to be reported
- Reporting format: How is performance reported
- Protection of the public: minimum performance
- Performance standards maintenance

2.5.1 Target audience

An ever present concern when creating a scheme for the reporting and rating of the performances of a particular detection system is to keep in mind who will be the reader of the performance report and make use of the presented information.

2.5.2 Rating schemes

Each specification of a given CBRNE detection system will need to have some agreed upon manner in which to quantify or qualify it. Additionally, different rating schemes could be envisioned based on the type of testing as well as the target audience of the report. For example, a very detailed rating scheme could be used for laboratory testing and have as its audience the scientist or engineers. A less detailed rating scheme could be presented for the

same testing but with a target audience of a procurement officer. As such, the procurement officer may be less concerned with a scientific review and most interested in a relative comparison of several similar devices. Furthermore, operational and human factors testing lend themselves better to a more qualitative analysis. Therefore, a corresponding scheme should be created. Finally, performance data is often more useful as a tool for a side-by-side comparison of detection systems.

Table 1: Simple performance rating scheme¹²




Sample Rating Scheme 1	
Green 	Fully Capable
Yellow 	Capable with limitations
Red 	Failure/No Capability

Table 2: Detailed performance rating scheme

Explosives Detection	
10 Excellent	90+ % of explosives
9	80 – 90% of explosives
8 Good	70 – 80% of explosives
7	60 – 70% of explosives
6 Acceptable	50 – 60% of explosives
5 Acceptable	40 – 50% of explosives
4	30 – 40% of explosives
3 Poor	20 – 30% of explosives
2	10 – 20% of explosives
1 Extremely poor	0 – 10% of explosives

Table 1, illustrates a rather simple scheme. Conversely, table 2 shows a rather more detailed rating scheme. The most detailed report would be the listing of the actual raw testing results, which can only be read by technical experts. Again, the usefulness of each rating scheme depends on how the rating is intended to be used.

¹² Myers, P.; Wästerby, P.; Strelb, F.; Kieboom, J. (2010): Operational Testing Framework. CREATIF deliverable report D.3.1. 87 pp

2.5.3 Device specifications - what to report

In section 2.2.3 of this document we discussed how we would define a specific detection system. Essentially, a specific detection system is the sum of the specifications. Here the community would have to determine in a performance standard, which if not all specifications would be reported and their associated performance.

It should be noted that numerous specifications could be listed twice: once each for laboratory and operational testing. An example would be that of the probability of detection. Other specifications only make sense in terms of human factors testing such as: ease of use of the software. Also, the way these are reported may be quite different as discussed in section 2.5.2.

2.5.4 Reporting format

The standardisation of the reporting format is a critical step. This is where all of the work that has been completed up to this point is consolidated and presented in a well formatted and concise way. Care should be given to present the information in such a way as to satisfy the needs of the target audience. Therefore it might be necessary to have several reporting formats. It could be warranted to have one for each category of stakeholder such as first-responder, procurement officer, scientist, etc. For the comparability of testing results, a standardised reporting format will be a crucial prerequisite.

2.5.5 Minimum performance and the protection of the public

CBRNE detection systems are by the very nature meant to protect the people from either intentional or unintentional release of hazardous chemicals, biological agents, radiation, or the use of explosives. As such it is reasonable to expect that there will be a minimum performance level for all CBRNE detection systems. The minimum performance level would be one of the criteria that could be used to determine if the device is fit to be sold within a given Member State or throughout the European Union.

This minimum level of performance should be defined by the stakeholder community defined earlier. It would be desirable to have such minimum performance levels be made enforceable by creating the relevant legislation. Oversight and enforcement could be provided by the Member States law enforcement agencies.

2.5.6 Performance standards maintenance

Once the normalised performance standards have been finalised the job isn't complete. These standards will need to be maintained and are expected to evolve as the CBRNE detection device sector evolves. It is reasonable to consider that review on a regular time-frame will be necessary to ensure relevance and accuracy.

2.6 Organisational Standards

2.6.1 Certification Process

In Creatif WP4 a detailed description on necessary steps toward a certification system for CBRNE detection systems has been developed (summary taken from Beckmann et al. 2011, WP4 deliverable report D.4.1-4.3)¹³.

The proposed CREATIF certification concept for CBRNE detection equipment can be embedded in existing national and international accepted structures of accreditation and certification (see Fig. 6).

In its final stage, the certification concept will rely on:

- Testing laboratories accredited according to standards EN ISO/IEC 17025
- Certification bodies working according to the EN 45011 / ISO Guide 65 (future; ISO 17065 (2010)) standard which will also co-operate with
- A future CBRNE certification association. It provides administration and linking between (e.g. national) certification bodies across Europe. The association will be controlled by a
- General Assembly where manufacturers, certifiers and other stakeholders discuss common strategic issues concerning European certification on CBRNE on the global market. This assembly is needed for a democratically controlled overarching CBRNE certification structure.

It will be a rigorous system, but this will:

- assure a high level of acceptance from side of the manufacturers, end users and stakeholders because they are familiar with the system logics from other technical domains
- allow mutual recognition of the proposed certification label between European countries and with international partners
- provide “third party”, independent reliable testing reports for the end-users
- stimulate and support the development of standards for testing in the CBRNE detection sector
- offer testing facilities the opportunity to achieve EU-wide recognition as reference laboratories

¹³ Beckmann J., Strebl F., Ewert U., Schröttner T., Geringer, T. (2011): Strategies, preconditions and rules for an internationally accepted CBRNE certification system. Deliverable Report D.4.1 – D.4.3. 48 pp.

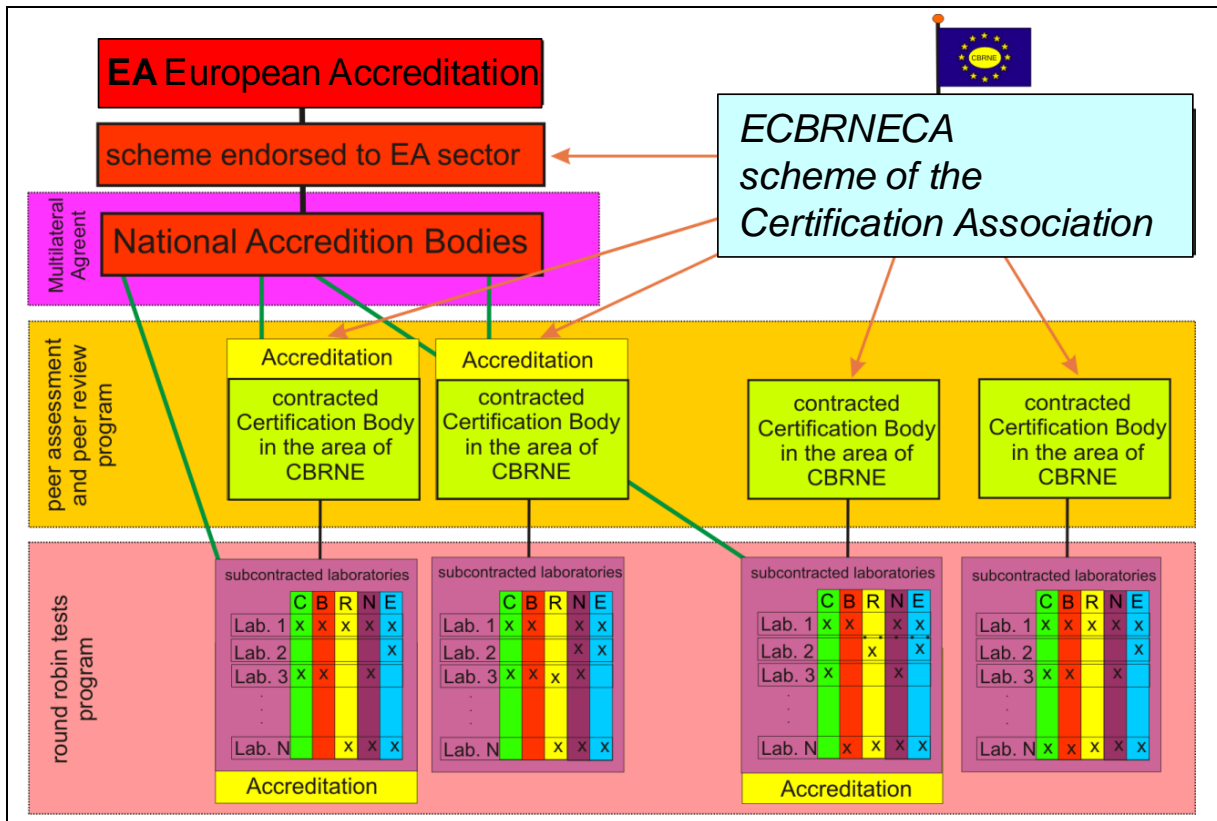


Figure 6: Quality control of suggested certification scheme (managed by a “European CBRNE Certification Association”) maintained by peer assessment, peer review programs and round robin exercises

The CREATIF consortium can be considered to be a nucleus for a future CBRNE certification system, while the CREATIF network can be seen as a first “CBRNE Certification Advisory Board” representing all stakeholders and giving advice to a future Certification Association. In the project already much work has been done on setting up preconditions for the future system according to the existing state of art. CREATIF could grow up towards a certification association and initiate first steps for the development of a CBRNE certification system.

From point of view of the CREATIF consortium, the certification system should deal with following tasks first:

- Organisation of inter-comparison exercises for testing facilities in the field of testing CBRNE detection systems.
- Initiation of technical audits of facilities with independent testing experts, provided by the future association – this peer assessment of quality management can replace full accreditation of laboratories in the initial phase.
- Initiation of harmonisation of protocols (where standards are still missing) which were or will be developed by the CBRNE community under the guidance of all testing facilities in the system and with strong involvement of all stakeholders (end-users, decision makers)
- Development & management of a “CBRNE Certification Label” visualizing the tested quality according to well-defined criteria (standards / protocols as suggested by the General Assembly of the „CBRNE Certification Association“)

- Establishment of a catalogue of all EU-certified detection products (carrying the “CBRNE Certification Label” as a service for end-users.

From the discussions at the Creatif certification workshop it can be concluded that:

- Not all existing testing laboratories (military and civilian) in EU will be able and willing to answer all the administrative requirements of laboratory accreditation. A peer-assessment procedure can overcome this lack. A certification system can also work with non-accredited laboratories, as long as they can prove the high quality of testing e.g. by participation in inter-comparison exercises.
- It is an open question, who should cover the required costs for the implementation of such a certification system incl. accreditation of laboratories. Without a strong and expressed political will the realisation of such a project will not be successful.

In the CREATIF stakeholder network all competences for testing, certification and the development of testing standards are represented and could be activated by future initiatives.

2.7 Relative position of each of the threats

Often during the CREATIF discussions it has been pointed out that the maturity of detection systems is very different for the different threats. This is also true for the availability of testing protocols or normalised standards. To the CREATIF consortium, the current situation can be summarised as follows:

2.7.1 Chemical

Due to the large variety of possible threat agents including toxic industrial chemicals, there exist a large number of detection technologies engaged in current C-detection systems. Summarised by WP2.1 on chemical detection the current status can be summarised:

- No specific civilian (EU) standards exist for testing of C-detection systems
- Military protocols and in house developed protocols based on NATO requirements (classified) are available
- Only a few facilities within the EU are capable of testing and are permitted to use CWA agents and relating chemicals
- Testing requirements change because the chemical threat keeps changing and new technologies are developed in the near future

For the further development of the testing of C-detection systems, Creatif stakeholders have suggested to use feedback from all stakeholders to create requirements and standards, as there needs to be a clear focus on necessary test standards. Operational testing needs more priority, and also laboratory testing should include more operational testing parameters.

Round robin exercises among existing testing facilities could be a useful tool in obtaining harmonisation and a broader acceptance of test and /or certification results. This can be a starting point for the development of testing standards and the harmonisation of test protocols for chemical detection systems.

The stimulation of contact and feedback between end-users, buyers and manufacturers with help of network events like annual meetings and workshops should be organised.

The development of EU wide testing standards should be supported by CEN or other standardisation bodies, while harmonisation efforts can be supported by the European Commission e.g. by coordination actions funded under FP7. These actions should include the setting up of intercomparison testing exercises to stimulate cooperation between testing centers throughout EU-27.

2.7.2 Biological

There is agreement that biological detection systems are the most recent and less mature technology in the CBRNE domain. Still, bio-detection is in the stage of development, and so there has not been the time for the definition of harmonised testing standards. Necessary prerequisites like the definition reference materials, reference methods and the methods for aerosol generation have to be elaborated first. Round robin exercises could be used to compare parameters currently used in testing protocols like limits of detection, response time and specificity of detectors. Feedback of these intercomparison exercises could be used for the creation of testing standards in a later stage.

For the definition of testing parameters and reference materials EU-funded capability projects would be a good means, as there is still the need for basic research to find out about the best solutions for these issues. Accordingly, the development of normative testing standards is not yet a priority in the next few years for bio-detection.

2.7.3 Radiological/Nuclear

In the field of radiological/nuclear detection most of the open questions around testing of detectors are already solved: IEC and ANSI standards are available for testing most kinds of detectors; adoption of standards by CEN/CENELEC is possible (desirable) within a few years. Also, first attempts for an intensified cooperation between IAEA, US, Europe in the field of testing of RN detection systems will be implemented by the ITRAP+10 project.

So, the way forward to provide international testing standards, and have testing facilities in Europe accredited under the existing European structures and then promote the certification of RN detection systems is well defined.

RN-experts in the CREATIF network pointed out following issues to be of priority in the future:

- Provide a framework for regular testing of instruments, especially the funding for such activities
- Laboratory tests and field testing (operational testing) are desirable
- Provide a platform to ensure regular exchange of knowledge and best practise for testing experts
- Support end-users by making available testing results

Still, the question of funding such activities has to be solved. The ITRAP+10 project is funded by the European Commission, for future work on developing RN testing standards and operational testing standards, as well as the organisation of intercomparison exercises for

RN detection testing centers could be funded in a similar way by dedicated EU-service tenders or FP7 coordination actions.

2.7.4 Explosives

For explosives detection systems (CREATIF mainly focussed to trace detection) there are already quite some products on the market available. Due to the high number of incidents, E-detection has a much higher priority than the other CBRN-threats. Therefore, there is a strong need for intense coordination with other EU sponsored groups like the NDE Network on the Detection of Explosives, ERNCIP European Reference Network for Critical Infrastructure Protection, EDA C-IED Detection expert group (European Defence Agency Counter-Improvised Explosive Device), ECAC (European civil aviation conference) to avoid duplication and increase of work for involved experts. End-users have to be involved in all these activities in order to focus work on their specific needs (civilian and military).

E-experts agree that still there is a need to develop European civilian standards, taking into account usability, human factors, and operational issues. The ECAC process could serve as an inspiration or model for the future work on harmonizing test methods and protocols for E detection equipment. The challenge to exchange classified protocols and results has to be solved on European level. Certification of E detection equipment has already started in the field of civil aviation (promoted by ECAC), so this can be a model to set up such systems for other uses of E-detectors as well.

European funded research (FP7 coordinated actions) could be a good means to support the further development of E-detection testing, but other funding sources like EDA or NATO projects should be taken into account as well.

A graphical representation on the progress of detector testing is given in Figure 7.

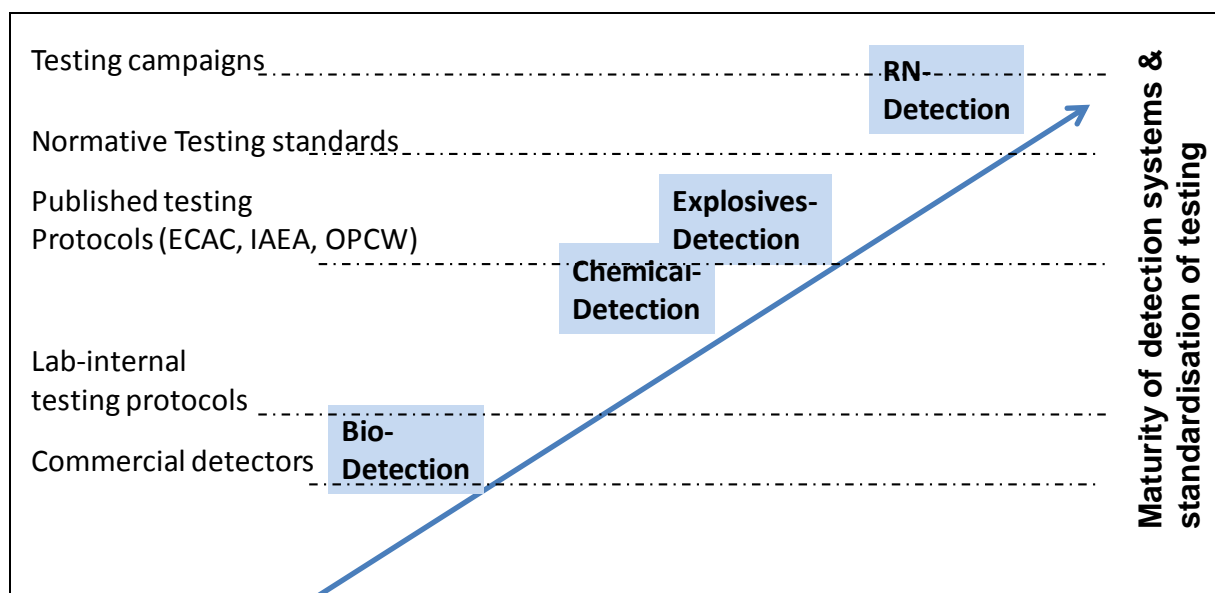


Figure 7: Relative position of CBRNE detection systems in terms of system maturity and standardisation of testing.

3 The Future of Testing Facilities in the EU

Citing from the Creatif Deliverable D.2.1 on testing facilities¹⁴, the future needs of the European Union can be summarised as following: The “**EU CBRN action plan**”¹⁵ to strengthen CBRN security in the EU has been adopted by the Council of the European Union in November 2009. It is based on results of a CBRN task force organised by DG JLS, who developed a comprehensive list of 264 recommendations to lower the risk of terrorist acts using CBRN materials. The final report has been published in January 2009¹⁶. For explosives threats, one year earlier and similar to the CBRN threat, an “**EU Action Plan on Enhancing the Security of Explosives**”¹⁷ has been published and adopted by the Council of the European Union (April 2008).

In both the mentioned CBRN and Explosives Action Plan, testing centers throughout Europe could play an important role. Therefore, CREATIF WP2 collected information on existing testing centers and their capabilities. Testing centers could carry out some of the recommended future actions or contribute necessary knowledge to reach the defined goals, especially, Detection, goal 2, Action H.23; H.24): “*Establish trialling, testing and certification schemes for CBRN detection in the EU*” (based on Task Force Recommendations No. 49, 50, 51, 52, 135-138, 225, 226). The text below is a quote of the cited Action Plans; it lists the most prominent goals defined for the midterm future¹⁸:

- establish an EU wide validation and certification scheme to indicate whether detection systems and tools meet set requirements relying on existing capabilities and facilities. It should comprise continuing quality assurance mechanisms;
- establish an EU wide testing scheme for detection tools and systems to assess the performance and quality of solutions relying on existing capabilities and facilities;
- establish an EU wide trialling scheme to evaluate the quality of both detection tools and systems in practical field operations relying on existing capabilities and facilities.

From the specific problems listed in context with chemical, biological and radiological/nuclear detection, following can be addressed by testing services, provided by detection testing centers: varying quality of detection methods/solutions and equipment; gap between requirements and offered solutions; better anticipation of future detection requirements; operational requirements of security authorities;

More specific problems, dependent on the threat include:

- C: There is a gap between the requirements of selectivity and specificity as well as available technology and minimum detection limits for chemical detectors;
- B: Lacking overview of good (reliable, sensitive and rapid) methods/solutions and

¹⁴ see p. 3; Strebl, F. et al. (2010): Database on testing facilities for CBRNE detection systems in Europe. Creatif Deliverable D.2.1.1-D.2.4.1, 1st revision, 63 pp.

¹⁵ <http://register.consilium.europa.eu/pdf/en/09/st15/st15505-re01.en09.pdf>

¹⁶ https://www.ebsaweb.eu/ebsa_media/Downloads/EBSAActivities/Biosecurity_and_Biopreparedness-p-877/CBRNupdate02_02_2009-p-1180/CBRN_TF_Report_20_01_2009.doc

¹⁷ <http://register.consilium.europa.eu/pdf/en/08/st08/st08109.en08.pdf>, p. 16

¹⁸ https://www.ebsaweb.eu/ebsa_media/Downloads/EBSAActivities/Biosecurity_and_Biopreparedness-p-877/CBRNupdate02_02_2009-p-1180/CBRN_TF_Report_20_01_2009.doc

equipment based on testing and field experience;

Create conditions that relevant national authorities could test detection tools on live dangerous organisms;

RN: The detection of shielded/masked sources;

EU-wide certification, testing and trialling schemes for CBRN detection solutions could be established. [...] Common certification, testing and trialling schemes would decrease the reliance of public authorities on information provided by the manufacturers of detection tools and would allow them to base their decisions on objective results. Finally, such systems would be of benefit to the private sector as they would allow manufacturers to market their products more effectively. Standardisation of certification, testing and trialling processes could be considered in order to ensure identical quality across participating entities.

In terms of preparation of a possible certification scheme, a system is needed whereby a detection tool could be assessed to see if it meets certain accepted standards or thresholds. This certification process would be conducted by accredited laboratories/organisations in the Member States and would be valid in all Member States.

An EU-wide testing scheme should also be pursued for overall assessment of the performance of a particular detection solution. Such a system would provide a framework for the exchange of test results between the public authorities and relevant institutes of the Member States. This aggregation of information on the performance of detection solutions collected in independent tests would be helpful for public authorities and other stakeholders as it would facilitate decision-making in procurement procedures.

Finally, an EU-wide trialling scheme for detection solutions should be established whereby the performance of multiple new detection technologies could be assessed using identical or very similar scenarios. Such a system would make it easier to compare different technologies originating from various solution providers. The aim of the trialling scheme would be to identify promising solutions and technologies and help bringing them to the market. The certification, testing and trialling schemes shall rely on existing capabilities and facilities in the Member States.

Also, in the “EU Action Plan on Enhancing the Security of Explosives”¹⁹ detection measures are considered, and under the fourth priority, following items are mentioned:

- Establish EU-wide certification, testing and trialling schemes for the detection of explosives
- Create a European wide certification scheme for explosives detection solutions and examine the possibilities to extend it beyond the EU, (e.g. cooperate with ISO and CASCO).
- Create a European wide testing scheme for explosives detection solutions taking into account existing work carried out by different bodies.

Under the scheme relevant authorities and institutes would be able to exchange test results. The Working Group on detection should look into the possibility of harmonisation of testing measures.

¹⁹ <http://register.consilium.europa.eu/pdf/en/08/st08/st08109.en08.pdf>, p. 16

3.1 The Joint Testing Facility

Inspired by discussions in the DTEP project on military testing facilities and those held in the framework of ESRIFF working group 9 on innovation, the idea of developing a joint test facility has been considered. The “Europe Defence Test and Evaluation Base” (DTEB) is managed by the European Defence Agency (EDA). EDA's Steering Board approved in a Conceptual Guide for DTEB to target priority areas, coordinate investments, encourage reciprocal use of facilities and create a network of test and evaluation capabilities, with the aim of having a consolidated and coherent European DTEB by 2030²⁰. Reduction of duplication on a European level is foreseen as well as the joint use of facilities by different countries²¹.

Additionally, the Creatif consortium has identified several other concepts that, at first blush, make the creation of a joint testing facility an ideal aspiration. The joint testing facility (JTF) can be seen as a single center of excellence. All of the very best practices and procedures will be developed therein. It would essentially be the source for all national laboratories to reference. The JTF would also ensure that at least one laboratory had the ability to conduct high level testing on detection systems for all four threat categories. It would also have the highest level of accreditation. This accreditation of course would be supranational (at the European Union level) and be acceptable to all countries involved. The final concepts would be the leveraging of expertise, the sharing of knowledge and the economies of scale.

3.2 Current facilities in the EU

In work package 2, the CREATIF consortium consolidated a listing of all of the CBRNE detector systems testing facilities that could be found. At this moment there are 68 facilities, belonging to a total 38 organisations that have been identified in 15 European countries. In many cases, one organisation holds testing facilities for more than one threat (e.g. for B and C detection systems). In these cases, facilities have been counted independently in the CREATIF database for each threat

In the following tables a summary of the test facilities is presented, their country, and the basic contact details. This list is not considered to be complete as will be discussed at the end of this section. More detailed information regarding the testing facilities and organisations can be found in Creatif Deliverable Report D.2.1.1-D.2.4.1.

CHEMICAL: At the moment, there are 22 facilities from 15 organisations in 10 European countries that can be identified for the testing of chemical detectors.

The countries that have representation in chemical testing facilities are: Czech Republic, Finland, France, Germany, Netherlands, Norway, Slovakia, Sweden, Switzerland, and the United Kingdom.

²⁰ http://goliath.ecnext.com/coms2/gi_0199-9211766/DEFENCE-INDUSTRY-EU-GOVERNMENTS-AGREE.html

²¹ http://www.eda.europa.eu/Libraries/News/061017_-_Seminar_Test_Facilities.sflb.ashx

Table 3: Chemical testing facilities

Organisation	Facilities	Country	Contact
FOI, Swedish Defence Research Agency	CWA detection test facility	Sweden	www.foi.se
FOI, Swedish Defence Research Agency	Semi-closed chamber	Sweden	
FOI, Swedish Defence Research Agency	Open Field range, 400 x 400 m	Sweden	
TNO, Netherlands Organisation for Applied Research, Defence Security and Safety Division	CWA and TIC vapour and gas detection test facility	Netherlands	www.tno.nl
TNO, Netherlands Organisation for Applied Research, Defence Security and Safety Division	CWA and TIC vapour and gas detection test facility in controlled temperature semi closed glove box	Netherlands	
FFI, Norwegian Defence Research Establishment, Protection Division	Semi-closed test chamber	Norway	www.ffi.no
SUJCHBO, National Institute for NBC Protection	CWA and TIC vapour and gas detection test facility; testing chamber and laboratories	Czech Republic	www.sujchbo.cz
SUJCHBO, National Institute for NBC Protection	Climatic / various environmental conditions/ testing chamber for CWA and TICs,	Czech Republic	
SUJCHBO, National Institute for NBC Protection	large scale (4000 m3) testing hall for CB tests, Radon Chamber and site for testing of explosive materials	Czech Republic	
CBRN TTC, Training and Testing Centre	large scale testing and training site for CB tests	Slovakia	http://www.consilium.europa.eu/ue_docs/cmsUpload_SK%20proposal.pdf
Dstl Porton Down, Chemical & Biological Detection	CWA and TIC vapour and gas detection test facility in controlled temperature semi closed chamber	United Kingdom	www.dstl.gov.uk
Dstl Porton Down, Chemical & Biological Detection	CWA and TIC vapour and gas detection test facility in semi closed chamber	United Kingdom	
Dstl Porton Down, Chemical & Biological Detection	Open air proving ground for CB testing	United Kingdom	
SPIEZ LABORATORY, National NBC Protection and Coordination Office	CWA and TIC vapour and gas detection test facility High tox chemical test facility testing chamber and laboratories	Switzerland	http://www.labor-spiez.ch/en/lab/index.htm
VTT, Technical Research Centre of Finland	TIC vapour and gas detection test facility	Finland	http://www.vtt.fi
PVTT, Finnish Defence Forces Technical Research Centre	Simulant, TIC and CWA vapour and gas detection test facility	Finland	http://www.mil.fi/laitokset/pvtt/index_en.jsp
Smiths Detection/ United Kingdom	simulant vapour and gas detection test facility	United Kingdom	www.smithsdetection.com
Environics Oy	Simulant, TIC and some limited CWA vapour and gas detection test facility	Finland	http://www.environics.fi
DGA Maîtrise NRBC		France	http://www.defense.gouv.fr/dga/la-dga2/expertise-etessais/dga-maitrise-nrbc
Thales		France	www.thalesgroup.com
WIS / Wehrwissenschaftliches Institut für Schutztechnologien - ABC-Schutz		Germany	http://www.bwb.org/portal/a/bwb/diensts/wis/aufgabe?yw_contentURL=/01DB022000000001/W26CJLD253INFODE/content.jsp
CEA	Calibrated Gas generator to prepare air bearing known concentration of specific gaseous chemicals (use of toxic or surrogates compounds)	France	http://www.cea.fr

BIOLOGICAL: At the moment, there are 20 facilities in 12 different organisations from 9 European countries that could be identified for the testing of biological detection systems.

The countries that have representation in biological testing facilities are: Czech Republic, France, Germany, Netherlands, Norway, Sweden, United Kingdom, Poland and Finland.

Table 4: Biological testing facilities

Organisation	Facilities	Country	Contact
TNO, The Netherlands Organisation for Applied Research, Defence Security and Safety Division	Bioaerosol test chamber	Netherlands	www.tno.nl
FOI, Swedish Defence Research Agency	Bioaerosol test chamber	Sweden	www.foi.se
FOI, Swedish Defence Research Agency	Semi-closed test chamber	Sweden	
FOI, Swedish Defence Research Agency	Open field range	Sweden	
DSTL Porton Down, Chemical & Biological Detection, Detection Department	Closed chamber	United Kingdom	http://www.dstl.gov.uk
DSTL Porton Down, Chemical & Biological Detection, Detection Department	Semi-closed barn	United Kingdom	
DSTL Porton Down, Chemical & Biological Detection, Detection Department	Open field range	United Kingdom	
SUJCHBO, National Institute for NBC Protection	Large closed hall (expected operational in 2010)	Czech Republic	http://www.sujchbo.cz/index.php?option=com_content&view=article&id=5&Itemid=10&lang=en
FFI, Norwegian Defence Research Establishment, Protection Division	Bioaerosol test chamber with temperature /RH control	Norway	http://www.mil.no/felles/ffi/english/start/research/Protection_Division
FFI, Norwegian Defence Research Establishment, Protection Division	Semi-closed test chamber	Norway	
Wehrwissenschaftliches Institut für Schutztechnologien -ABC-Schutz (WIS)	Bioaerosol test chamber	Germany	http://www.bwb.org/portal/a/bwb/diensts/wis/aufgabe?yw_contentURL=/01DB022000000001/W26CJJLD253INFODE/content.jsp
DGA Maîtrise NRBC	Small wind tunnel	France	http://www.defense.gouv.fr/dga
DGA Maîtrise NRBC	Wind tunnel	France	
DGA Maîtrise NRBC	Confined chamber	France	
DGA Maîtrise NRBC	Field range	France	http://www.defense.gouv.fr/dga
Proengin	Tunnel	France	http://www.proengin.com/
Thales	Bioaerosol test chamber	France	http://www.thalesgroup.com
CSTB	test chambers; experimental office room	France	www.cstb.fr
Military Institute of Hygiene and Epidemiology	Glove box	Poland	
PvTT	Semi-closed test b-chamber	Finland	www.mil.fi/laitokset/pvtt

RADIOLOGICAL: At the moment, there are 12 facilities from 12 different organisations in 8 different European countries that could be identified for the testing of radiation detection systems.

The countries that have representation in RN testing facilities are: Austria, Belgium, France, Germany, Italy, Poland, Sweden, United Kingdom.

Table 5: Radiological testing facilities

Organisation	Facilities	Country	Contact
Seibersdorf Labor GmbH, Radiation Safety & Applications	test hangar for handling open radioactivity, source movement device	Austria	http://www.seibersdorf-laboratories.at
SCK-CEN / Institute for Environment, Health & Safety / Expertise group of RP Dosimetry & Calibration /Laboratory for nuclear calibrations	horizontal irradiation beam with Co-60 and Cs-137 sources; vertical irradiation beam with Co-60 source; panoramic irradiation beam with Co-60 and Cs-137 sources; neutron irradiation setup with Cf-252 sources;	Belgium	http://www.sckcen.be/en/Our-Services/RP_dosimetryand-calibration/Nuclear-calibrations
IRSN - Institut de Radioprotection et de Surete Nucleaire, DSU/SERAC/CTHIR	sources for radiation and ionizing radiation (irradiation multi-source 137Cs and 60Co, Generation X) and neutrons (irradiator VAN GOGH, throttle ALMOND); cell radiation panoramic cobalt 60 (cell IRMA) for performing exposure to gamma radiation;	France	http://www.irsn.fr/FR/larecherche/Principes_Organisation/Unites_de_recherche/unite-etude-recherche-suretenucleaire/unite-etude-analyse-specialisees-evaluationsurete/Pages/Centre-technique-d-homologation-de-linstrumentation-de-radioprotection-1289.aspx
CEA/Radiation Protection	Outdoor facilities for studies and training with radiation sources (liquid and enclosed sources) in a 0,5 ha enclosed and secured test field. Indoor facilities	France	http://www.cea.fr
DGA Land Systems / DGA	Outdoor and indoor facilities for studies and training with radiation sources (liquid, dust and enclosed sources) in a 35 ha enclosed and secured test field.	France	http://www.defense.gouv.fr/dga
FhG-INT (Fraunhofer Institute for Technological Trend Analysis)	radiation sources for testing of gamma and neutron detection systems, field tests	Germany	http://www.int.fhg.de
European Commission - Joint Research Centre (JRC), Institute for the Protection and Security of the Citizen (IPSC) Nuclear Security Unit	Different internal and external (open space) laboratories for handling sealed radioactive sources and special nuclear material; automated source movement device	Italy	http://ipsc.jrc.ec.europa.eu/facility.php?id=perla ,
CLOR - Central Laboratory for Radiological Protection	walk-in radon aerosol chamber	Poland	www.clor.waw.pl
FOI, Swedish Defence Research Agency	RN sources with a positioning track to irradiate at dose rates from 15-30 μ Sv/h to more than 100 mSv/h;	Sweden	http://www.foi.se/FOI/templates/Page_7555.aspx
HOSDB - Home office Scientific development branch	variety of RN sources, gamma spectroscopy	United Kingdom	http://scienceandresearch.homeoffice.gov.uk/hosdb/securityprotection/public-protection/explosives-weaponsdetection/index.html
National Physical Laboratory (NPL) Acoustics and Ionising Radiation Division	Wide range of radionuclide neutron sources (Cf-252, Am-Be, Am-B, Am-F, Am-Li). A 3.5 MV Van de Graaff accelerator for producing monoenergetic neutrons and thermal neutrons.	United Kingdom	http://www.npl.co.uk/
International Atomic Energy Agency, Seibersdorf Laboratories,		Austria	http://www.iaea.org

EXPLOSIVE: At the moment, 14 facilities from an equivalent number of organisations in 6 different European countries that could be identified for the testing of explosive trace detection systems.

The countries that have representation in explosives testing facilities are: France, Germany, Italy, Netherlands, Spain, and the United Kingdom.

Table 6: Explosive testing facilities

Organisation	Facilities	Country	Contact
MoD/DGA Land Systems	Energetic material laboratory; firing range	France	http://www.defense.gouv.fr/dga
French-German Research Institute of Saint Louis - ISL	explosives laboratory - firing range	France	http://www.isl.eu
LCPP, Laboratoire Central de la Prefecture de Police	Chemical laboratory	France	http://www.prefecture-policeparis.interieur.gouv.fr/labo_central/accueil.htm
CEA Le Ripault	Pyrotechnics facilities, protocols for explosives detection tests, explosives vapours generation benches , metrology adapted to explosives vapour generation.	France	http://www.cea.fr/le_cea/les_centres_cea/le_ripault
Service technique de l'Aviation civile – STAC	Test site at Biscarosse	France	http://www.stac.aviation-civile.gouv.fr
Home office/CTSI	Chemical and physical laboratory	France	http://www.interieur.gouv.fr/sections/a_l_interieur/la_police_nationale/organisation/dapn/dapn/view
MoD/DGGN/IRCGN	Forensic explosives laboratory	France	
MoD/ LQCA la maranosa	Explosives laboratory	Spain	http://www.mde.es/en/areasTematicas/investigacionDesarrollo/centros/la-maranosa/#sub1
SEADM	Chemical laboratory	Spain	http://www.seadm.com/
Fraunhofer Institute for Chemical Technologies ICT	Laboratory and test sites	Germany	http://www.ict.fraunhofer.de/EN/coreco/ES/fae/index.jsp
IUT Institut für Umwelttechnologien GmbH	Chemical laboratory	Germany	http://www.iutberlin.info/7.0.html?&L=http%3A%2F%2Fhonamfishing.co.kr%2Fphpmysqladmin%2Flibraries%2Fodzov%2Fneloze%2F
DSTL	Forensic explosives laboratory	United Kingdom	http://www.dstl.gov.uk
JRC, Joint Research Center Ispra, European Commission	Test site	Italy	http://serac.jrc.it/index.php?option=com_content&task=section&id=4&Itemid=31 ; http://www.jrc.cec.eu.int
TNO	E detection systems evaluation facilities (HME, liquid and solid, military, commercial explosives, homemade explosives (incl. liquid) explosives), bulk detection and trace detection; focus on aviation security detection systems	Netherlands	www.tno.nl

As mentioned earlier, the findings that were made totalled 68 facilities from 38 organisations in 15 different countries. While this is a large number of facilities we don't believe that this listing is complete or inclusive of all the facilities that exist in Europe.

Why do we believe this? In fact there are two main indicators; the first is that the country representation seems too little. Currently, there are only 15 countries that are listed while there are 27 in the EU alone. Of the remaining 12 EU countries there are large economies that aren't represented such as Bulgaria, Denmark, and Hungary. These countries are likely to have some program addressing CBRNE threats. In addition to the EU countries there are numerous countries at the periphery of the EU that could be of interest to us such as Russia,

Serbia, and the Ukraine. However, non EU member states have not been included in the search for testing facilities in the framework of Creatif.

There are caveats to the lack of country representation. It is understood or assumed that it is less likely for the smaller countries to have their own CBRNE detection system testing program and facilities to conduct the testing. Smaller countries might not have a standing army. A standing army is a pretty good indication that a given country is concerned by defence and that CBRNE threats are considered. It is also possible that certain countries perceive the threat levels that they face don't warrant their own program. Finally, it could be an issue of the cost associated with testing facilities. In some countries it might not be financially possible to have facilities of their own. Therefore, the absence of countries such as Malta, Luxembourg, and Cyprus could be explained by the issues mentioned above.

The next indicator that the list is incomplete is the listing of the facilities by threat category. Currently, there are only three countries (France, Germany, and the United Kingdom) that have facilities that address all four of the threat categories. It would seem more likely that a given country that has a CBRNE program would have facilities to address each threat independently. It is possible that some countries have prioritised certain threats above others. However, we believe that they would still have at least one facility for each.

With everything considered the obvious question is: What kept CREATIF from finding all of the facilities?

The answer is simply an issue of information. All of the information sought and found was "open source". By this we mean that the information is what could be found with a reasonable amount of work using sources such as the internet, trade papers, patents, news articles, scientific publications, personal contacts, and the like. No information gathered was from confidential sources. Confidential sources are those that require special clearances. The fact that we used open sources leads into the next couple of issues. National security is a large concern when dealing with CBRNE detection systems and their testing. Most countries treat this subject, CBRNE detection system testing, as a national security issue. They feel that it is in the countries best interest in not disseminating information regarding it. Essentially, they make secret their work in this area and in fact make everything surrounding this work secret, including the locations and very existence of the (military) testing facilities. A related issue is that of advertising. The lack of press, papers, or patents from test facilities might be for one of two reasons. First, it can be directed from the state not to draw attention to them or to suppress public releases due to national security concerns. The second reason may be of a more practical origin. The testing of CBRNE detection systems is largely a scientific endeavour carried out by scientists. As such it might not occur to them or be of any value to them to advertise in print, to create a website, or the like.

One concluding remark should be that any testing facility that is not listed in this or other CREATIF documents should not take offence. We have made efforts to find as many as we can. However, it's not always possible to find all of them.

3.3 Moving forward without a Joint Testing Facility

During the consortium meetings and also in the framework of the two CREATIF workshops it became clear very quickly, that existing testing facilities are not keen to be replaced by a joint testing facility, and also end-users prefer the close contact to “their” testing facility within a given country, mostly based on personal trustful contacts.

In addition to the general feeling in the consortium meetings, there is the position presented by the European CBRN Task force.

Box 1: Certification, trialling, testing in the EU

“...Finally, an EU-wide trialling scheme for detection solutions should be established whereby the performance of multiple new detection technologies could be assessed using identical or very similar scenarios. Such a system would make it easier to compare different technologies originating from various solution providers. The aim of the trialling scheme would be to identify promising solutions and technologies and help bringing them to the market.

The certification, testing and trialling schemes shall rely on existing capabilities and facilities in the Member States. The procedures are adjusted to the field of application of the devices. ...”

Source: p. 25 of EBSA_CBRN....report_2009.doc²²

The mandate from the CBRN task force is clear; they will have to move forward with testing without creating a joint testing facility. There were four additional reasons that were sighted, over the course of the Creatif project, as to explain why a joint testing facility was not desirable: national security, experts at home, economics, and certifications. To be fair, these reasons are interrelated but will be treated separately here.

As was mentioned earlier, CBRNE programs are most often considered to be critical to national security. The data involved in such activities is usually classified and as such would prove to be difficult if not impossible to exchange. Along with the data come the experts. Each country has an interest to keep experts in this field within their respective countries. Collecting them in one laboratory would still require having them within one member state, thereby potentially placing one nation in a position of advantage and the others disadvantaged. Economics also plays a part. Laboratory testing of detection systems can be a great source of income for a country. Again consolidation could potentially deny countries of this income. Finally, certification of testing centers is normally done on national level, so there is no specific need for a joint center from the viewpoint of the end-users. The discussion from the Certification Workshop on end-user preferences concerning testing and certification underlines this fact²³ (see p. 15, Beckmann et al. 2011).

²² DG JLS (2009): Report of the CBRN Task Force. 98 pp. Available online: http://ebsaweb.eu/ebsa_media/Downloads/Activities+_Projects/Biosecurity+and+Biopreparedness/CBRNupdate02_02_2009/CBRN+TF+Report_20_01_2009.doc

²³ See p. 15, Beckmann, J., Strelb, F., Ewert U.: Report on the Second CREATIF Workshop: “European Certification System for CBRNE Sensor Systems and Devices”. Deliverable report D.4.4, 25 pp.

What we can do to move forward?

Respecting all of the arguments that have been presented up to this point, we can still move forward. In fact, a joint testing facility is not a prerequisite for the advancement of testing but rather a good concept that has, by the community at large, been rejected. Additionally, it probably has not escaped the readers' attention that the purpose of this paper is addressing the things that can be done, even without a joint testing facility.

Recapping:

- Stakeholder assessments
- Terminology definitions
- System descriptions
- Assessment means and methods
- Performances reports
- Certification and
- All of the details surrounding each.

The central concept that will make forward progress possible as well as the achievement of all of the aforementioned items is that of cooperation and knowledge exchange. An increase in cooperation at three levels: the national level (Member States), European Union level (collectively), and internationally.

3.4 Current status of testing facilities in the US – the GRaDER program

Although this report is focused on the European situation, the leading position of the United States has to be considered, before creating a European roadmap. After 9/11 development of ANSI-N42 standards for homeland security instrumentation (HIS) has been pushed and four related IEC standards have been published recently. They have been applied in several test programs, such as the currently ongoing Graduated Rad/Nuc Detector Evaluation and Reporting (GRaDER) program, which applies ANSI-N42 standards as the initial acceptable performance baseline for radiation detectors. The GRaDER program is managed by DHS's (US Department of Homeland Security) Domestic Nuclear Detection Office (DNDO), together with NIST and laboratories certified within the Voluntary Laboratory Accreditation Program (NVLAP).

Citing from the GRaDER web-site²⁴, the testing process includes two phases. The first phase involves testing by laboratories participating in the NIST NVLAP accreditation process against existing unclassified, consensus based ANSI/IEEE N42 standards. Subsets of the requirements in these consensus standards are used to determine DNDO compliance levels. These subsets emphasise radiation detection performance capability first and then environmental and operational capabilities and limitations.

²⁴ http://www.dhs.gov/files/programs/gc_1218639594553.shtm

The second phase entails testing at DNDO sponsored government facilities against more challenging threat based government unique technical capability standards (to be published), and sources under realistic operational and environmental conditions.

In addition to these two phases of GRaDER testing, DNDO will implement a product surveillance program that will be conducted by NIST (see Figure 8). This will involve subsequent post-market testing and assessments of radiation detectors that have already been tested and evaluated under the GRaDER Program. Results of these post-market assessments may impact the standing of the radiation detectors identified within the GRaDER Program.

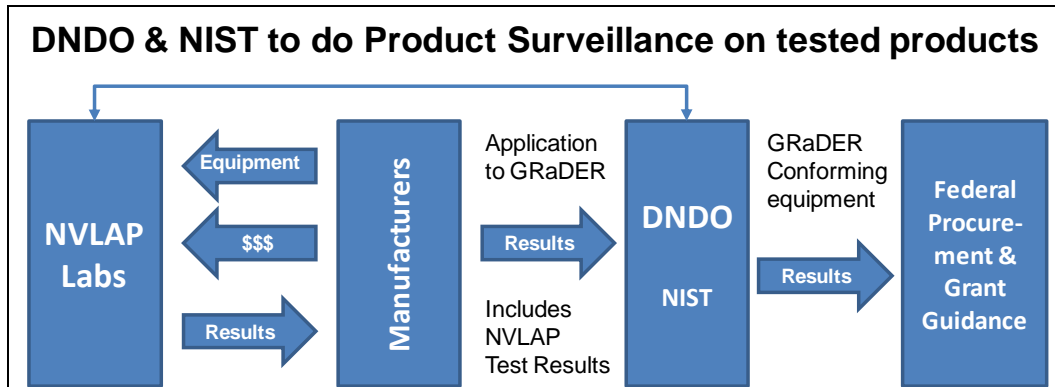


Figure 8: GRaDER Programme overview: two phases of evaluation of radiation detection equipment

Results of the GRaDER program testing will be made available to law enforcement and first responder agencies to support their procurement and grant awards processes, by provision of an equipment list - GRaDER Evaluated Equipment List (GEEL). This list contains also a classification of the instruments by using a compliance level (0-3).

All testing under GRaDER is voluntary and at the vendor's expense. Although, testing of equipment is not directly regulated by US-law, the development of the test programs is funded by the US government and manufacturers have to participate to be considered by governmental procurement. This procedure practically makes testing mandatory for all major companies selling such equipment in US.

This programme is a good model how testing facilities for CBRNE detection equipment can be engaged on a regular basis to the benefit of end-users and manufacturers. To some extent, the ITRAP+10 programme, organised by European Commission and implemented by the Joint Research Center in Ispra makes a similar attempt for Europe. In the near future, radiation detection equipment will be tested on the basis of uniform testing procedures (mainly based on IEC and ANSI standards identical to GRaDER project) developed by European testing experts in cooperation with IAEA and US nuclear testing experts. Still the programme is in the proposal phase. The main part of testing will be performed in Ispra in the JRC testing facilities, but subcontracting to other European testing facilities is foreseen and a respective call for tender has been published. The outcome of the ITRAP+10 project²⁵ will be

²⁵ From Call for tender: OJ/S S59, 25/03/2010, 86876-2010-EN: I-Ispra: illicit trafficking radiation assessment programme (ITRAP+10 project) — equipment 2010/S 59-086876. Available online: <http://web.jrc.ec.europa.eu/callsfortender/index.cfm?action=app.showdoc&id=5621>

a final report on the current technical level of commercially available equipment used in nuclear security. The final report will help define the general performance capabilities of each equipment class. The performance capabilities may be used to develop requirements for future equipment selection activities; however, no selection of specific instruments will be conducted as part of ITRAP+10. Also, it is made clear that this project cannot provide a comprehensive survey of this fast developing market. From the testing results, needs for improvements will be identified as necessary, including the user-friendliness for the use by non-specialist operators.

More information on the planned activities under ITRAP+10 can be found in the call for tender at the JRC web-site²⁶.

²⁶ <http://web.jrc.ec.europa.eu/callsfortender/index.cfm?action=app.tender&id=651&type=4>

4 International perspectives of testing

4.1 Standardisation at an international level

4.1.1 Relevant organisations

European Committee for Standardisation (CEN)²⁷

The CEN provides a platform for the development of European Standards and other technical specifications. These services facilitate business in Europe by removing trade barriers for European industry and consumers. The CEN has 31 members representing the national standardisation organisations of all 27 EU States, three States of the European Free Trade Association (EFTA), and Croatia.

The CEN is a partner with the other two European Union standards bodies: the European Committee for Electrotechnical Standardisation (CENELEC) and the European Telecommunications Standards Institute (ETSI).

International Organisation for Standardisation (ISO)²⁸

The ISO is widely recognised as the creator and publisher of international standards. It has published more than 18,000 international standards, covering a broad range of topics including aerospace, agriculture, defence, security, mechanical engineering and information technology. The ISO is a non-governmental organisation with its seat in Geneva. It is a network of national standards institutes from 163 States around the world. Its member institutes are either part of their national governments or mandated by them, or are private sector associations.

International Electrotechnical Commission (IEC)²⁹

IEC (International Electrotechnical Commission) is the world's leading organisation for the preparation and publication of international standards for all electrical, electronic and related technologies; these are known collectively as "electrotechnology". IEC provides a platform to companies, industries and governments for meeting, discussing and developing the international standards they require. All IEC international standards are fully consensus-based and represent the needs of key stakeholders of every nation participating in IEC work. Every member country, no matter how large or small, has one vote and a say in what goes into an IEC international standard.

Over 10,000 experts from industry, commerce, government, test and research labs, academia and consumer groups participate in IEC standardisation work. The IEC is one of three global sister organisations (IEC, ISO, ITU) that develop international standards for the world.

²⁷ All information consolidated from CEN homepages: <http://www.cen.eu/cen/pages/default.aspx>

²⁸ All information consolidated from ISO homepages: <http://www.iso.org/iso/about.htm>

²⁹ All information obtained from IEC homepages: <http://www.iec.ch/about>

European Committee for Electrotechnical Standardisation (CENELEC)³⁰

CENELEC is the European Committee for Electrotechnical Standardisation and is responsible for standardisation in the electrotechnical engineering field. CENELEC prepares voluntary standards, which help facilitate trade between countries, create new markets, cut compliance costs and support the development of a Single European Market. CENELEC creates market access at European level but also at international level, adopting international standards wherever possible, through its close collaboration with the International Electrotechnical Commission (IEC), under the Dresden Agreement. In an ever more global economy, CENELEC fosters innovation and competitiveness, making technology available industry-wide through the production of voluntary standards.

Through the work of its members together with its experts, the industry federations and consumers, European standards are created in order to encourage technological development, to ensure interoperability and to guarantee the safety and health of consumers and provide environmental protection.

4.1.2 Development of International / European Standards

Drafting a European standard

European standards are drafted in a global perspective. CEN has signed the 'Vienna Agreement' with the International Organisation for Standardisation (ISO) through which common European and international standards can be developed in parallel. More than 30% of the European standards adopted by CEN are identical to international standards. These EN/ISO standards have the dual benefits of automatic and identical implementation in 31 CEN Member countries, and global applicability. In addition to the EN/ISO standards, a number of ENs developed by CEN are closely linked to ISO standards³¹. In brief, the process of developing a European standard, is as follows (cited from CEN brochure, p. 6³⁰):

A proposal for a European standard may come from any interested party like National standards bodies, the European Commission (EC) or any other stakeholder. The appropriate CEN Technical Committee makes a decision on the adoption of the proposal. An adopted standardisation project is allocated to one of the Working Groups for the drafting of the standard. Working Groups respond to the Technical Committee. The draft of a European standard is prepared and then released for public comment, a process known in CEN as the 'CEN Enquiry'. During the public commenting stage, everyone who has an interest (e.g. manufacturers, public authorities, consumers, etc.) may comment on the draft. These views are collated by the National standards bodies and analyzed by the CEN Technical Committee. After careful consideration of comments from the CEN Enquiry, a final version is drafted, which is then submitted to the CEN Members for a weighted formal voting. After ratification by CEN, each of the National standards bodies adopts the European standard as

³⁰ All information was obtained from the CENELEC website:
<http://www.cenelec.eu/aboutcenelec/howeare/index.html>

³¹ see p. 4 and 6; CEN (2010): Compass – The World of European Standards. 12 pp. Available online:
<ftp://ftp.cen.eu/cen/AboutUs/Publications/Compass.pdf>

an identical national standard and withdraws any national standards which conflict with the new European standard. Hence one European standard becomes the national standard in the 31 member countries of CEN. Often national standards serve as basis for a European standard.

Adoption of IEC into CENELEC standards

The topic of CBRNE detection, as electronic devices, can be allocated to the responsibility of IEC and CENELEC, as they are dealing with electrotechnical standardisation. European experts participate mainly in IEC working groups, as it is very effective to influence the international standards at this early stage. Contribution to European Committee for Electrotechnical Standardisation (CENELEC) is less attractive, as adoption is often performed without major changes and does not offer so much influence. The lack of volunteer experts is probably one of the reasons for the long delay for adoption of IEC standards by CENELEC. This situation is also reflected in the current status of European standards for radiation detection equipment. For the important instrument types IEC standards are available, but they have not yet been adopted by CENELEC. The volunteer work model limits participation and contribution of experts, which result in a limitation of resources and performance. National or European funding for independent experts would speed up the adoption and push the release of CENELEC standards

The Dresden agreement³² regulates on a formal basis the cooperation between IEC and CENELEC in order to avoid duplication of standardisation work and an adoption of IEC standards by CENELEC (with or without jointly developed revisions) is a frequent and welcomed practice.

Without having signed any formal agreement, CEN-CENELEC-ETSI have more or less regular meetings (every 18 months) with ANSI - American National Standards Institute³³. Moreover, ANSI (and other national standardisation bodies) has official cooperation agreements with the international standardisation organisations (ISO, IEC); therefore the way forward from ANSI to IEC and further to CENELEC standards is well defined. It is only a question of the appropriate allocation of resources, how long it will take to transfer the existing testing standards to European ones.

4.2 Mutual recognition

Mutual recognition is an agreement between two or more organisations to recognise each other's processes, programmes, products, or services. For example, in higher education, it could mean that universities would validate each other's degrees, programmes, and the acceptance that their respective methodologies and procedures are operationally sound. Considering agreements between countries it could mean that each country recognises the others laws, certifications of one country could apply to the other, or products created in one country are marketable within the other. In either case, mutual recognition is at its most basic a trade facilitation mechanism.

³² Agreement on common planning of new work and parallel voting. IEC website:

<http://www.iec.ch/about/partners/agreements/cenelec-e.htm>

³³ CEN: <http://www.cen.eu/cen/AboutUs/CENnetwork/Relations/MoUs/Pages/default.aspx>

Within the European Union, the principle of mutual recognition has been formalised in Regulation (EC) No 764/2008 and is considered “one of the means of ensuring the free movement of goods within the internal market. Mutual recognition applies to products which are not subject to Community harmonisation legislation, or to aspects of product falling outside the scope of such legislation.”

In the EU context, mutual recognition allows that products created, tested, marketed, and the like in one Member State to be automatically accepted to be marketed and sold in another. This removes the possibility of the creation of a trade barrier in disguise.

The legal form that mutual recognition takes is that of a mutual recognition agreement (MRA) which is an internationally accepted bilateral agreement. MRAs are overseen by the World Trade Organisation based on that organisations governance of the conformity assessments. Conformity assessments are typically based on the technical rules of each country. Technical rules are “*rules laying down requirements to be met by those products, such as rules relating to designation, form, size, weight, composition, presentation, labelling and packaging.*”³⁴

Often accompanying a mutual recognition agreement there is an outward exhibition of the shared mutual recognition. Within the European Union, this outward exhibition comes in the form of the CE marking. The CE marking is introduced into the common understanding in Regulation (EC) No. 765/2008m, Chapter IV: CE MARKING. You can see it affixed to everything from food to electronic devices.

Therein is a problem. Under the current system using the CE marking a CBRNE detection system can get the CE marking and yet be forced to go through the testing process again. Essentially, a detection system developed in one country will go through that country’s testing procedures typically at its national laboratory. Thereafter it is certified for sale within that country. It is also usually allowed to place the CE marking on the system stating that it conforms to the technical rules of the countries of the European Union. The CE marking is masking the underlying issue that the European Union has not come up with a harmonised set of testing procedures or processes for verifying detection capabilities of CBRNE detection systems.

The majority of the work outlined in this document to be done on the future of testing is essentially geared to creating a situation where we can be in a position to enter into mutual recognition agreements between member states for CBRNE detection systems based on a shared set of testing procedures.

In addition to the actual work of creating the testing procedures we have to have a convenient way of showing the mutual recognition. We cannot simply use the CE marking for the reasons described earlier. Therefore, what is needed is a CBRNE certification label or a security label. This was mentioned earlier during the certification portion of the text. Also see Deliverable Report D.4.1-D.4.3 on certification strategies³⁵. Such a label must be able to assure: privacy, reliability, availability, integrity, continuity, accuracy, safety, confidentiality, and authenticity.

³⁴ Regulation (EC) No 764/2008 of the European Parliament and of the Council Regulation (EC) No 764/2008 of the European Parliament and of the Council of 9 July 2008

³⁵ Beckmann J., Strebl F., Ewert U., Schröttner T., Geringer, T. (2011): Strategies, preconditions and rules for an internationally accepted CBRNE certification system. Deliverable Report D.4.1 – D.4.3. 48 pp.

The benefit of such a label would remove the CE masking and would provide real benefits such as:³⁶

- A catalyst for investment by the European security-related industry and service providers and attract new investors to the security sector, introducing a new business model supported by public-private-partnership (PPP).
- Provide a framework to enhance the competitiveness of European security-related industry and service providers.
- Provide a reference for the performance of security-related systems, processes and services (implying importance of a strong, concerted European competence in the field of standardisation and certification).
- Assist in all phases of risk management.
- Provide basic criteria upon which to base decision making regarding the acquisition and implementation of security products, processes, services.
- Inform and reassure the citizen.
- Contribute to a more secure European society and economy and provide an answer to the present state of real and perceived security/insecurity in Europe and the Member States.

Once everything has been sorted out within the European Union, we could then start to look at creating mutual recognition agreements with other regions such as the United States and others.

In addition to the problems within Europe regarding mutual recognition and recertification there are issues, particularly with countries like the United States. In a similar fashion, the detection systems that are manufactured here are subject to recertification if they are to be sold in the United States. Essentially it can be seen as a barrier to entry into the American market as it can be very costly to go through the process of certification in the United States.

A mutual recognition agreement between the European Union and the United States could be seen as an attempt to level the playing field with respect to this industry.

4.3 The United States NVLAP program

4.3.1 Program Summary^{37, 38}

In the United States of America, the National Institute of Standards and Technology (NIST) administer the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP provides accreditation services through various laboratory accreditation programs (LAP). Each LAP includes specific test or calibration standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration.

³⁶ Excerpt from a speech given by Mark Miller on the European Security Initiative at EASC09 in Stockholm Sweden. Available online: <http://www.itsallon.tv/media/CC/09.10.02.easc.cc.1020D.pdf>

³⁷ <http://www.nist.gov/pml/nvlap/about-nvlap.cfm>,

³⁸ <http://www.nist.gov/pml/nvlap/>

NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests.

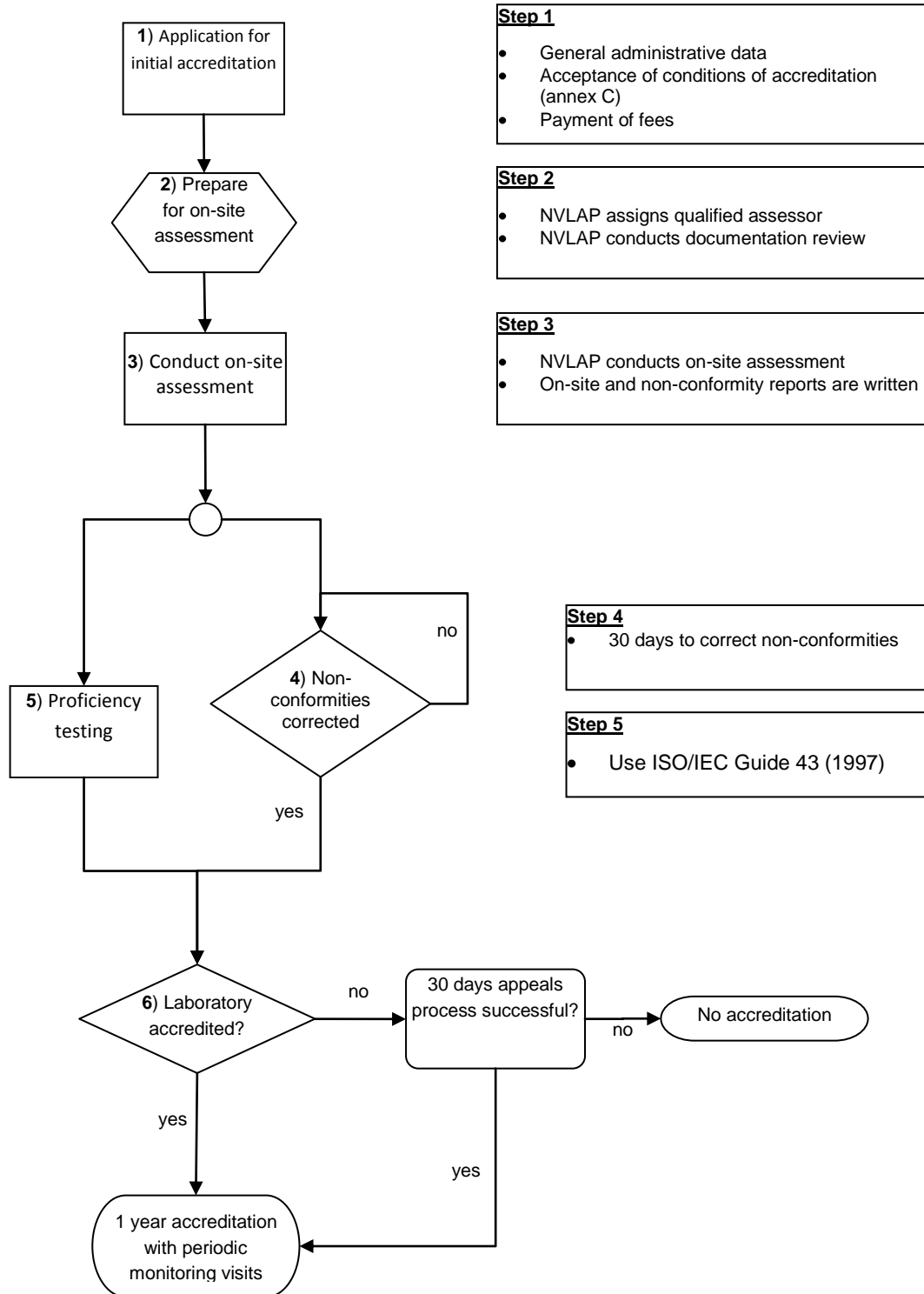


Figure 9: Summarised NVLAP accreditation procedure³⁹

³⁹ Derived from: National Institute of Standards and Technology Handbook 150, 2006 Edition, Natl. Inst. Stand. Technology Handbook 150, 2006 Ed., pgs. 14-23

Accreditation complies with ISO/IEC 17011, *Conformity assessment - General requirements for accreditation bodies accrediting conformity assessment bodies*. Furthermore, the requirements are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), *NVLAP Procedures and General Requirements*, and encompass the requirements of ISO/IEC 17025.

The process for accreditation is presented in a summary fashion in Figure 9. The process can be thought of as having six steps summarised as:

1. Application for accreditation
2. Preparation for the on-site visit
3. Conduct of the on-site visit
4. Correction of non-conformities
5. Proficiency testing
6. Decision of accreditation.

Once the process has been successfully completed, a certificate of accreditation and scope of accreditation are publicly announced. Additionally, the most visible recognition of successfully completing the accreditation process is that of the NVLAP marking. Any laboratory accredited can use this symbol on all forms of correspondence.

4.3.2 Laboratories outside of the United States

Figure 9 illustrates the basic procedure for accreditation in the NVLAP program. This basic scheme is the same for all laboratories worldwide. For those laboratories that are outside of the United States there are a couple of additional conditions that have to be considered. These are listed in annex D of the NIST Handbook 150. There are three basic conditions, namely **Language assistance** (under NVLAP, All documentation, correspondence, and discussion are to be done in English); **Fees** (all additional fees associated with the application being processed outside of the United States will be calculated and paid at the time of application); and **License** (a laboratory will need to obtain a license for export for any materials that the United States deems as sensitive, e.g. CBRNE reference sources).

4.3.3 CBRNE testing laboratories

Before any laboratory that is dealing with CBRNE detection system testing and calibration could apply for accreditation in the US using the NVLAP system, it would be necessary to evaluate the existing laboratory accreditation programs (LAPs). The evaluation would be done with the goal of finding any applicable LAP. With a rather brief internet search it is possible to find a few relevant LAPs which are listed in Table 7 below.

Table 7: CBRNE Relevant LAPs⁴⁰

Relevant LAP	
<p><u>NIST Handbook 150-2D:2004</u> <u>NVLAP Calibration Laboratories, Technical Guide for Ionizing Radiation Measurements</u></p>	<p><u>Lab Bulletin LB-37-2008: NVLAP Assessment of Calibration Laboratories with Field Locations</u></p> <p><u>Lab Bulletin LB-25-2007: Revisions to NIST Program-Specific Handbooks 150-2A through 150-2H</u></p>
<p><u>NIST Handbook 150-4:2005</u> <u>NVLAP Ionizing Radiation Dosimetry</u></p>	<p><u>Lab Bulletin LB-49-2010: Selection of Beta and Photon Categories for Mixed Field Testing</u></p> <p><u>Lab Bulletin LB-46-2009: Revised ANSI N13.11 and ANSI N13.32</u></p>
<p><u>NIST Handbook 150-23:2010</u> <u>NVLAP Radiation Detection Instruments</u></p>	<p>none</p>

What should become immediately apparent is that the only CBRNE threat that has any coverage at all in this table is the radiological and nuclear threats. This is probably simply a reflection of the advanced state of testing relative to the other threats. What this table should be telling our community is that if we want to get NVLAP accreditation, we will have to work hard to define the elements of the LAP such as test, protocols, etc. for the remaining three threats as well as a lesser amount for radiological and nuclear.

4.3.4 LAPs established by request

Once we have completed our preliminary work we will have to request that a new LAP be created for at least each threat. More likely we will have to make several LAPs per threat. The procedure is summarised below. It is usually initiated by a request made in writing to the Chief of NVLAP. Each request must include:⁴¹

- a) the scope of the LAP in terms of products, testing services, or calibration services proposed for inclusion;
- b) specific identification of the applicable standards and test methods, including appropriate designations, and the organisations or standards-writing bodies having responsibility for them;
- c) a statement of the perceived need for the LAP;
- d) an estimate of the anticipated demand for the program, including the number of laboratories that are likely to seek accreditation and an estimate of the number and nature of the users of such laboratories;
- e) a statement of the extent to which the requestor will support necessary developmental aspects of the LAP with funding and personnel.

Essentially, based on a-e, the Chief of NVLAP will decide if a LAP is necessary or possible.

⁴⁰ <http://ts.nist.gov/Standards/Accreditation/handbook.cfm>

⁴¹ National Institute of Standards and Technology Handbook 150, 2006 Edition, Natl. Inst. Stand. Technology Handbook 150, 2006 Ed., p. 18

4.3.5 Going worldwide with accreditation of testing laboratories (ILAC)

The International Laboratory Accreditation Cooperation (ILAC) started in 1977 with the aim of developing international cooperation for facilitating trade by promotion of the acceptance of accredited test and calibration results. In 1996, ILAC became a formal cooperation with a charter to establish a network of mutual recognition agreements among accreditation bodies that would fulfil this aim. The ultimate aim of the ILAC Arrangement is the increased use and acceptance by industry as well as regulators of the results from accredited laboratories and inspection bodies, including results from laboratories in other countries. In this way, the free-trade goal of 'product tested once and accepted everywhere' can be realised.⁴²

NVLAP is a signatory to the multilateral mutual recognition agreement the (ILAC arrangement). Laboratories and accreditation bodies from more than 70 economies have signed the "arrangement". Therefore, it is conceivable that once the work of this document and the laboratory accreditation in particular has been completed, CBRNE specific laboratories should enjoy a completely harmonised environment.

In fact, ILAC is the bridge between US and European accreditation systems, as most European national accreditation bodies are represented both in EA – the European Cooperation for Accreditation, which is a regional member of ILAC and ILAC itself and use it as a platform for cooperation and information exchange. Also, the certification concept developed in WP4 acknowledges the membership in EA as a suitable means for establishing a certification system (see p. 39 of Creatif report D.4.1-4.3⁴³), as EA promotes a transparent and quality-led system for the evaluation of the competence of conformity assessment bodies throughout Europe, the same is done by ILAC on international level.

4.4 The US Safety Act⁴⁴

Another possible avenue for mutual recognition or even preferential treatment for European detection manufacturers and testing laboratories in the United States is that of the US Safety Act. The Support Anti-terrorism by Fostering Effective Technologies Act of 2002 (Safety) has been created to facilitate the development of effective anti-terrorism technologies. The program applies to products, services, and software and other forms of intellectual property. Specifically, it covers products like detection systems, services such as screening and scanning services, and testing, and software such as decision support software.

Table 8, provides a concise summary of the Safety Act. There are three levels of effectiveness: DT&ED (Developmental Testing & Evaluation Designations), Designation, and Certification.

⁴² www.ilac.org

⁴³ Beckmann J., Strelb F., Ewert U., Schröttner T., Geringer, T. (2011): Strategies, preconditions and rules for an internationally accepted CBRNE certification system. Deliverable Report D.4.1 – D.4.3. 48 pp.

⁴⁴ Information consolidated from a source document: U.S. Department of Homeland Security, (2011): Safety_Act_101_briefing

Table 8: Safety Act Award Summary

	DT&ED	Designation	Certification
Effectiveness Evaluation	Needs more proof but potential exists	Proven effectiveness (with confidence of repeatability)	Consistently proven effectiveness (with high confidence of enduring effectiveness)
Protection	Liability cap Only for identified test event(s) and for limited duration (≤ 3yrs)	Liability cap for any and all deployments made within 5-8 year term	Government Contractor of Defense (GCD) for any and all deployments made within 5-8 year term
Additional Benefits		<ul style="list-style-type: none"> • Exclusive action in Federal Court • No Joint and Several Liability for non-economic damages • No punitives or prejudgment interest • Recovery reduced by amounts from collateral sources 	<ul style="list-style-type: none"> • Benefits of Designation + Certification • Assert Government Contractor of Defense ; even if not selling to a Government entity Includes services and COTS • Placed on SAFETY Act's Approved Product List for Homeland Security

Effectiveness should be a key concern; it is most usually associated with the testing methodology and testing protocols. In this case, operational testing is the focus.

The operational criteria includes but isn't limited to:

- Evidence of performance metrics, including:
- Probability of Detection
- False Positive and False Negative Rates
- Limits of Detection (and why that limit is relevant)
- Interferents
- Maintenance and Training

Additionally, a proven track record in past deployment, proof of favourable internal and external audits, positive customer feedback and a documented Quality Assurance plan are all considered. It should be noted that with respect to the three levels, DT&ED is typically awarded for prototype devices that have only been tested in the laboratory. It is recognised that European laboratories are lagging in the field and should attempt to catch up.

The other two levels, designation and certification have roughly the same level of operational testing. The difference lies mainly in the added emphasis of performance in real world situations.

Key considerations when determining performance include:

- Consistent positive results (e.g., long-term low failure rates and false alarms)
- Reliability/Availability is high
- Performs in accordance with performance specifications
- Installation, use, maintenance procedures proven
- Documented processes (e.g., training, hiring, technology refresh) are being followed
- Standards are identified and met
- QA/QC processes are effective

It probably goes without saying that the goal for any Safety Act evaluation of any European CBRNE detection system, service, or software would be that of getting “Certification”. There are the obvious benefits that have been mentioned earlier. The one great additional benefit is that of the Safety Act marking.



After the successful certification this label can be affixed to the product, or used in any correspondence, advertising or the like for services and software applications. This is a highly visible and highly valued assertion of quality.

5 Summary and Conclusions

- The current situation with respect to the testing of security products is not an ideal one. The market is disjointed. The testing procedures are not harmonised. In many fields, there is no standardisation. The work from outside of Europe is not being considered. The accreditation scheme for laboratories is not commonly used for testing facilities.
- All threats (CBRNE) are at a different point of development with respect to their detection systems as well as their testing protocols and standardisation.
- A program towards the development of EU wide testing standards is required. Followed by either international standardisation or full mutual recognition of the standards.
- Both military and civilian organisations and all relevant EU programmes (like NDE network, ERN-CIP) need to work together
- There is a need for three types of testing: laboratory, human factors, and operational testing. To get a more precise estimate of overall performance all three testing results need to be considered.
- Scenario based testing may prove to be the most effective form of testing.
- Round robin exercises could be proposed as a tool to compare test results from different laboratories and provide a means of quality assurance for testing.
- There is an insufficient amount of discussion between manufacturers and end-users. A greater inclusion of all stakeholders is required.
- For RN-detection, there are suitable standards (ANSI) for testing detection systems, so don't reinvent the wheel, only a transfer to international (IEC or CENELEC) standards is desirable.
- There needs to be increased cooperation between national, regional, and international standards bodies such as: ANSI, CEN, CENELEC, IEC, IAEA, ISO, etc.

- Accreditation of the testing facilities and the worldwide acceptance of the accreditation is a final goal. It is possible to have different levels of accreditation based on the capabilities of the laboratory.

- The proposed roadmap for testing should be considered:
 - Stakeholder assessments
 - Terminology definitions
 - System descriptions
 - Assessment of means and methods
 - Performances
 - Certification and accreditation

- The joint testing facility concept has not been accepted by the stakeholder community due to different reasons. Therefore, identifying, contacting and including all of the laboratories are even more crucial to provide a good coverage of testing services throughout Europe.

- A medium term goal would be to gain mutual recognition of the testing protocols and laboratories between US and Europe. Some of the methods that are available are US Safety Act, the NVLAP program, and bilateral or multilateral mutual recognition agreements through organisations such as ILAC.