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PROMOTE

Efficiency control and performance verification
of improved approaches for soil-groundwater protection and
rehabilitation

Specific Targeted Research Project
Thematic priority: Global Change and Ecosystems

ANALYSIS OF VERIFICATION SYSTEMS

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1 Introduction

In the last few years great efforts and progress have been made to develop innovative, improved on-site and in situ remediation techniques, site characterisation tools and monitoring approaches for soil and ground water systems. Their application is efficient in terms of costs, time and reliability of results. Although these facts are known, the technologies and approaches available still face several barriers to being accepted and implemented. This is due, among others, to a lack of understanding of their role in site characterisation, monitoring and remediation by the authorities, regulators, service providers and potential users and a lack of confidence in the effectiveness of these techniques due to lack of independent evidence on their performance. Convincing the market of the merits of their environmental technology is often very difficult for producers, and especially for SME's (small and medium sized enterprises). Establishing a mechanism to validate objectively the performance of these products would increase purchasers' confidence in new environmental technologies.

1.1 Development process

Academics and technologists have stated over the years that the use of sensors will expand enormously in determining chemical parameters in the environmental field. Over the years development of in situ monitoring and characterization techniques has been a matter of technology push by a small group of institutes and companies. Scientists have lots of new ideas, which they feel are important from a technical point of view and which should get funded. Decision makers on contaminated land issues however are commonly not interested in developments on data acquisition techniques. The existing techniques are effective, so why invest money. They think in terms of risk management and benefits to a decision making process. Often the benefits of developments cannot be substantiated immediately. Also since the number of developers and marketers is small, decision makers assume that there is enough of a commercial interest to do the developments. Developments however are costly and time-consuming. Hence the classical dead lock, what comes first. The money to develop and show the benefits of the idea, or the final instrument that, in the opinion of potential clients concerned, of course is then assumed to gain a widespread use because the benefits will be self evident. The latter is not true since clients want to use proven technologies and hesitate to be the first time buyers of the service.

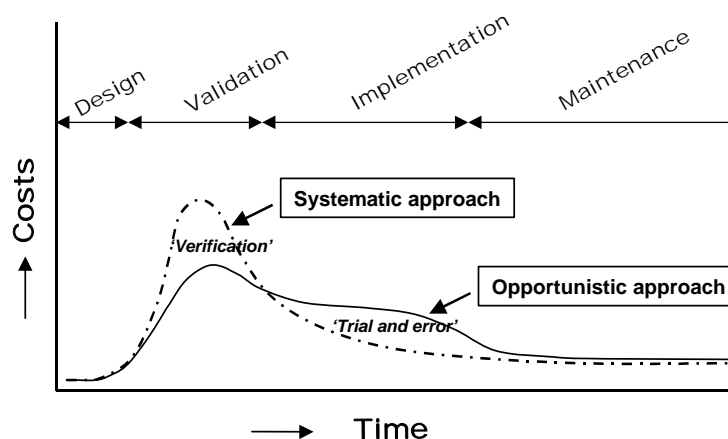


Figure 1.1: the investment curve for two approaches in instrument development and implementation.

Phases that can be distinguished in technology development are:

- design and build,
- validation,
- implementation and optimisation and
- maintenance.

At each stage different parties have to be involved given the focus of each phase. Amongst these are sensor developers, instrument builders, sales organisation, consultants, contractors and commercial clients from industry and government etcetera. This makes the development process not only complex from a technical point of view, but also from an organizational point of view.



Figure 1.2: development stages

1.2 PROMOTE

The overall aim of PROMOTE is to set up an efficiency control and performance verification (ETV) system for soil-groundwater protection and rehabilitation based on a more generic testing and performance verification concept, in a network of testing centres. This is in direct accordance with the European Technologies Action Plan, as the Action Plan aims at removing obstacles so as to tap the full potential of environmental technologies for protecting the environment while contributing to competitiveness and economic growth.

A strong impact of PROMOTE is to be expected concerning a faster market introduction of novel techniques hence strengthening the competitiveness of technology developers in Europe. This guaranteed by an extensive integration of SME's and Eastern European partners. PROMOTE will gain the potential to act as a germ cell of a pre-normative verification system, overcoming implementation barriers and bridging the gap between innovative and standardised techniques.

1.3 Work package 1

PROMOTE is organised in several work packages. In each work package the activities will be carried out by a group of partners from different member states. This report deals with the activities for work package 1, mainly carried out by the partners DECHEMA and GeoDelft. The objectives for work package 1 are summarised as follows:

- Generating a comprehensive overview of existing approaches for validation and verification as well as on actual strategies to develop ETV systems;
- Identifying common elements of a validation and verification system to be developed for and used by different Member States within their legislative framework;
- Identifying non-technical aspects such as the roles of different stakeholders, economics, relation to existing standardisation and quality control procedures together with WP3;
- Establishing of an overall assessment and guidance for the identified information needs, criteria and conditions to be fulfilled in the development of an efficiency control and performance verification system for in situ monitoring and remediation techniques.

2 Barriers encountered

Many small and medium sized enterprises (SME's) find difficulties in accessing the market with their newly developed technologies. Most of the difficulties are caused by lack of funding for the overall costly process. The lack of funding is usually due to little interest of the problem owner (Van Ree, 2001)

Small businesses can be divided into two categories: developers and users. Developers include small businesses and entrepreneurs who seek to create and market new environmental technologies. Users, in this field, are small businesses that seek financing in order to adopt environmental technology for compliance.

From the phase of development to commercialisation three phases can be distinguished:

- Technology creation
- Product development
- Early Commercialisation

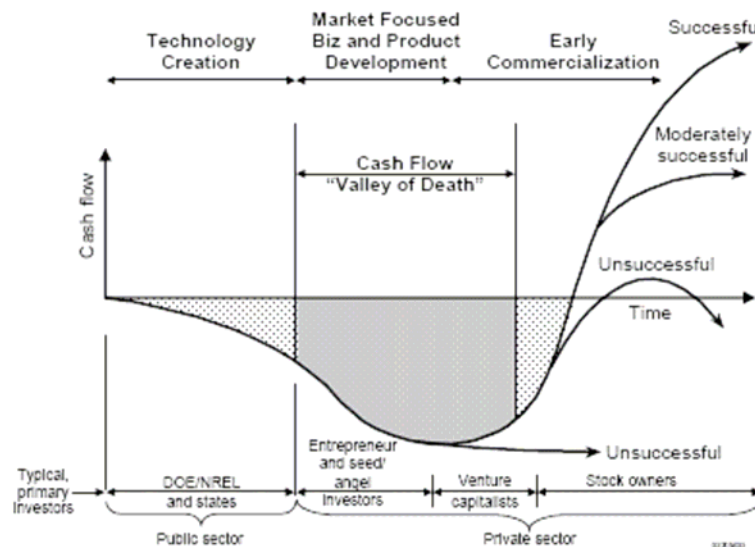


Figure 2.1: Commercialisation stages correlated with financing sources and cash flow for the venture.
After Murphy, M. et al., 2002.

In the phase of technology creation the stages of 'idea development' (product conceptualisation, initial drawings, calculations, theoretical validation) and 'proof of concept' (construction of a rough yet functioning model of the technology) can be recognised. Typical amounts of funding needed in the stage of concept prove or qualification for start-up capital is estimated to be in the order of magnitude of \$US 25,000 to \$ US 500,000 (Murphy, M. et al., 2002).

Product development includes the phases of 'pilot' (making an actual working version of adequate technical quality testing the technology's operating performance), 'prototype' (last model built before the use of any production machinery), and 'application/demonstration' (market ready model manufactured in a limited production run to be used in 3rd party testing). Typical amounts of equity financing rounds for complete product development and initial marketing will be about \$US 500,000 to \$US 3,000,000 (Murphy, M. et al., 2002).

Especially the demonstration/application phase requires a great amount of private sector funding due to the lack of available government funding.

For most small businesses and start up companies the source of capital in the early stages is from (personal) savings and small investments from family and friends. Research and development money is obtained from foundations and governmental sources (local, regional and national, European). These resources are usually depleted before the entrepreneur has a final model or has commercialised the product, plunging the entrepreneur into the valley of death (see figure 2.1).

Demonstration activities require substantial amounts of capital. For the early R &D stages much public funding is available. Demonstration, however, is hardly ever funded by governments. Besides that venture capitalists and potential customers usually wait until a technology has proven itself in the demonstration (after the product has become established in the market) before making an investment or purchase. Private sector investors focus their resources and efforts on market focused businesses with good profit potential - not technologies.

Small businesses will therefore encounter great difficulties in getting funding for reaching the commercialisation phase. At the time of demonstration all financial sources will already be depleted.

2.1 Barriers to obtain funding

In a study of the American Small Business Administration several financial barriers to obtain funding were found. They include (Bridging the valley of death: financing technology for a sustainable future, U.S. Small Business Administration, December 1994):

- Entrepreneurial obstacles: entrepreneurs often lack business skills. This is often the reason why environmental technology deals are being turned down;
- Regulatory obstacles: multiple permitting requirements at various levels of government, lack of material explaining the process, and delays up to several years are examples. Usually small companies do not have enough money, the expertise and personnel available to survive the process. For investors the main issue will be the uncertainty of the process to predict any possible return;
- The permitting process – market fragmentation: member states authorise processes while being more stringent in adoption of European regulations. Besides that permits are often granted on a site specific basis and not on a technology. As a result market will be partitioned into many regional and local regulatory districts. Each district requires new testing and demonstration procedures, creating a high level of inefficiency;
- Regulatory uncertainty: developers evaluate their technology on basis of existing regulations and the expectance of their prolongation. However, after a significant amount of time and money spent on developing the product, the regulations may be altered or even rescinded. The products needs rendering in that case;
- Testing: demonstration stages of environmental technology's development is a critical step, since demonstration is needed for permissions, and potential customers and investors. However, full scale testing under real-world conditions is costly and there are few sites available. One reason for the lack of testing sites is the inability of developers to gain permission from potential costumers to use their sites;

- Technology lock in: customers refuse to make use of technologies that are innovative and not approved yet. Customers rather keep using technology on which standards are based and that are described in control technology guidance's. This is called technology lock in and will even account for a less expensive and more effective technology;
- Lack of information: up to date and accurate information is critical to investors and developers to assess the market's needs. Such information is often absent due to the industry's reluctance to publicize their environmental problems. Because of the tendency to shield themselves from negative publicity they will not disclose environmental technologies developed in company, thus hiding environmental solutions from the market place;
- Government technology programs focus on R & D aspects of technology development but provide little or no assistance for commercialisation of technologies;
- Financial institutions often lack familiarity with the industry. They won't invest in any project because they do not sufficiently understand the industry.
- The side-effect of public-sector financing: entrepreneurs usually are not aware of the impact of dependence on public-sector financing may have. Although very important and appropriate, public-sector financing can be interpreted by private investors as an indication that the venture is not market focused and is still in the R&D stage (Murphy, M. et al., 2002).

2.2 Technical & regulatory barriers

Besides these barriers in funding the ETAP Soil Protection Issue Group (ETAP Discussion Paper, July 2003) has identified several barriers that are holding back development, diffusion and use of specific technologies in the field of contamination of soil and groundwater (assessment, characterisations, investigation, technologies).

- Lack of acceptance of potential end-users
- Gap between knowledge of scientists and end-users
- Lack of service providing role of the municipalities (lack of qualified and trained people)
- Lack of harmonised and comparable standards for soil analysis and lack of Soil Management Policy throughout the EU
- Limitation in developing standards and standardised methods: high costs in relation to relative small market
- Lack of recognition of the value of best practices in site characterisation
- Lack of EU-wide good quality data, knowledge and understanding

2.3 Barriers EETV takes care off

The "Valley of Death", as shown in figure 2.1, should be overcome by EETV by co-financing. The financial barriers, as described in 2.1, show that funding is required, and funding requires stakeholder support.

The "technology lock-in", as described in 2.2 should be overcome by providing an EETV logo. Education could overcome the lack of knowledge and business, while publications help to overcome the lack of government focus on commercialisation.

The disharmonised regulations in the MS show that it is necessary to add all regulations to the verification protocol.

3 Existing ETV systems

Environmental Technology Verification (ETV) is a recent development that started in the USA in the mid 90's. The objective of these systems is to accelerate market acceptance of innovative technologies by providing users with impartial information about the technology's performance, thereby reducing user's and purchaser's uncertainty and scepticism (IPTS).

Basically two different types of environmental verification systems can be distinguished worldwide. They comprise the American ETV system and the Canadian ETV system. The other systems, like for example ETV systems in Korea, Japan, and China, are all derived from the American or Canadian ETV model.

The difference between the two systems can be seen in the fact that the Canadian system verifies claims from the technology owner while the American model makes public the technology performance without judging the result. Both systems have advantages and disadvantages.

The run time of both systems is over a year, which is considered too long by technology vendors. The American system is very expensive, approximately € 200,000.- for each technology, each year. No information about the costs of the Canadian system can be found, but the costs are probably comparable to the American system, because in both systems the same steps are performed. Because of these disadvantages, the European system should not be a copy of one of these systems, but a new system that uses the advantageous elements.

The two different models are discussed below. A more detailed elaboration on all worldwide ETV systems, including the systems derived from the USA and Canadian models is given in appendix 3.

3.1 ETV USA

In the US model, the program managing organisation has the testing of the technology entirely performed by one of its partners, a third verification organisation. The US model aims to make public the technology performance data without judging the results. ETV USA evaluates and verifies. It does not certify (IPTS, 2005).

The ETV program operates as a public-private partnership through cooperative agreements between EPA and private non-profit testing and evaluation organizations. These ETV verification organizations work with EPA technology experts to create testing procedures that verify the performance of innovative technologies. Market input is conveyed by the active involvement of stakeholder groups consisting of technology buyers, sellers, permittees, consultants, financiers, exporters and others within each sector. EPA research professionals and their verification partners - private sector testing organizations selected through peer-reviewed competition - work with more than 800 stakeholders in 18 separate stakeholder groups to facilitate performance evaluation of innovative, efficient, and cost-effective environmental technologies.

Any technology vendor within each technology category selected by stakeholders for verification is welcome, but in no way required, to participate (www.epa.gov/etv/).

Verification activities are announced in relevant publications, and on the ETV website and ETV list server. Test plans are prepared with developers and tests are conducted by independent third parties. Verification statements, based on the performance data in the

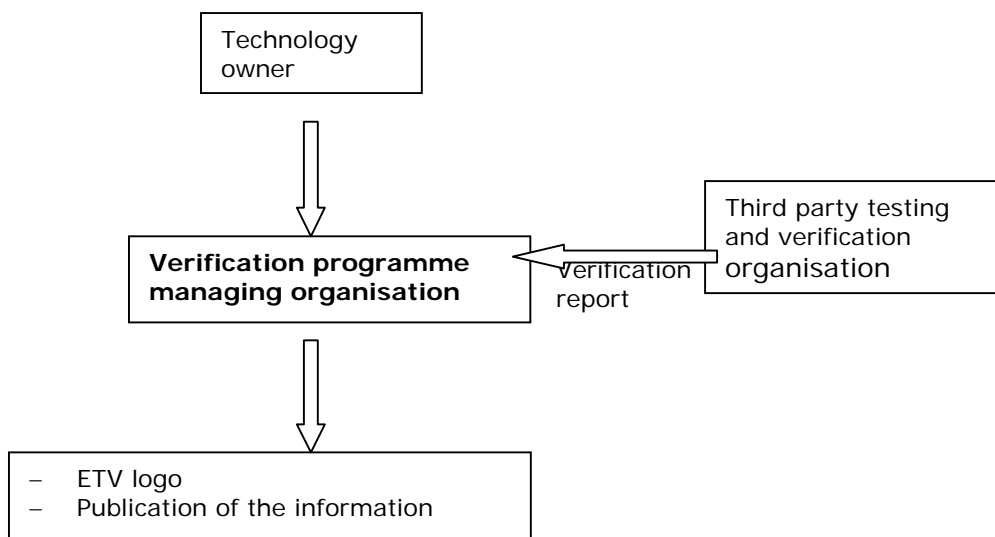
reports, are signed by EPA and the verification organisation, and are published on the ETV website.

ETV operates five centres (www.epa.gov/etv/): ETV Advanced Monitoring Systems Centre (Battelle), ETV Air Pollution Control Technology Centre (RTI International), ETV Greenhouse Gas Technology Centre (Southern Research Institute), ETV Drinking Water Systems Centre (NSF International), ETV Water Quality Protection Centre (NSF International), ETV P2 Coatings and Coating Equipment (pilot) (Concurrent Technologies Corporation), ESTA Environmental and Sustainable Technology Evaluations.

Vendors and others in the private sector, as well as government agencies (federal, state and local), share their costs with EPA to set up ETV protocols and verifications. Over the last decade, funding of the programme increasingly relied on private financing. Subsidies were diminished from about US \$ 10 million (equals € 7.7 million) per year in 1995, to about US \$ 2 million (equals about € 1.5 million) each year (source Theresa Harten, EURODEMO-PROMOTE-TESTNET joint meeting, March 2006)

The efforts of ETV centres are guided by the expertise of stakeholder groups. These groups consist of representatives of verification customers for a particular technology sector: buyers and users of technology, developers and vendors, state and federal regulatory personnel, consulting engineers, environmental organisations, financiers, and underwriters. The groups of stakeholders help to set priorities in verification of technologies, and review all protocols and operating procedures (Round Table (II), 2005).

In the figure below the flow diagram of the system is given (IPTS, 2005).



USA Model

applied in USA, Japan, South Korea

Flow diagram of USA ETV system operated by EPA

The verification process itself is described as follows (<http://www.epa.gov/etv/vendors/process.html>):

ETV USA is open to any technology, but to manage the development of protocols and efficiently operate the program, stakeholder groups are asked to help in setting technology testing priorities. After a category of technology is selected, the search for all

technology vendors in that category who might be interested in verification begins.

Technology Categories

To organize and set priorities for its verification activities, ETV identifies specific categories of environmental technologies. The technology categories are selected jointly by the ETV partner organization and stakeholder groups. Technology categories are under continuing review by the stakeholder groups and frequently change to reflect the changes in the marketplace. In general, stakeholders apply three criteria in setting priorities among technology categories:

- existence of an important environmental problem to be addressed,
- availability of techniques for performance testing, and
- feasibility and practicality considerations.

Verification Factors

After a technology category is selected or a single innovative technology is accepted for verification, stakeholders define the questions that need to be answered about the technology from their individual points of view. The "verification factors" defined by these questions are those items about which purchasers and permittees need information on to make decisions. For example, monitoring technologies are evaluated for such items as measurement precision and accuracy as well as other performance factors. For a field monitor, the required technical proficiency and training of the operator, the time required to set up and break down, and the overall ruggedness of the instrument can be very important performance considerations. For other technology categories, energy consumption, down time considerations, failure rates, and multimedia impacts (e.g., air control technologies that may produce water or solid waste residuals) can be critical factors and can make the difference in the ability of innovations to succeed in the marketplace. When the full list of questions or issues concerning the performance of a technology is agreed upon, actual testing procedures are developed. Draft methods documents are usually developed by the partner organizations based on compilation of existing test procedures or by starting from scratch. Stakeholders and/or technical panels of experts then review these drafts to determine if data collected in this manner will, in their opinion, answer the questions and allow the ultimate verification report to speak definitively on each verification factor.

Verification Process

First, the technology category for which testing will be conducted is selected, followed by identification of vendors interested in participating in verification. Verification can be conducted for one product or for a group of similar products at the same time. To conserve resources, ETV evaluates technologies within a given technology category in test groups when there are multiple vendors. Several options exist to contact vendors.

After vendors (and their products) are identified for a particular test event, the specific test/QA plan is developed by the partner and agreed to by EPA and the vendors. Any possible needed test site is generally identified at the same time of test/QA plan development so that the test/QA plan can be tailored to the particular test location. After testing and data analysis are complete, the partner drafts the verifications statements and reports (one set for each product tested), which are reviewed by EPA, the participating vendors, and peer reviewers. After the review comments are addressed and approved by EPA management, EPA and the partner sign the verification statements and issue the statements and reports by placing them on the ETV Web Site. The final step in the process for EPA is to develop a generic verification protocol for the technology category, either by revising the generic verification protocol that was developed prior to

testing (if one was developed), or based on the test/QA plan that was used in testing. In both cases, the final generic verification protocol reflects any lessons learned during the testing experience.

The verification process costs can vary from US \$ 80,000 to 150,000 (equals about € 62,000 to 115,000) for each technology, dependent on the run time (2 to 6 months per technology) (source Theresa Harten, EURODEMO-PROMOTE-TESTNET joint meeting, March 2006).

The technologies that the system aims at can be found in advanced monitoring systems (air, water, site characterisation, and monitoring technologies), air pollution control, drinking water systems, green house gas technology, water quality protection, and building decontamination. Since the PROMOTE programme aims at soil and groundwater protection, and rehabilitation, the technology groups might be of interest for PROMOTE can be found in Site Characterisation and Monitoring Technologies (www.epa.org/etv/).

An overview of all verified technology categories in this field is given in the table below (JITEX, 2006):

ETV USA	Site Characterization and Monitoring Technologies	<ul style="list-style-type: none"> - Decision Support Software - Gas Chromatographs (Field Portable) - Gas Chromatographs/Mass Spectrometers (Field Portable) - Ground Water Sampling Devices - Immunoassay Test Kits/Immunosensors - Infrared Monitors (Field Portable) - Ion Mobility Spectrometers - Ion Selective Electrodes - Laser Induced Fluorescence Sensors - Lead in Dust Detection Technologies - Sediment Sampling Technologies - Soil/Soil Gas Sampling Technologies - X-Ray Fluorescence Analyzers (Field Portable)
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On the EPA website the verified technologies are technology related and verification reports are easily accessible.

3.2 ETV Canada

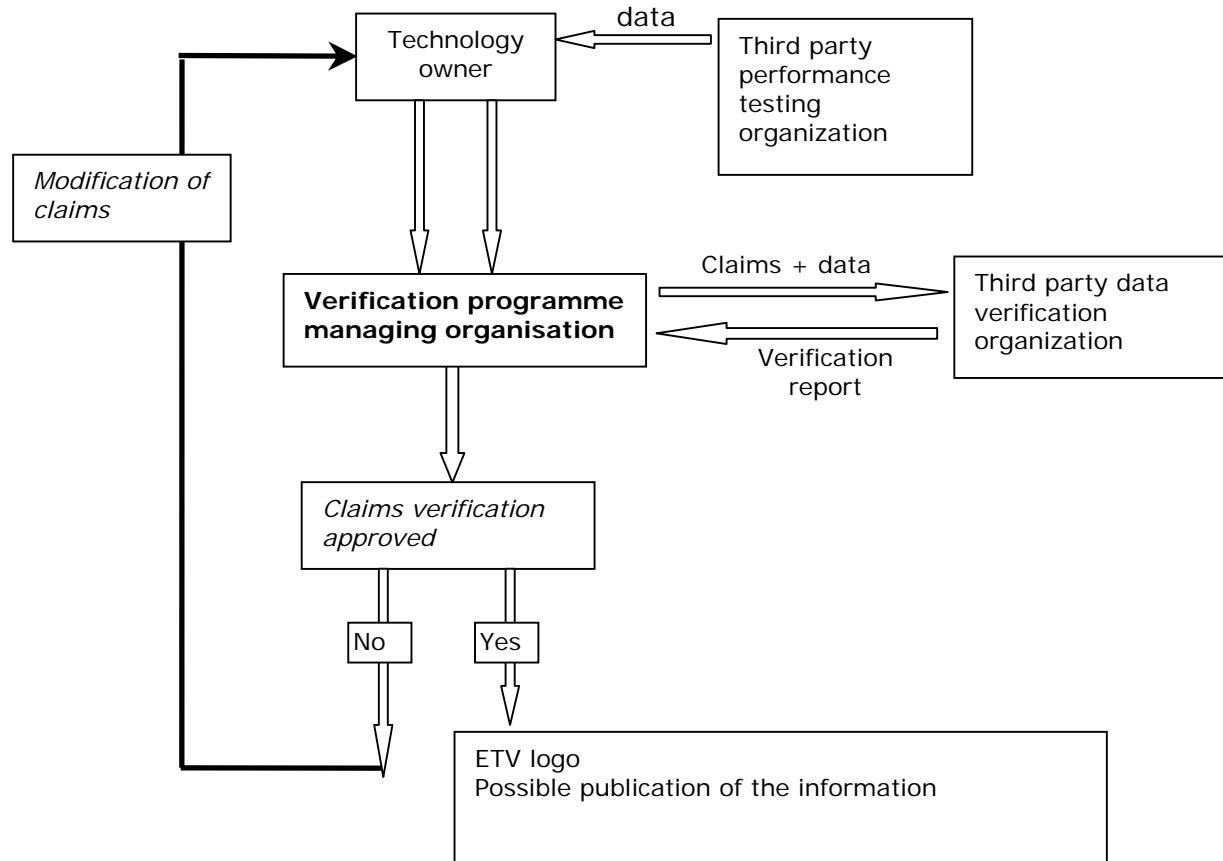
The program managing organisation (ETV Canada) collects the claims and all the data provided by the technology owner and submits them to a third party verification organisation, which verifies that the data are reliable and then compares them with the vendor's claim. The system checks whether the vendor's performance claims are true. In the process independent laboratories perform tests to provide supporting data for the verification. If tests were done by the vendor prior to application, the verification organisation can require additional testing by independent laboratories if the testing was not performed according to specific ETV-protocols. The actual verification of the adequacy between the claims and the test results will be performed by third party verification entities that can be both public and private organisations. These verification entities generate a verification report on the technology.

The role of ETV Canada is, besides collection of the vendor's claims and data, also establishment of protocols, identification of verification entities, reviewing of the generated verification report, and the preparation of a technology fact sheet and verification certificate.

This is a model on voluntary basis. The vendor will pay for the whole process. In return the system helps marketability of a product that is verified as being innovative and of a higher state-of-art than any current existing commercialised technologies (Round Table (II)).

The vendor will decide on publication of information at the end of the process. The verification system is not restricted to use for environmentally sound technologies.

In the figure below the flow diagram of the system is given (IPTS, 2005).



Canadian Model

applied in Canada, New Jersey, China, Bangladesh

The verification system is not restricted to use for environmentally sound technologies. The technologies that the system aims at can be found in emissions to air, soil remediation and groundwater protection, and energy production technologies/greenhouse gas reduction. Since the PROMOTE programme aims at soil and groundwater protection, and rehabilitation, the technology groups that have been addressed by ETV Canada and are simultaneously of interest for PROMOTE, will be limited to pollution detection and monitoring, pollution control and treatment, and site remediation and restoration (JITEX, 2006).

On the ETV Canada website the verified technologies are company related and therefore in database format poorly accessible when looking for verified technologies, or the number of verified technologies. An overview of technology groups that were submitted for verification is given below.

<p>ETV Canada</p>	<p>All environmental (products and processes)</p>	<ul style="list-style-type: none"> - Pollution detection and monitoring - Pollution prevention technologies - Environmentally-related human health protection - Pollution control and treatment - Energy efficiency/Management - Greenhouse gas reduction - Emergency Response - Non-hazardous and hazardous waste management - Site remediation and restoration - Land and natural resources management
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Technology groups presently addressed within ongoing verification programmes (JITEX, 2006)

Although ETV Canada was originally set up for existing, market ready technologies, ETV Canada started a programme for technology development assessment (Environmental Technology Development Assessment, ETDAP). Companies attempting to develop and commercialize new technologies face lack of understanding of the market and the market niches they seek to penetrate. To help address the challenges accompanying the technology development, and to assist the successful commercialization of technologies ETDAP provides a review of the market application of a particular technology and detailed advice on the required technical performance data needed to support quantifiable environmental performance claims (ETDAP background).

Stages in the process (www.etvcanada.ca):

1. Pre-screening. The technology to apply to the ETV program must be an environmental technology or an equipment-based environmental service, where equipment performance can be verified. It must meet minimum Canadian standards and national guidelines for the specific technology/claim (specified by ETV) and must be commercially available or commercial ready for full-scale application. If the technology is still in pilot-phase, the owner should contact ETV Canada to obtain advice regarding planning of test programs to generate relevant data for subsequent claim verification. If these criteria are met the applicant can submit a pre-screening application to ETV. ETV will review the application. This is free of charge.
2. Formal Application Review. If the technology and performance claims can apply to ETV program, a formal application can be submitted. Costs \$1,000 CDN (equals € 630.-), non refundable. ETV reviews the application for completeness and whether it can be accepted in the process. If not acceptable, it can be resubmitted. This is free of charge. If more information is required to support the claim during the process, it is the applicant's responsibility to arrange and pay for the generation of the necessary data or modify the claim. The cost of actual validation is agreed upon together with Verification Entity, depending on the scope and effort needed. If applicant agrees with proposed program and costs, ETV will make up a contract which specifies the Verification Entity to be used and costs associated with verification.
3. Verification. Verification Entity analyzes data to determine if additional testing is required, or information is sufficient. After the verification a report is made on the results of the verification process. This is submitted to ETV Canada for review. If the claim cannot be substantiated, the claim can be modified to substantiate with

existing data. The claim may be supported by further testing, this must be paid for in addition.

4. Award. If the claim is substantiated, the applicant will receive a Final Verification Report and a Technology Fact Sheet defining conditions of performance and a Verification Certificate, which is usually awarded by the Minister of the Environment or a designated representative. After 3 years the verification should be put up for renewal. A renewal fee will apply.

ETV Canada is the independent verification organization which manages Canada's Environmental Technology Verification Program under a license agreement with Environment Canada.

In addition to technology specific verifications, ETV Canada provides sector- and program-based performance benchmarking services. These services address the need to develop acceptable performance criteria which can be used to establish credible third-party verification of reported performance claims. This performance benchmarking is stakeholder driven. For site characterisation technologies, monitoring, and remediation technologies no such service exists yet.

3.3 European systems

There are no national programmes dealing with the verification of environmental technologies at a European level. Some examples exist, however, of sectorial programmes focused on specific technologies. They can be found in Scandinavia and the UK and Germany.

3.3.1 Nordtest – Nordic Innovation Centre

This system aims at verification and accreditation of testing laboratories and certification of personnel. It covers the Baltic States (Denmark, Sweden, Norway, Finland, Iceland, Greenland, Faroe Islands, Åland). The certification meets the requirements of ISO/IEC (Norden, 2005).

Nordic Innovation Centre initiates and finances activities that enhance innovation collaboration and keep market smooth in the Nordic region. The Innovation Centre works primarily with SME's in the Nordic countries. Partners involved can be found in industrial organisations, interest groups, research institutions and authorities (Norden, 2006)

The Nordic Innovation Centre Board (NICe) has the overall responsibility for the scheme and the scheme handbook including maintenance and development. It also approves appointments for the Nordtest Technical Group (NTG).

The Nordtest Technical Group (NTG) consists of the following representatives (Norden, 2005):

- One representative of the Nordic Innovation Centre Board
- One representative of a certifying body from each participating country
- One national representative from each participating country

- One representative from the branch organisation (like sampling companies, or samplers organisations) from each participating country
- As many members as possible of the Nordic ministries of the environment or other relevant ministries are represented as national representatives

The NTG chooses a chairman and a secretary from all members. The members will be appointed for 4 years, with a maximum of two periods. All NTG members must sign an agreement on confidentiality.

The responsibilities of NTG are:

- To advise the NICE board on all issues related to the Nordtest Sampler Certification Scheme
- To perform simple maintenance of the scheme
- To suggest required maintenance and development of the scheme tot the NICE board
- To promote international collaboration of the scheme
- To suggest new members for the NTG tot the NICE board
- To initiate regular joint Nordic Baltic seminars.

If the scheme must be altered beyond simple maintenance, the NTG must seek funding with for example the NICE board.

NTG costs will be covered by NICE after annual application.

The National certifying bodies shall define their policies and procedures themselves. They must:

- Register with NTG before initialising certification
- Appoint a scheme committee
- Seek accreditation of their quality manuals
- Have access to technical experts for certification with qualifications and experience
- Identify, contract, and register at least one course unit for training and examination
- Survey the course and examination bodies

The course and exam units are responsible for training and exam arrangements. This will not be dealt with in further detail.

The exact types of technology/fields of technology Nordtest is aiming at, is not entirely clear.

3.3.2 Monitoring Certification Scheme (MCERTS) UK

MCERTS is managed by the Environment Agency's Monitoring and Assessment Process and operated by SIRA Certification Service (SCS). A similar system exists in Germany, known as Continuous Monitoring Systems by Umweltbundesamt (UBA) on behalf of Ministry of Environment (BMU).

The programme provides for a certification of monitoring devices, the competency certification of personnel and the accreditation of laboratories based on international standards.

Sira Certification Service is a company limited by guarantee. The company is part of the Sira Group of leading specialist technology-based companies. Sira Certification Service operates internationally and provides certification of management systems, personnel and products.

Sira is accredited for these activities by the United Kingdom Accreditation Service (UKAS) and is appointed as a 'notified body' by the UK Government under European Directives.

The scheme provides a framework within which environmental measurements can be made in accordance with the Agency's quality requirements. The scheme covers a range of monitoring and sampling products including: continuous emissions monitoring systems, ambient air monitoring systems, portable equipment for stack emissions monitoring, instruments and sampling systems for water monitoring, and portable systems for emission monitoring (SIRA, 2005). For PROMOTE the main technology group of interest will be the monitoring of emissions to land by means of chemical testing of soil. However, no technologies in site characterisation, monitoring and remediation are known to be certified by SIRA.

SIRA operates the MCERTS scheme on behalf of the Environment Agency. Evaluation of a product consists of laboratory testing where performance (accuracy, repeatability, cross-sensitivity, etc) is determined, and (where appropriate) a field-test where the performance of the product is determined whilst installed on a process over a three month period. In the appendix more information is given on SIRA.

3.3.3 European Organisation for Technical Approvals (EOTA)

The role of EOTA is primarily to monitor and progress the drafting of European Technical Approval (ETA) Guidelines and to co-ordinate all activities relating to the issuing of ETA's. EOTA operates in close co-operation with the European Commission, EFTA, CEN, European trade associations and industrial organizations, who are also present as observers at various EOTA levels (<http://www.eota.be/>). The procedure starts with an informal application to the national certification authority, which clarifies the further procedure with the EOTA. A construction product with an ETA, satisfying the Attestation of Conformity provisions, can carry CE marking and can be placed on the market in any of the EEA countries. EOTA has been constituted as a legal body under Belgian law, with four organizational levels: Plenary Meeting - Executive Commission - Technical Board - Working Groups.

Procedure accomplishment is co-coordinated with a series of admissions and mass production. The relatively large number of homogeneous testing methods makes the standardization of procedures for admission in ETAGs possible. The objective is given by the standard.

Interesting is the CUAP, which considers individual regulations of the different Member States.

The following information must be attached for application:

- Description of the product
- Test reports
- Schematic diagrams
- Intended purpose
- National permissions

Member states are linked to EOTA by a membership. For example Germany is a member through DIBt (Deutsche Institut für Bautechnik) which gives a procedure for building material, construction products and structural engineering for national technical approval. The test procedures are prescribed in admission procedures adopted by the DIBt and are described exactly in the form of a test instruction. Every kind of construction product has its own admission procedure (for example test procedure for waterproof floor covering). The tests verify the compliance with existing DIN and EN. The standard gives the objective. The evaluation of the products refers to product quality and production quality, i.e. the efficiency of a company to produce constant quality by mass production is an important component of the admission.

Accomplishment:

ETA are accomplished on basis of existing guidelines (ETAG) or on the basis of a concerted statement of the certification authority (CUAP). For the concerted statement (CUAP) the permission guidelines of all European countries are considered, in order to achieve a European acceptance of the ETA. The permission is accomplished with the help of the EOTA Guidance documents.

Definition of terms within the program can be found in documents such as EOTA GD 002 (for example short, medium, long working life). There are documents, which examine the description of the product, the manufacturing way, current quality control, in-plant competencies for the product, personnel qualification in the form of check lists (questions), competencies and duties during the admission procedure, e.g. EOTA GD 006.

The manual for setting guidelines is ETAG or CUAP, has the number EOTA GD 001. This is an internal paper and is not accessible.

The tests examine the compliance with existing European standards. The standards give the objectives. DIN handbooks with checklists are not accessible for free.

Costs

The following example shows the order of magnitude of the costs involved in fulfilling the programme.

The Austrian institute for structural engineering (OIB) charges as follows:

- Basic charges: issue of an ETA on the basis of a guideline: € 550,--
- Issue of an ETA without guidelines: € 660,--
- Prolongation of an ETA: € 330,--
- Hourly wage rate for process time: € 110,--

3.3.4 Accreditation bodies

Each Member state has its own accreditation institutes. In Germany there is the Deutsche AkkreditierungsRat (DAR), under which several bodies are operational, for example Bundesanstalt für Materialforschung und -prüfung (BAM). They for example are dealing with accreditation of personnel, certification bodies, internal processes, and laboratories, usually organized in different departments.

The accreditation department of BAM for labs and certification bodies is the BZS. The other departments of BAM emphasize development and standardization but they also carry out product, reference material or QM-system certification.

The accreditation procedure is defined in the DAR-QM-handbook.

Objectives and test procedure are defined by standards.

Application:

The application procedure consists of

- Request
- Preliminary talk
- Application for accreditation
- Confirmation of application for accreditation
- Application assessment
- Accreditation contract

The application forms vary depending on accreditation authority. Example DATech, accreditation as test lab - three sided form with following contents:

- Applicants contact data

- Information on staff members
- Description of the test field
- Already existing accreditation?
- Disclaimer on notion and acceptance of accreditation terms.
- Place, date, signature
- 19 enclosures required by DIN EN ISO/IEC 17025

Accomplishment:

Assessor selection in accordance with the applicant

- Assessor commissioning
- Professional examination of application documents
- On site assessment
- Assessment report
- Evaluation of assessment results

The test type and the objectives are given in DIN EN 45000ff und DIN EN ISO/IEC 17000ff.

Checklists for assessment can be requested from DATech.

3.4 Usable elements in existing systems

Elements from the American and Canadian system, which can be used in the European system, are:

- Claims from technology owner initiate verification (Canada)
- Possible help in development stages by ETV managing organization (Canada)
- 1 active managing organization (Both)
- Allow technology owner to have performance tested by 3rd party (Both)
- Publication online and hardcopy (Both)
- Entrance solely for market ready technologies (Both)

Usable elements from other systems, are:

- Existing infrastructure: accredited laboratories in different MS
- Possible example for QA

4 Existing information on development of a European ETV system

The EU is working on a European version of the ETV system (European Environmental Technology Verification, or EETV). The most efficient way to develop a new European system is to use the existing systems merely as a guideline and a basis. In the meantime learning from previous inventions and issues surrounding other ETV systems must be priority.

In studies performed previous to PROMOTE and developed in other programs like TESTNET and EURODEMO, several ideas and requirements to an EETV system were generated. These are presented below in chapter 5.1. In chapter 5.2 requirements solely for PROMOTE, following from stakeholder and Advisory Board consultations, are presented. All ideas and possible improvements were inventoried to make the newly developed EETV system, up to date and state of the art.

4.1 EU ETV system elements from PROMOTE network consultations

By means of consultations of stakeholders from different EU MS and the Advisory Board members PROMOTE has identified some key elements and boundary conditions for development of the future EETV system.

Most important is that during the ETV design procedure the following must be assessed:

- The EETV system should be independent, and objective
- Performance of the system must be evaluated constantly. Ongoing assessment of the draft ETV system ensures adherence of project objectives.
- The system must accelerate market entrance
- It should be economically feasible to follow the EETV system.

Besides, the system itself must fulfill certain requirements. The verification procedure may be vendor driven, while verification of test design and test protocols will be carried out by an EETV entity. On the other hand the system may be Verification Organization driven as well. In this last option tests are being performed by the ETV-organization and their contractors, while the vendors' task is limited to giving input on their techniques. Besides that the possibility exists to make the entire procedure stakeholder driven as well.

Basic requirement for the newly developed EETV testing is a claim of a vendor's technology that is identified, at least together with the verifying and assessing entity (PROMOTE WP1-3 workshop 07 July 2006, Dechema).

Technologies should be allowed to approach the EETV system at various stages of development. In addition each technology, applying for verification should be scanned to mark its stage of development (innovative, design phase, ready to market, etc.). These quick scans must be guided by protocols. The result of quick scanning a technology should define the further data needs for fulfilling the program.

The system needs to ensure that all experts involved are independent. There should never be any type of conflict of interest.

Each verification should have a limited validity in time. This is partly in order to generate some continued revenue for administrative costs. Besides that, it will keep all technologies up to date to evolving standards.

Each verified technology will be provided with a unique, individualized, registration number. The number will provide the ETV results, i.e. restricted access to the results should be guaranteed. The vendor must be able to refer to a databank for customer information.

Learning from ETV USA and ETV Canada, and combining the remarks made within the TESTNET and EURODEMO programs, PROMOTE designed an own draft ETV system. This draft version is presented in the next chapter.

4.2 EU ETV elements from previous studies and other programs

The Institute for Prospective Technological Studies states that three different EU ETV system models can be distinguished (IPTS, 2005). One of these may be implemented in Europe.

- EU ETV team as the overall manager : the EU ETV team designs, operates and supervises the programme;
- EU ETV team as the designer and supervisor: the EU ETV team designs and supervises the programme, but will give the task of operating the programme to verification entities;
- System without EU ETV team: the programme operates without any dedicated EU-level entity. The working principle is based on the networks of specialised labs and stakeholders, contracted by EU ETV programme administrators.

Important in this is the assumption that no new laboratories or verification centres will be created on behalf of the ETV system. The verification will be carried out entirely by existing centres across Europe.

The second option seems to be most appropriate in order to avoid complex managing issues, or financial, and procedural/bureaucratic problems of the first option. Compared with the third option, the second proposed system may be able to ensure broad recognition to vendors, intermediaries and end users (JRC-IPTS, 2005).

Some necessary basic elements for a future European verification system are summarised in the same studies. The conclusion was drawn that the system can only be successful if the technology would be verified, rather than being evaluated or certified. In verification the technology will prove the truth of the performance of a technology under specific protocols and data quality assurance procedures with reference to predetermined criteria.

The verification of new technologies in the programme should promote these environmental sound technologies. In addition it should give confidence to buyers, attract vendors and make access to the market easier.

To succeed in this scope the technology should be ready for commercial use, and protocols and test plans should be available, or should be developed within a reasonable time frame and cost range. The requirements of performance and minimum requirements must be defined by regulations. If no regulations exist for certain aspects the requirements should be defined by stakeholders. Quality management should be established by a European level organisation.

Any testing and verification organisations should be independent, accredited and should be able to guarantee a constant level of quality. Concerning the testing organisations and verification organisations the Canadian model, in which the testing organisations are separate from the verification organisation, is considered to be most efficient. This implies that the vendor can choose whatever testing organisation it wants and that verification organisation is under control of the ETV organisation (JRC-IPTS, 2005). Besides that the separation enables segregation between the private component (verification organisation) of the programme (vendors and testing organisations) and the public component (Round Table (II)). The Round Table, however, concluded in their position paper that one same entity should be made responsible for the whole verification procedure; from choosing test labs to assuring quality. The test laboratories should be selected from a group of existing labs (JRC-IPTS, 2005).

A decentralised structure (i.e. each Member State has its own verification centres) is supposed to be closer to innovators and the testing labs. In this way a better service could be given to the client. The drawback of this may be that a decentralised organisational structure could undermine the European-wide recognition. A balanced structure with local offices and a central European managing office must be found (Round Table (I), 2005)

In the field of financing, the study draws the conclusion that a mix of public and private funding is the best way to support SME's through direct funding, incentives or other instruments. Especially the testing could be a 100% private investment (vendor). Generation of protocols, on the other hand, should be funded by the European Community since it is a Community's profit (Round Table (II), 2005)

At the end of the entire programme, the outcome would be a successfully verified technology that can enter the market accompanied by a report focussing on performance (one summary for public use and one detailed report for the vendor).

Concerning the organisation of the programme the JRC-IPTS study states that the vendor should choose an accredited test lab/verification centre which in its turn will contact the verification organisation. This organisation should verify for each technology that the lab is accredited for the needed testing and should appoint a vericator who will supervise the testing process and will validate the obtained data. The verification organisation will review and approve the delivered reports and form and maintain the network of stakeholder groups.

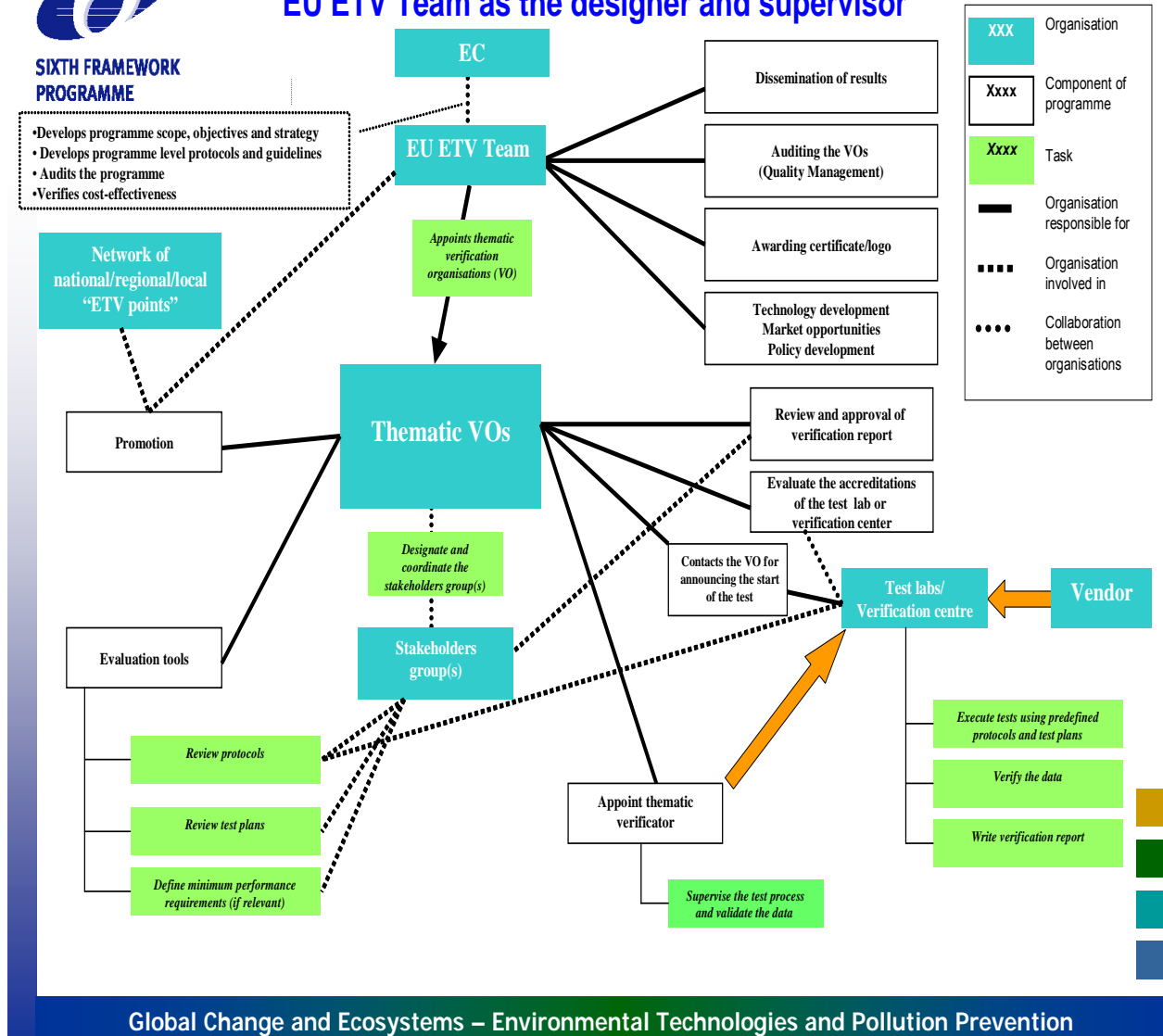
This is shown in the organisational flow diagram below.



SIXTH FRAMEWORK
PROGRAMME

- Develops programme scope, objectives and strategy
- Develops programme level protocols and guidelines
- Audits the programme
- Verifies cost-effectiveness

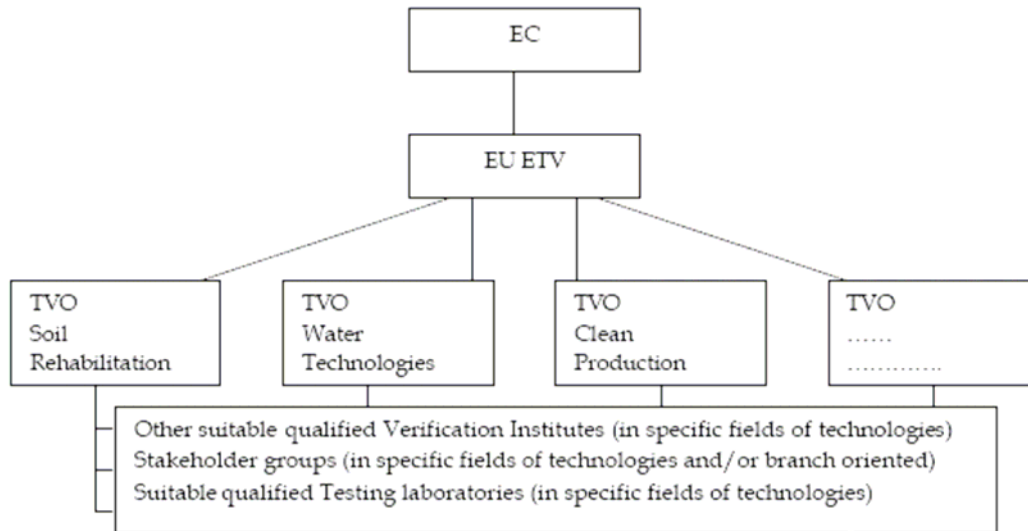
“EU ETV Team as the designer and supervisor”



Global Change and Ecosystems – Environmental Technologies and Pollution Prevention

On this structure TESTNET concluded in their results from work package 2 that certain aspects could be altered to generate a less bureaucratic procedure. They distinguish verification institutes in the heart of the market as a certification institute. Besides that the verification institute is a verifier that supervises the protocol and the testing procedures. The awarding of the verification statement is controlled by a thematic verification organisation. The TVO focuses in controlling, monitoring, and improving the operational functioning of the verification system. A limited number of verification institutes and representatives of stakeholders form the TVO. The programme is led by the EC (DG Environment). They are responsible for evaluation and improvement. The EU ETV board of directors designs, leads, monitors and redesigns the programme as a whole.

In general the opposed structure of the main process is given in the chart below. Although TESTNET aims at a verification system for more environmental technologies than only site characterisation, soil remediation and monitoring it does give a clear overview of the structure.



The verification statement belongs to a ready-to-market product. The producer can apply to the system, and not a vendor (not being a producer). When a vendor thinks the verification might be useful he should approach a producer to apply.

4.3 Basic requirements and boundary conditions for EETV

- Entrance: market ready technology, quick scan
- Claims from technology owner initiate verification
- EETV system should be independent and objective
- EU wide acceptance is needed for EETV logo (harmonisation of verification needs)
- EETV must accelerate market entrance
- EETV must have multiple points of entry
- Validity of verification limited in time
- It should be economically feasible to follow EETV system
- Performance of the system must be evaluated constantly (benchmarking)
- Testing and verification should be carried out in field conditions

5 Discussion items

In the process of designing a European ETV system several items should be addressed that cover the verification process itself, organisation, and barriers in verification and marketing of technologies. In this chapter discussion items are presented to stimulate complete consideration of these aspects. The discussion items are presented as short lists including an elaboration in a question like manner.

5.1 Technology to be verified

Aspects:

- How is technology defined?
- Should the EU ETV system be limited to techniques, or should accompanying strategies (technology in broader sense) be verified
- In what stage of development should the technology be offered for verification

If environmental technology is defined as the mere technique an EU ETV system will be developed as only to verify the instruments in the field of site characterisation, monitoring and remediation. If technology is considered in a broader sense, the strategy that exists behind use of the instruments plays an important role as well. With verification of strategies one is committed to making protocols about how to use the instruments. Questions that might be raised in this perspective are: should protocols be developed for each *type* of instrument, or be custom-made for each instrument? Who or what organisation will make the protocols (ETV organisation/accreditation or certifying organisations)? How will MS legislation be interwoven in this?

Besides the terms of definition, the question remains in what stage of development a technology should be offered to the EU ETV system. Is it possible to accept a technology that is only a prototype, or should the technology be completely commercially ready? Or should the only requirement be that it will operate properly on submission? In this case it must be realised that too high a constraint might imply that SME's will find this a barrier for submitting innovative technologies.

5.2 Claim

Aspects:

- What claims are acceptable
- What performance can be claimed
- Should, besides performance of an instrument, the offered claim also be verified against 'reality'. Verification in the field.
- May the technology be offered as a black box or should all working principles be clear

One of the basic assumptions about the EU ETV is that the system should be a claim verifying one. The vendors/developers submit claims about the operational success of their technologies together with their technologies. When a technology is submitted for verification the accompanying claims should contain a minimum of information, for example: what component/ions the technique measures, what is the accuracy of the

measurements, what is the minimum effect of the technology, in what type(s) of soil (sandy, clayey, organic, gravel) it was applied and tested, etc. The claims that are offered should be tested against some sort of reference, for example: standard solutions, lab scale reference soil samples, laboratory analyses on standpipe samples, etc. The question raises: what is reality? What technology will serve as a reference in measuring?

If an instrument is submitted, a minimum of information must be offered to the ETV organisation/verification organisation: all working principles must be known. This should prevent technologies from having an environmental friendly result while the instruments/technologies themselves make use of polluting materials/chemicals. The best way to assess this is to require a complete Life Cycle Analysis of the technology. However, this might imply extra costs for the vendor/developer which may form a barrier for submission of innovative technologies.

5.3 Organisation and role of players in ETV system model

Aspects:

- In what way should verification be organised
- Should testing labs be independent
- Should accreditation/certification of testing labs be done within the ETV system
- What role do stakeholders have in system, will they bring up the innovative technologies
- Should non-European technologies be accepted as well

According to IPTS studies the model with EU ETV Team as a designer and supervisor will be the most plausible model to build the ETV system. In this model the EU ETV Team appoints thematic Verification Organisations (VO). The vendor/developer must contact the VO for verification of its technology. The EU ETV Team accounts for dissemination of results, auditing of the VO, and awarding the logo. The VO should review and approve the verification report and should execute the verification/test. To do this the VO should appoint test labs and verification centres. The test labs should be independent. The question remains what organisation will be responsible for accreditation/certification of the test labs? Should this be integrated within the ETV system? If not, MS legislation differences may form an obstacle. The accreditation/certification organisations for the labs should offer an EU-covering uniform quality; does this exist yet?

Another question is the role of the stakeholders. Should they play an active role in identification of innovative technologies? Should they establish the evaluation tools together with the VO?

Should stakeholders select the testing labs? In this way a strong market involvement will be created.

5.4 Possible barriers in implementation of innovative technologies

Aspects:

- Vendor/developer does not know market/positioning options
- Too costly
- Verification may take too long
- Status of ETV organisation
- Legislation in several MS

If a vendor/developer does not know how to market its technology, should ETV organisation offer an investigation to assess possible market needs, obstacles, etc.? Should ETV support the marketing process, in which proper verification requirements are integrated?

It is stated by JITEX (JITEX (II), 2005) that in most cases an acceptable timeframe for verification would be 6 months. The necessary timeframe however depends on the type of technology and cannot be fixed for all technologies, e.g. As a result of possible long time effects. Should there be a maximum duration guarantee for the verification process?

5.5 Possible barriers in verification of innovative technologies

Aspects:

- Protection of ideas by inventor/developer of technologies
- Extra costs for vendor/developer because of verification in certified labs
- How should innovative technologies be identified

When a technology is submitted for verification and all operating principles should be handed in, the vendor/developer might find this a barrier in terms of unprotected/non-patented technologies. This can specifically be the case when the technology is developed by an SME, which can not bear the costs of a patent application. How to solve this?

If the EU ETV system requires the technologies to be tested before any claims about the technology can be submitted the question raises whether the primary testing lab should be a certified one. If this is not required for submission, but the ETV system will verify the claims using certified labs, this will imply extra costs for the vendor/developer.

Should the ETV system then oblige the primary testing to be performed in a certified lab? Many technologies are not primarily developed for soils and groundwater. Many developers/vendors will probably not realise that their technology is applicable in the field of monitoring/site characterisation/remediation. Should the EU ETV organisation wait passively till developers/vendors apply their technology for this purpose, or should the stakeholders and VO's have an active role in tracing these technologies? If so, how can they do this successfully?

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- <http://www.cetacwest.com>
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Appendix 2 Definition of terms

In this report several definitions are used on the subject of ETV systems. The main issue is the description of what action should be taken: verification, evaluation, or certification. Below the several possibilities are described and defined. The European technology verification system however is aiming at verification. Both evaluation and certification were considered to reach too far, since the objective of ETAP was to convince the market of the merits of environmental technologies. Establishing a mechanism to validate objectively the performance of technologies will increase buyers' confidence in using and purchasing innovative technologies (Commission of the European Communities, 2004). To reach this goal verification is a cost effective way.

The three definitions given below were published by the Round Table before. Besides these definitions Eurodemo, Testnet and Promote were asked to generate as joint list of definitions by the advisory board. These definition of terms are given in appendix 2.1. As can be seen the definitions made by the Round Table are not completely equal to the joint definitions. The list of joint definitions however is still evolving.

PROMOTE is aiming at Verification of environmentally friendly technologies in the field of site characterization, monitoring and remediation technologies.

Verify (Round Table (II), 2005): to establish or prove the truth of the performance of a technology under specific predetermined criteria or protocols and adequate data-quality assurance procedures, with reference to predetermined criteria. These criteria can be defined by:

- The vendor: in this case, the claims, given by the vendor, are verified, without technology approval or endorsement. This option is called 'claims verification' in ETV Canada
- The buyers, stakeholders, etc.: the minimum performance criteria can be defined to allow comparison with best performing products as a reference
Synonym; confirm, corroborate, substantiate, validate

Evaluate (Round Table (II), 2005): to carefully examine and judge the efficacy of a technology; to submit technologies for testing under conditions of observation and analysis. Or: to obtain a set of credible third-party performance data, without technology judgment, approval or endorsement (as provided by the US ETV program).
Synonym: measure, estimate, classify, test

Certify (Round Table (II), 2005): to guarantee a technology as meeting a standard or performance criteria into the future (e.g. international standards, regulations, etc.).
Synonym: ensure, warrant, guarantee

Appendix 2.1 Uniform definition of terms EURODEMO, PROMOTE, TESTNET

In the joint Eurodemo, Promote, and Testnet meeting of 6-8 March 2006, the advisory board concluded by recommending a combined glossary. By using the same vocabulary all research programmes assure producing publications and reports that can be used and read without misunderstanding by all parties involved.

Accreditation
[underway]

Certify – (Product) Certification (-> evaluation, verification)

To give a justified confidence that every specimen of a product is meeting a standard or minimal performance criterion in future.

Certification

The process of certifying that a certain product has passed performance and/or quality assurance tests or qualification requirements stipulated in regulations such as a building code < and nationally accredited test standards, or that it complies with a set of regulations governing quality and/or minimum performance requirements.

<http://en.wikipedia.org/wiki/Quality_assurance

<http://en.wikipedia.org/wiki/Building_code>

Conflict of interests

A conflict of interests *between* parties is normal and quite acceptable in business: when positively used it acts as a driver for development and growth.

In the actual context we refer to internal conflicts of interests (within a party). These should be avoided because they point to a conflict of responsibilities that may jeopardize the independency required of an ETV-system.

Environmentally Sound Technology (EST)

According to Agenda 21, Chapter 34:

- *EsTs protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they are substitutes.*
- *EsTs in the context of pollution are "process and product technologies" that generate low or no waste, for the prevention of pollution. They also cover "end of the pipe" technologies for treatment of pollution after it has been generated.*
- *EsTs are not just individual technologies, but total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures. (...)*

The definition can be made more precise by the following three additions:

- Technologies to manage resources more efficiently;
- Technologies and processes to manage/reduce pollution;
- Less pollution and less resource-intensive products and services.

In the framework of ETV-Europe technologies are only considered EST's if the following criteria are met¹:

- Additional investments and reduced operational costs compared to the average practice, however resulting in increasing payback times,
- Environmental incentives to make investments.

ETAP, relevant action for our projects

Improvement of testing, performance verification and standardization related to environmental(ly sound) technologies.

Evaluation (-> Verification)

¹ If this restriction were not be made, far too many technologies would be considered EST's. Eg. the energy use of mobile telephones is continuously decreasing by new technology. We propose not to consider this technology an EST, because it has never been developed for *environmental* reasons: This technology is attractive because the recharging frequency of batteries is decreased when mobile phones use less energy. Moreover, for the technology there is no barrier at all to enter the market.

To obtain a set of credible, third party performance data, without a technological judgment, approval or endorsement

Notification

[underway]

Producer

The entrepreneur who manufactures products, whether or not as a vendor.

Stakeholder

Every party significantly concerned in development of policies and principles regarding the content and functioning of a verification scheme.

Standardization

The agreement on specifications and criteria to be applied consistently in the classification of materials, the manufacture of products and the provision of services. (from ISO page)

Technology group

Group of connected technologies (e.g. soil and groundwater remediation technologies, clean production technologies).

Testing laboratory

Institute, suitably qualified to perform the tests as required in the protocol for the verification of a EST.

Thematic Verification Organisation (TVO)

Organization that is responsible for the verification process for a Technology Group.

Vendor

The party that delivers the product to the customer.

Verification: (-> Evaluation, Certification)

To establish or prove the truth of the performance of a technology under specific protocols and adequate data quality assurance procedures with reference to predetermined criteria (EPA-ETV).

Variety (see mail of Thomas Track, 5 July 2006)

To establish or prove the truth of the performance of a technology under specific, predetermined criteria or protocols and adequate quality assurance procedures. (from US-EPA ETV)

Verification Institute (VI)

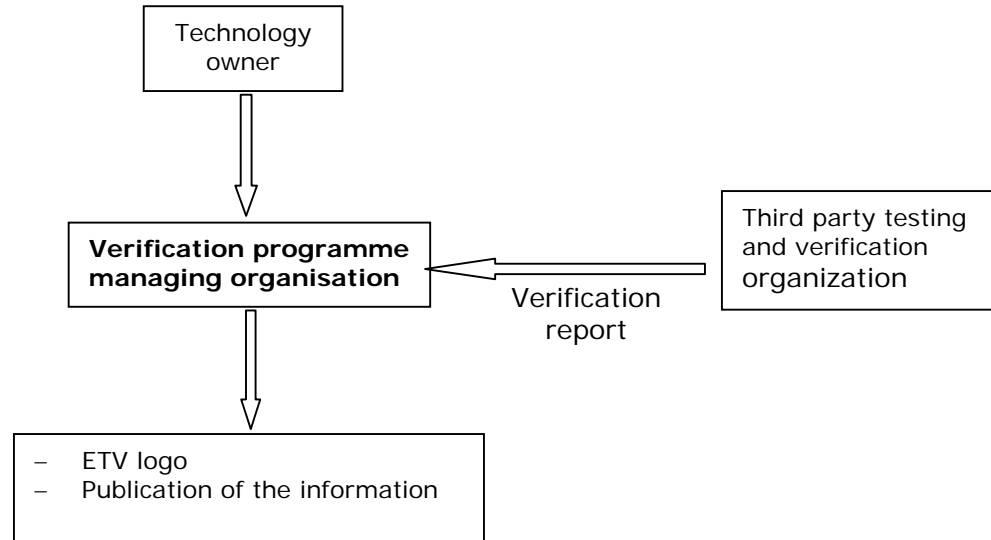
Entity that issues the Verification Logo and that, to be allowed to do so, is suitably qualified to act as verifier.

Verification Logo

Formal prove that a technology or product has passed successfully the ETV procedures.

Appendix 3 Elaboration on world wide ETV systems

Appendix 3.1 ETV USA



USA Model

applied in USA, Japan, South Korea

Roles of bodies/organisations (Round Table (II), 2005)

Vendor:

- Contacts ETV team

ETV Team:

- establishment of general protocols and quality system
- review of quality
- oversight of Verification Organisations
- Review of Final Verification Report

Stakeholder groups:

- Set verification priorities
- Review protocols and operating procedures

Verification Organisations (private/public organisations), Third party verification:

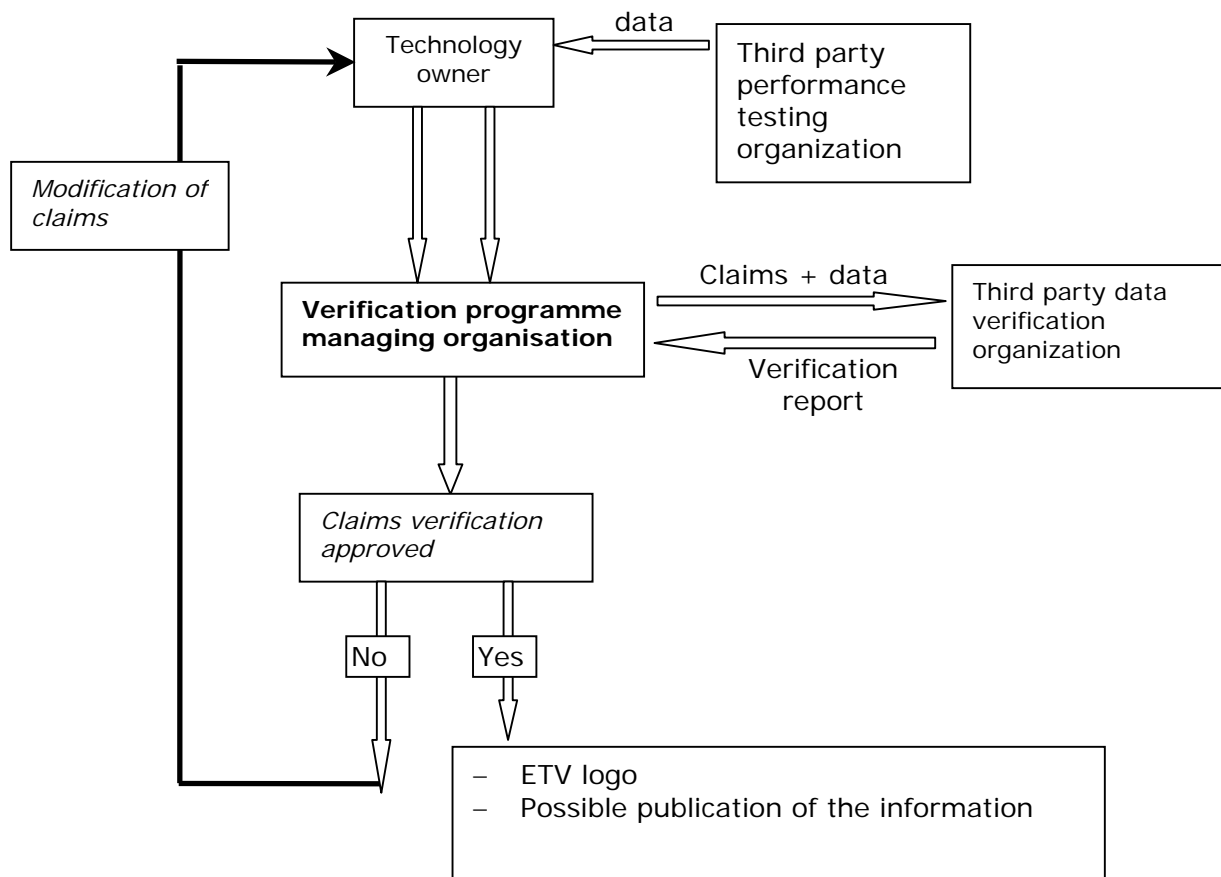
- Develop and conduct test plans
- Execution of verification tests
- Preparation of verification report

Summary (Round Table (II), 2005)

- Purpose: provide public credible performance data, not technology approval or endorsement
- Eligibility: environmental sound technologies

- Solicitation: advertisement by ETV through business journals, direct application of vendors
- Application: the vendor contacts ETV on a voluntary basis
- Funding: moved from a primarily government funded effort to a primarily private sector funded effort
- Testing and verification: the same third party organisation establishes testing plans, conducts tests to evaluate the vendor's technology and ensures compliance with the quality management plan
- Issuance: ETV report available on ETV website
- International recognition: signature of MOUs, establishment of tools towards reciprocity, although to date no US ETV-verified technology has benefited from a reciprocity agreement.

Appendix 3.2 ETV Canada



Canadian Model

applied in Canada, New Jersey, China, Bangladesh

Roles of bodies/organisations (Round Table (II), 2005)

Vendor:

- Submits data form independent labs to ETV

Independent labs:

- Execution of test plans
- Collection, analysis of technologies and samples
- Generation of data to verify claims

ETV Canada:

- Collection of vendor's claims and data
- Establishment of protocols
- Identification of verification entity
- Review of final verification report
- Preparation of technology fact sheet, verification certificate

Verification Entities (private/public organisations), Third party verification:

- Verification of supporting data
- Comparison of data to claims
- Preparation of verification report

Environment Canada, Industry Canada:

- Programme policy

Summary (Round Table (II), 2005)

- Purpose: verify that the vendor's performance claims are true. Help the marketability of a product recognised as being of a higher state-of-art than current commercialised products
- Eligibility: at first limited to environmental sound technologies, now extended to all technologies
- Solicitation: direct application of vendors, to a lesser extent government procurement
- Application: the vendor contacts ETV; application requires claims of the vendor
- Funding: primarily private sector effort
- Testing and verification: independent laboratories perform tests to provide supporting data. It may happen that tests have been made before application; the vendor can be obliged to have test done again if the latter have not been performed according to specific ETV-protocols. Verification of the adequacy between claims and tests (supporting data) is performed by verification entities (third party verification)
- Issuance: the vendor decides on the publication of the information
- International recognition: signature of some reciprocity agreements.

Appendix 3.3 ETV New Jersey

The New Jersey ETV system is based upon the Canadian system and can in general be described by a claim verification system. The organisation that promotes technologies in energy and environmental fields, and operates the verification system is New Jersey Cooperation of Advanced Technology (NJCAT). NJCAT assists developers of new technologies and services with the regulatory, commercial, financial and technological assistance required to bring their technologies to market by providing third party credible and independent verification of their technology performance claims. Interested vendors are invited to apply to the program for verification of their technology performance claims. If the claims are verified, the vendor is entitled to use a NJCAT verification mark, along with the accompanying certificate, in their regulatory and commercialization activities (NJCAT protocol).

The verification process consists of four stages:

- Review of Application for Acceptance into the NJCAT Verification Program
- Claims Development process
 - o Identification of specific claim(s)
 - o Verification of specific claims(s)
- Assessment of Data Quality (QA/QC)
- Report Preparation

NJCAT requires good quality claims:

A claim must be specific.

- A claim must clearly specify the minimum performance or range of performance that is achievable with the technology, and not simply the maximum performance.
- A claim must clearly specify the conditions under which the claim is applicable.

A claim must be measurable.

- The data supporting the claim must demonstrate that the technology has a measurable effect on the specific parameter(s) identified in the performance claim.

A claim must be verifiable.

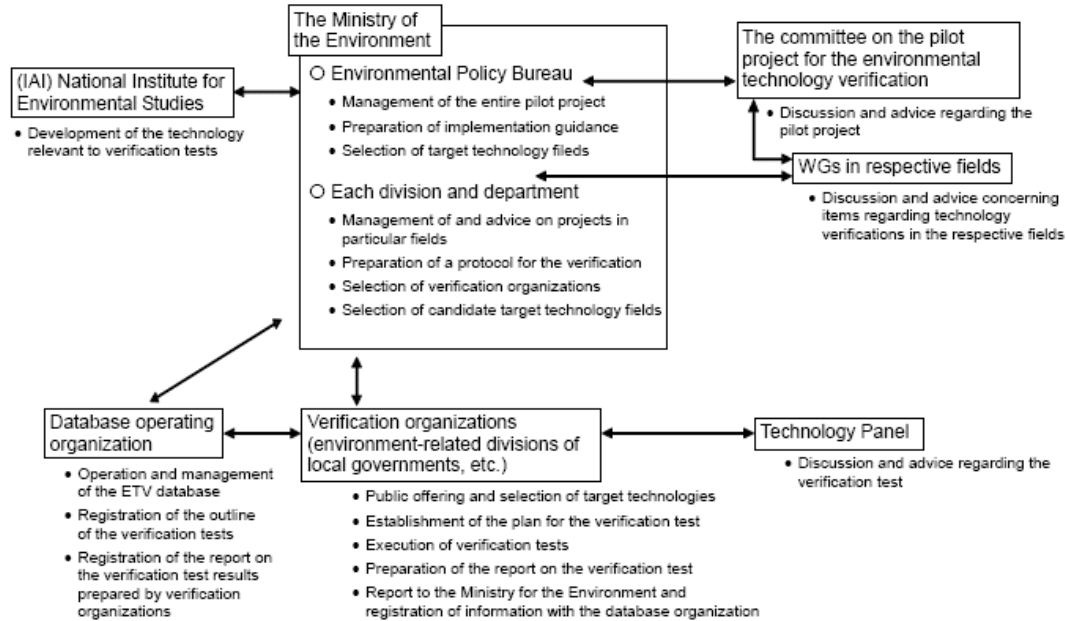
- A claim must be verifiable using acceptable test procedures and analytical techniques.

Appendix 3.4 ETV Japan

The Japanese ETV system will be set up according to the American system. The Japanese government started a pilot project in 2003 to set up a national ETV system which is not completed yet. In this period verifications will be conducted on a trial basis in representative technological categories, which will lead to Phase 2 in which vendors will be expected to pay for the verification. This pilot project is planned to end in the year 2007 after which in the year 2008 the technology categories will be expanded, and the verification program will enter the full operation phase (Kamita, 2005).

The Japanese government decided to establish an ETV system since many innovative environmental technologies that are already in a practically applicable stage, and seem to be useful, have not come into wide use because end users, including local municipal entities, companies, consumers, and the like, cannot use the technologies with confidence due to the lack of objective evaluation of the environmental protective effect (Japanese Ministry of the Environment, 2003). Ministry of the Environment (MOE) of Japan, therefore, launched the Pilot Project of the Environmental Technology Verification (ETV) in 2003 as a trial implementation of ETV, to verify objectively the performance of the advanced environmental technologies by third parties (URL: etv-j.eic.or.jp/en)

In the picture below the different roles of the organisations within the Japanese ETV pilot is given.



After: The Japanese Ministry of Environment, 2003

The Japanese ETV system aims at the following fields of environmental technologies (Kamita, 2005):

- Treatment Technologies for organic waste (biomass resources)
- Energy system technologies (excluding light- & wind-collecting equipment)
- Treatment technologies for contaminated soil and groundwater
- Greening technologies for walls/rooftops
- Technologies for sludge treatment (re-use)
- Technologies for waste plastic treatment (re-use)

At this moment no information about funding and further organisational characteristics is known.

Appendix 3.5 ETV Korea

In Korea the American ETV system was adopted for verification and assessment of new environmental technologies for water, air, waste, and soil.

(source EMS through www.koetv.or.kr)

Objective

The objective of the system is to let the government authorities verify, assess and recognize environment technologies developed or improved in Korea for promoting distribution of excellent technologies and nurturing industries in environment area

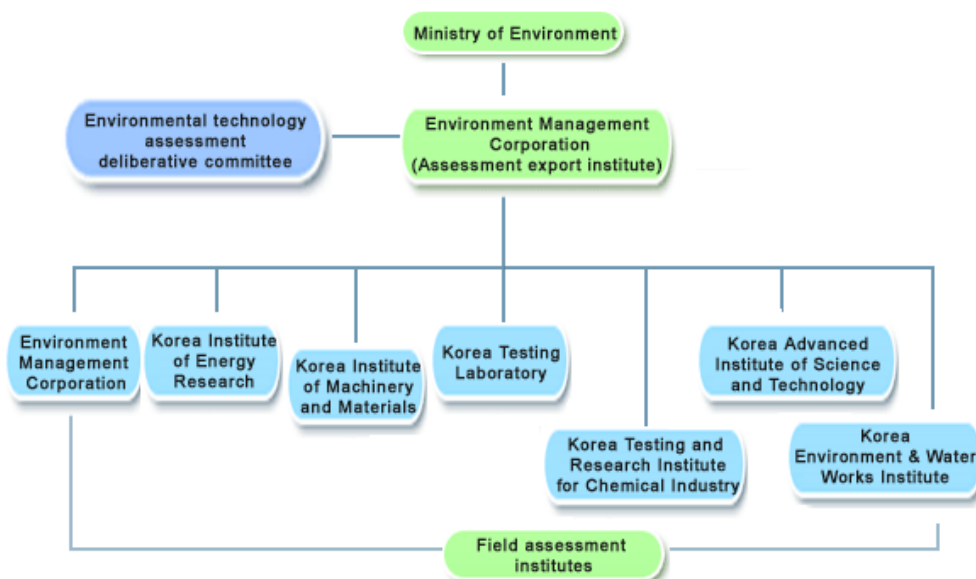
- Consumers of technologies: The consumers are aggressive for identifying capabilities of technologies verified in objective and technological manner, and employing and utilizing new technologies
- Developers of technologies: The developers are aggressive for developing new technologies upon promoted distribution of technologies and easy market penetration due to increased rewards such as recognition of achievement.

Types of Assessment

Designation of new environment technologies designating new technologies through document review and field review:

- A system permitting designation of new environmental technologies only upon document review and field review when a developer bears experimental data sufficient for proving state-of-the-art, advancement and validity;
 - Issuance of certificate of designation of new environmental technologies (Minister of Environment).
- Verification of new environment technologies designating new technologies through document review and field verification
 - A system of application for verification of new environmental technologies by proving state-of-the-art, advancement and validity by field verification of an official field assessment organization, should a developer not bear sufficient proving data for the new technologies;
 - Issuance of certificate of designation of new environmental technologies or certificate of verification of environmental technologies (Minister of Environment);
 - Issuance of report on verification of environmental technologies (the Environment Management Corporation).
 - There also exists an environmental technology verification system for simply verifying capabilities of environmental technologies:
 - A system for field verification of technologies introduced from foreign countries or current domestic technologies for capability assessment by an official field assessment authority;
 - Certificate of verification of environmental technologies (Ministry of Environment), and report on verification of environmental technologies (the Environment Management Corporation).

In the figure below the organisational characteristics are presented:



The tasks of the several organisations are described by EMS in Korea as follows:

Authority/organization	Business of each authority and organization
Ministry of Environment	<ul style="list-style-type: none"> - Acceptance of applications - Notification on official gazettes for collection and coordination of opinions of stakeholder - Issuance of certificate of designation of new environmental technologies or certificate of verification of environmental technologies
Assessment expert organization (Environment Management Corporation)	<ul style="list-style-type: none"> - Consulting on, supporting and reviewing applications - Building and operating the environmental technology assessment deliberative committee <ul style="list-style-type: none"> • Review of designation of new environmental technologies • Review of assessment criteria and overall assessment for verification of environmental technologies • Coordination of opinions of stakeholders Issuance of report on environmental technology verification - Follow-up management of new technologies - Public relation of new environmental technologies - Designation of official field assessment organizations
Field assessment organizations (seven organizations)	<ul style="list-style-type: none"> - Executing field assessment business for environmental technology verification - Executing agreements with applicants for field assessment - Executing field environmental technology verification pursuant to assessment criteria; - Developing report on results of environmental technology verification

Appendix 4 Elaboration on European systems

Appendix 4.1 SIRA

Sira operates the MCERTS scheme on behalf of the Environment Agency. Evaluation of a product consists of laboratory testing where performance (accuracy, repeatability, cross-sensitivity, etc) is determined, and (where appropriate) a field-test where the performance of the product is determined whilst installed on a process over a three month period.

Below information about application, quotation, and organisation is given (SIRA, 2005):

Products that can be certified

- continuous emission monitoring systems for gaseous emissions, particulates, temperature, pressure and flow
- continuous ambient air quality monitoring systems for SO₂, NO_x, CO, O₃, particulates, metals, benzene and certain polycyclic aromatic hydrocarbons
- continuous water monitoring equipment including turbidity and pH meters; ammonia, COD, TOC, dissolved O₂, total P, NO₃ and TON analysers
- water flow meters
- automatic wastewater sampling equipment
- portable systems for emission monitoring

Application for certification

Applications are accepted from product manufacturers. If the manufacturer is not based in the UK, a local representative or agent can apply where appropriate.

A feature of the MCERTS scheme is surveillance and design control of the product. If a third party manufactures a major component of the product upon which performance is dependent, the application form should be in joint names.

The details on the Application form should state the main applications or processes on which the product is to be installed. If there is a product range with differences between the different products allowing them to be used on a variety of processes, then the applicant is advised to state the most rigorous process; this will allow the certification to be extended to the less severe processes with minimum cost and time. The applicant specifies the measurement ranges for which the product is to be certified, in line with the performance standards published by the Environment Agency. The applicant is required to provide evidence that an appropriate quality management system controls manufacture of the product. If the manufacturer has an ISO 9001 certificate from an accredited certification body, details should be supplied with the application. MCERTS performance standards require that an audit of the manufacturing process is undertaken by the certification body to confirm that the manufacturer has implemented procedures to ensure manufacturing reproducibility and control of any design changes so that they do not degrade performance below the MCERTS standard.

Quotation

Sira will initially supply a budgetary quotation that includes the cost of any laboratory tests, field tests and certification. The applicant has the option of choosing which laboratories perform the testing providing they are qualified to do so (generally this means they are accredited to ISO/IEC 17025). To reduce the amount of testing required by the scheme, the applicant can also submit existing test reports, which will normally have to be from a suitably accredited laboratory. Following the budgetary quotation stage, the applicant will be invited to attend a launch meeting with Sira and the test laboratory to discuss and finalise the test programme. This meeting will focus on the

required scope of certification required (applications, special conditions etc) and on the required timescales. Certification and testing of a product is supervised by an independent panel of experts, the impartial Certification Committee – who will review the test programme(s) and evaluate the results. The applicant has the right to comment on the composition of the Certification Committee.

Laboratory tests

The applicant will supply a product direct to the test laboratory. The product will be operated according to its instruction manual. If the product should fail any performance test, then the programme will be halted and the applicant asked to comment.

Field tests

Sira has some standard test sites available for field tests. Manufacturers can propose alternative sites provided that it is acceptable to the test laboratory and that the product is essentially identical to the product undergoing laboratory tests, though this may increase costs. To shorten certification time, field and laboratory tests may be conducted simultaneously if the applicant can supply two instruments. During the field test, only the laboratory will have access to the product under test, although the site operator may log the output readings for his own monitoring purposes. The manufacturer will have access for normal repair/servicing activities as necessary.

Typically, the applicant will commission the instrument under the supervision of the test laboratory. The applicant will be asked to provide a commissioning timescale. Since commissioning is supervised, excessive over run of timescale may incur additional costs. If the applicant does not install the product, the applicant will have the opportunity to inspect the installation and request changes if it does not comply with the instruction manual. If other changes are made that are not included in the manual, then these will be reported to Sira and may affect the granting of a certificate. If the product should clearly fail any performance test, then the programme will be halted and the applicant asked to comment. The instrument may need to be removed and/or the test period may require to be extended to compensate. The applicant can comment on the reports from both the laboratory and field tests before the Certification Committee considers them.

Recognition agreement with UBA

A type-approval scheme for CEM's, operated by the Umweltbundesamt (UBA) in Germany has many similarities with the MCERTS scheme. To minimise the burden on manufacturers seeking both UBA and MCERTS approval The Environment Agency and UBA have an agreement, which provides for the mutual recognition of laboratory and field test data. Therefore, manufacturers with UBA type-approval certificates may apply to Sira for MCERTS certification. The MCERTS Certification Committee will review the UBA test data before recommending certification in accordance with its established procedures.

Granting of a certificate

The independent Certification Committee recommends whether a certificate should be granted, specifying the wording on the certificate and any special conditions.

Audit of the manufacturing process

Sira is required to conduct an initial audit of the manufacturers of certified products. Certification cannot be granted until the initial audit has been successfully completed. The purpose of the audit is to confirm that the manufacturer has provisions to ensure manufacturing reproducibility and to control any design changes that may degrade product performance.

Surveillance

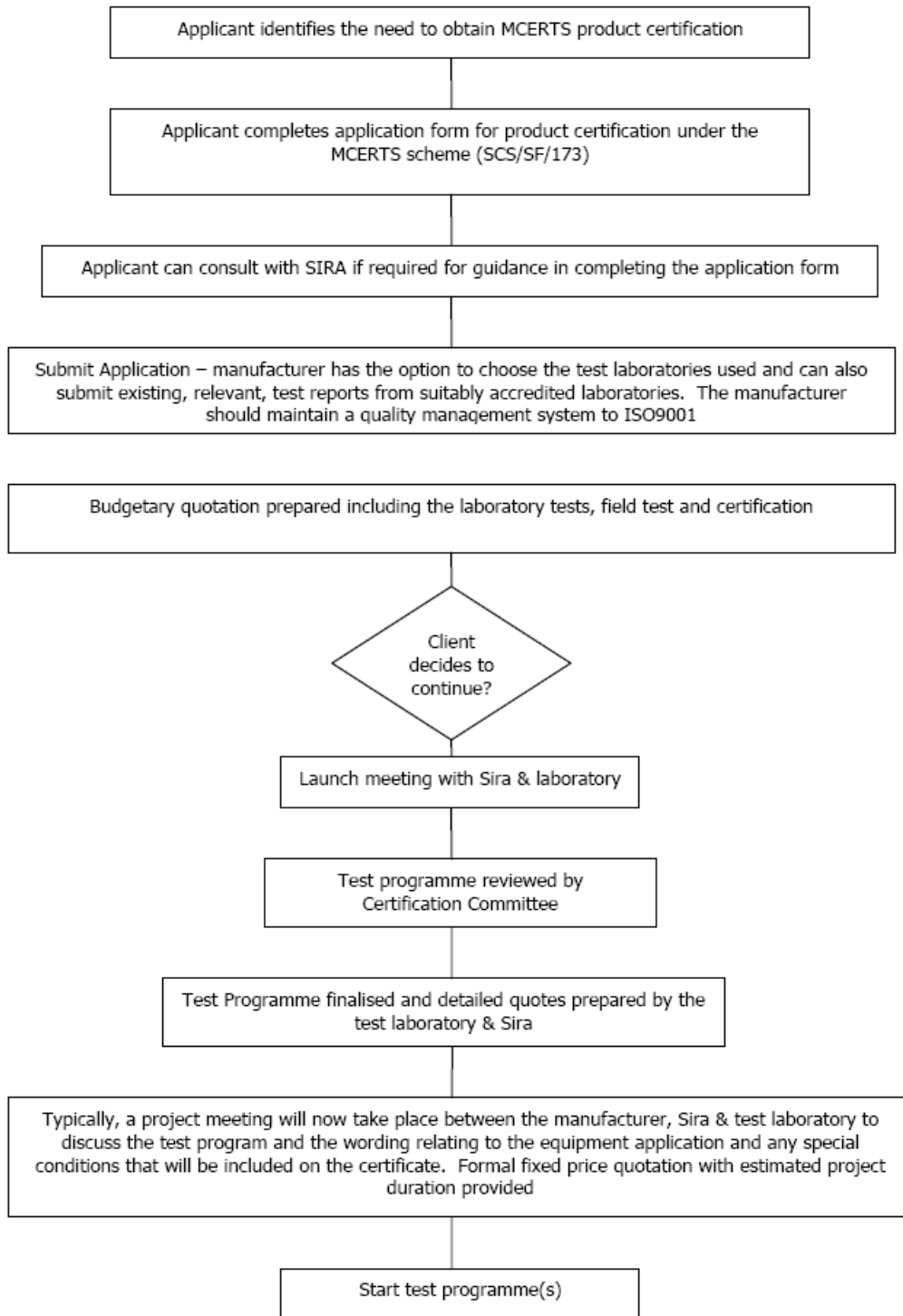
Surveillance audits are normally conducted annually until sufficient evidence of a well-proven robust system has been collected. Once this has been established, Sira may progressively extend the interval between audits or waive an audit visit and instead require the manufacturer to submit specific audit data for review off-site.

Applicants with more than one manufacturing site may have sites audited on a sampling basis if there is a common quality system controlling all the sites. The typical audit process covers the following areas:

- Review of the Quality Management System
- Review of design changes
- Examination of final inspection and calibration
- Review of feedback from customers/users
- Examination of a sample of the product
- Checking compliance with conditions of certification
- Monitoring of compliance with performance specifications

Certificate validity

Certificates are valid for five years. After this time, the certification is reviewed and any necessary retesting will be identified to maintain certification.



Source: SIRA Certification Service Form 1177-Issue 7, May 2005.