PROMOTE

A verification approach for monitoring and remediation technologies in soil and groundwater systems

Results & Recommendations

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PROMOTE ETV

Bringing innovation to the market

SIXTH FRAMEWORK PROGRAMME

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Project Co-ordinator:
Dr. Thomas Track
DECHEMA e.V.
Theodor-Heuss-Allee 25
60486 Frankfurt/Main/Germany
Email: track@dechema.de

Editors:
PROMOTE-Partners

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SETTING THE SCENE

Many new environmental technologies lack proven information on their performance under real or field conditions. This makes it difficult for their manufacturers, especially SME, to convince first customers due to the perceived risks, to secure the sources of finance necessary to fund related industrial developments and sometimes it delays the necessary authorisations to place the technologies on the market.

The European Commission is preparing a proposal for establishing a EU-wide voluntary system, offering credible verification of the performance of innovative and new technologies: Environmental Technology Verification (ETV). The approach of technology verification is directly related to the Environmental Technologies Action Plan (ETAP) of the European Commission, where a lack of confidence in novel technologies and approaches has been listed as one of the most prominent barriers for environmental technology implementation. A Commission initiative after summer 2008 is expected to initiate a European framework on technology verification.

Verification is to be understood as the independent quantitative assessment of the performance of an environmental technology, based on performance claims and predetermined protocols. This means the proof of performance of a specific product. Verification does not prove the operability of a class of technologies in general! It is to be distinguished from certification, which aims at guaranteeing that a technology meets technical standards or regulatory requirements permanently. Verification is most useful in areas where standards do not exist or in areas where standards are normally not applied.

Projects funded within FP6 were initiated to outline requirements for verification in different technology sectors and to come up with sector specific recommendations and protocols. In this respect PROMOTE covers the technology areas site characterisation, monitoring and remediation technologies for soil and groundwater.

At the end of the project and just in time for the upcoming European ETV system PROMOTE provides:

- A verification procedure, tailored to its specific technology sector.
- First reference reports on verified technologies.
- Recommendations for a European ETV system, based on communication with stakeholders and several pilot verifications.
- A CEN Workshop Agreement on verification of site characterisation, monitoring and remediation technologies for soil and groundwater.

Together with results of the other ETV related projects the PROMOTE outcomes are building blocks for future actions on international harmonisation and mutual recognition of Environmental Technology Verification.

Thomas Track
PROMOTE Co-ordinator

CEN WORKSHOP AGREEMENT 32

Environmental technology verification – Soil and groundwater site characterization, monitoring and remediation technologies

Scope

CEN Workshop Agreement (CWA) 32 provides guidelines for the verification of specific products for site characterization, monitoring and remediation of soil and groundwater systems, as long as no European ETV system is in place. In particular, it specifies a reporting structure for verified vendor claims of products in these three technology areas. This CWA describes a procedure which will result in a report that contains verified elements. The report in turn provides a standardized set of key information about a specific technology undergoing the procedure. The report aims to illustrate the performance of the technology and can therefore be used to help all stakeholders in their decision making, i. e. to evaluate if a particular technology is suitable for the site specific pollutant(s) and conditions of a soil and groundwater system.

The CWA provides substantial input to the future European ETV system. It gives guidance on technology verification on a voluntary basis to bridge the time until the European ETV system is established.

Procedure

The verification of a technology for site characterization, monitoring or remediation of soil and groundwater systems shall be performed stepwise, using a generic verification procedure (figure 1), which is indirectly given by the standard reporting system. The first product of following the CWA is the test report. This test report needs to undergo an external review. Thus, when setting-up a test report the review criteria as specified in CWA 32 should be considered. The review, resulting in the review report, proves whether the information given in the test report is comprehensible and correct. The review shall be performed by any qualified party that is independent from the originator of the test report. A verification has to be documented by the verification report.

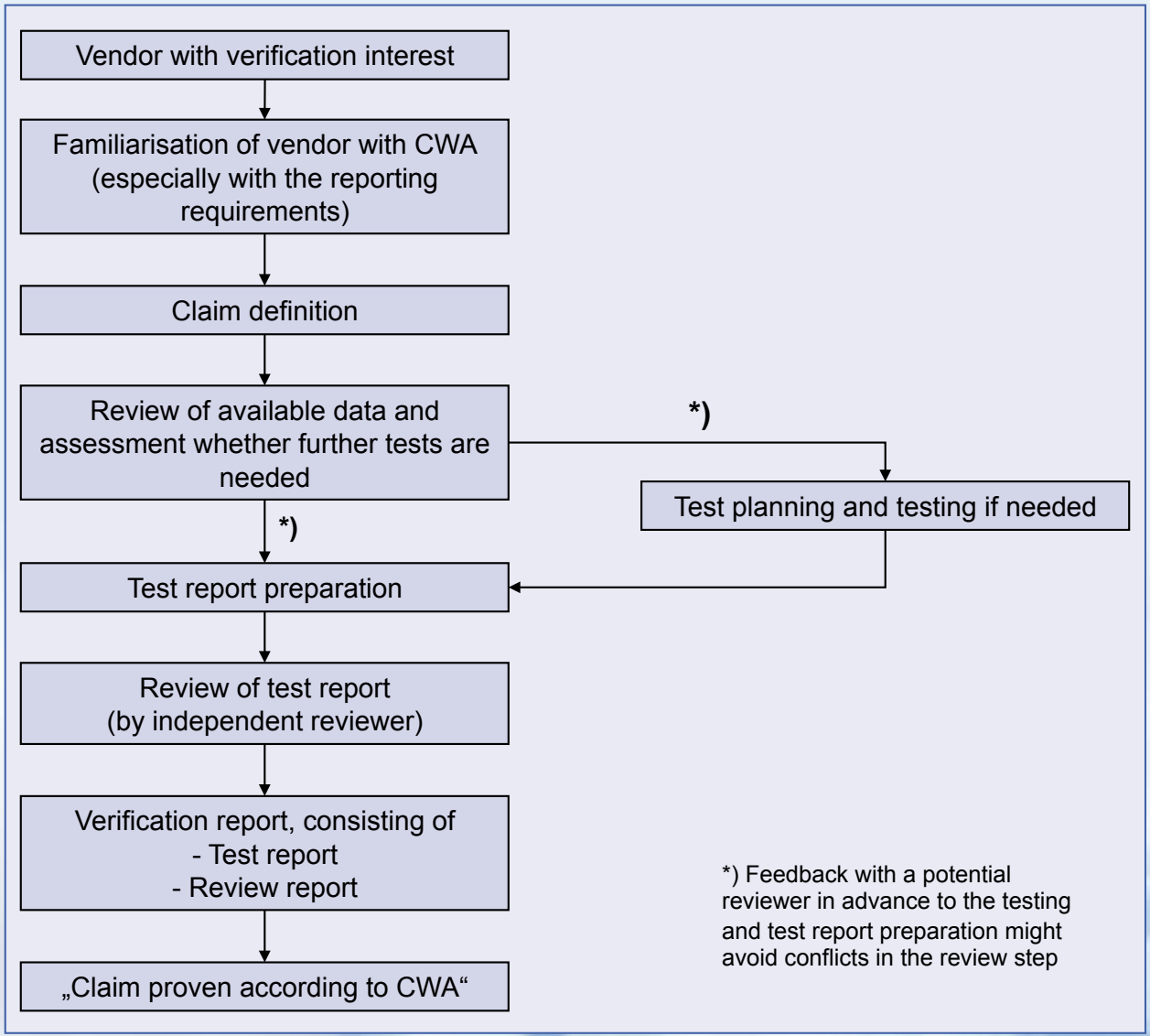


Figure 1: CWA 32 generic verification procedure

Testing

According to the requirements of the CWA, seven steps have to be considered in technology testing and data assessment to prepare the test report:

1. Short explanation of kind and purpose of the technology
2. Schematic overview of the technology or method
3. Technology description
4. Claim specification
5. Testing strategy and test description
6. Documentation of test results
7. Evaluation of test results against the claims

Verification

The review of the technology test report shall be done by an external and independent organization, expert, or party with proven competence. This will result in the review report that judges the validity of the claims with respect to the testing results.
The final product, the verification report shall consist of two parts, part I: the review report, and part II: the test report. The verification report shall be structured in this way; otherwise the verification is not in accordance with CWA32. In addition, the verification report may include other content or sections as annex in order to provide further information, which is found to be valuable to note by the reporting party.

An example – Soil Corer and Direct Well from Eijkelkamp Agrisearch BV

Demonstration of the results of innovative technologies is an important element in the sales of equipment in a competitive market. Independent verification of performance claims based on literature reviews, existing data as well as additional tests according to a generic framework clearly is a step beyond current practice by vendors. To test the verification approach Eijkelkamp Agrisearch BV internally evaluated the verification needs and opportunities of their technology sales program finally resulting in two technologies being selected as examples. Figure 2 shows both the Direct Well and the Soil corer kit. Brochures, technical documents and manuals existed and were used as a basis for steps 1 to 3 in testing these technologies.

The next step, claim specification, needs a lot of consideration. The claim has to be clear, verifiable and needs to be relevant. In the example of the Soil Corer for sampling of very volatile components such as benzene, toluene, xylene and chlorinated hydrocarbons the claim is related to a loss as a percentage of the true concentration. Since different guidelines and standards (e.g. Dutch NEN 5743 and US EPA method 5035A) exist aimed at minimizing the loss, a literature study provided data for the claim specification (step 4) as well as for the testing strategy and technical design. The losses found in practice depend on handling procedures and time elapsed before analysis. Acceptable holding times of samples also depend on conservation methods (e.g. extrusion/extraction in methanol) and storage temperatures (cooling or freezing). A series of laboratory tests with spiked samples, different storage temperatures and typical holding times with Soil Corer samples make up the tests (step 5) for evaluation against the claim.

The documentation of the claims, test strategy and test results (step 6) are extremely relevant to the evaluation and review process (step 7). Although installation of monitoring wells is a common practice, there is no generic and accepted list of objective criteria to describe the quality of the well that fits all site conditions and all well types that are found in practice. The state of the art therefore does not automatically provide a useful (unbiased) reference method. Definition of partial claims (related to separate elements of a technology) is a possible solution. The case of Direct Well is a good example for this. Claims related to fast and simple installation and prevention of the risk of cross contamination by vertical leakage were addressed separately as part of the overall performance compared to 'traditional' wells.

Figure 2: Direct Well (left) and Soil coring kit (right).

RECOMMENDATIONS FOR A EU ETV SYSTEM

Generic recommendations

- It has to be pointed out clearly, that ETV aims to verify specific products and to verify a technology in terms of a class of products.
- Verification has to remain voluntary. There are major concerns, that in case the system becomes mandatory, innovation is hindered by discriminating non verified innovative technologies.
- A faster entrance of verified products into new European and international markets would be a great benefit for technology providers.
- International, mutual recognition would increase the attractiveness of a European ETV scheme.
- Language of verification: Besides English national languages of the major target markets of a product have to be addressed, which is prerequisite for acceptance by public administration.
- National contact points are necessary to avoid access barriers to ETV.
- A well traceable ETV logo, with an easily understandable range of validity is essential for acceptance.
- Customer feedback on the usefulness of ETV when applying verified technologies should be possible.
- The benefit of verification has to exceed verification costs to attract vendors and to convince customers.
- Additional funding would be of major benefit for ETV acceptance.
- A lean EU verification organisation that contracts experts on a case specific basis is recommended instead of creating large technology sector specific verification centres.
- Identifying independent experts for innovative technologies is difficult in many cases. Often the vendor is the most qualified expert or external experts are already in a business relation with the vendor, a competitor or are competitors themselves.
- If technology acceptance and application procedures are regulated by national law, verification will not help.

Standardisation and Best Available Technique Reference Documents (BREF):

- Verification should be linked to the BREF Documents. A successful verification should ease the uptake of innovative technologies in the BREF chapter “Emerging Technologies”.
- Standardisation of the verification procedure as such is welcome to ensure a Europe-wide and internationally comparable handling of the verification procedure. A standardised verification procedure does not mean the compliance of a technology or technology provider with a standard, e.g. ISO 14000 et seq., but the execution and documentation of the verification according to a predefined procedure.

The verification procedure

- Identifying credible, verifiable claims is the most important task within the verification process. It must be possible to adjust claims according to test results.
- Verification must allow multiple points of entry: initiation by vendors and regulators.
- A well balanced approach between the acceptance of existing data and the credibility of the verification system has to be ensured.
- Liability issues have to be clearly defined for a European verification scheme.
- Combination of verification with a pilot installation or demonstration - within the client’s application - would help to reduce efforts for verification.
- Qualification of laboratories should be based on accreditation or comparable record. Where outstanding qualification is required this has to be proven individually.
- Sampling, handling and transport during technology testing has to comply with related, generally accepted procedures and protocols. Keep shipping time at a minimum.
- Logistics is a crucial point for field scale verification, e.g. sample handling and transportation, on site infrastructure, testing schedule.
- The vendor should be integrated in the selection of test and analytical laboratories.
- Dissemination of verification results must guarantee protection of company internal know-how.

Scales of verification

- Benefits and limitations of different scales of verification have to be outlined clearly.
- Lab scale:
  - Parameters that are mainly independent of matrix and field conditions, e.g. technology principle.
  - Basic parameters of operation, e.g. concentration ranges, cross reactions, mass balances.
  - Statistical parameter, e.g. accuracy, precession
- Reference scale – spatial located between lab and field, under well defined and controlled conditions:
  - Statistical parameters
  - Interferences (boundary conditions, matrix effects…)
  - Strongly varying parameters – everything that needs control and flexibility
- Field scale:
  - Mandatory if the claim is focused on field related parameters
  - Handling under field conditions, e.g. set up, operation and maintenance efforts
  - Influence of environmental conditions, e.g. climate
- Influences caused by the subsurface – but restricted to site specific conditions

THE PROMOTE VERIFICATION PROCEDURE

A basic system and its formal entities

PROMOTE developed a basic system for environmental technology verification (ETV), focusing on site characterisation, monitoring and remediation technologies for soil and groundwater. This is to support the design of a European ETV system with specific suggestions and recommendations for this technology sector. By doing so PROMOTE defined formal entities involved and proposed a stepwise verification procedure. The preliminary ETV system and procedure is designed as a vendor driven system. It is meant to provide valid results on technology performance using fast, easy, and cost efficient ways.

The basic ETV system for site characterisation, monitoring and remediation technologies relies on the following entities:

- European Verification Organisation (EVO)
- Verification Board (VB)
- Board of experts

Besides the formal entities the following groups are involved:

- Test lab
- Vendors/producers
- Stakeholders

The EVO is the formal administrative body of the ETV system and will install technology specific Verification Boards according to vendors' demands for technology verification in different fields. An additional "board of experts" including senior experts and representatives of the research sector and the market might provide advice and expertise as well as it could act as clearing party in conflicts concerning e.g. the assessment of verification reports etc.

European Verification Organisation (EVO)	Verification Board (VB)
• Permanently installed management and controlling institution with a low number of staff • Contact point for the first application of vendor/ producer • Initialisation of technology specific Verification Boards, delegation of managers to VB and assigning contracts to experts for VB • Validation of verification reports • Awarding the ETV certificate	• Team of employee(s) out of EVO for management of the board plus contracted expert(s) that is/are chosen from the list of registered experts. • Limited installation for one defined verification task • Assessment of application documents and available test and data • Development of the technology specific verification procedure • Supervision of tests • Assessment of results • Compilation of the verification report • Cooperation with contracted test labs, vendors and stakeholders

Table 1: Role of European Verification Organisation (EVO) and Verification Board (VB)

THE PROMOTE VERIFICATION PROCEDURE

The basic ETV procedure consists of max. 13 steps that are divided in five phases: contact phase, application phase, test phase if needed, assessment phase and publication phase (figure 3).

Contact Phase

In the contact phase three organisational steps finally lead to the installation of the VB.

Step 1: Contact and Quick scan: Vendor/producer contact EVO for admission to ETV procedure by submission of a Quick Scan Input Form. With the Quick Scan Input Form the vendor provides an overview on his technology.

Step 2: Evaluation of the Quick Scan Input Form: The EVO evaluates the information given in the form. Optionally, the EVO can consult the Board of Experts to evaluate the technology information.

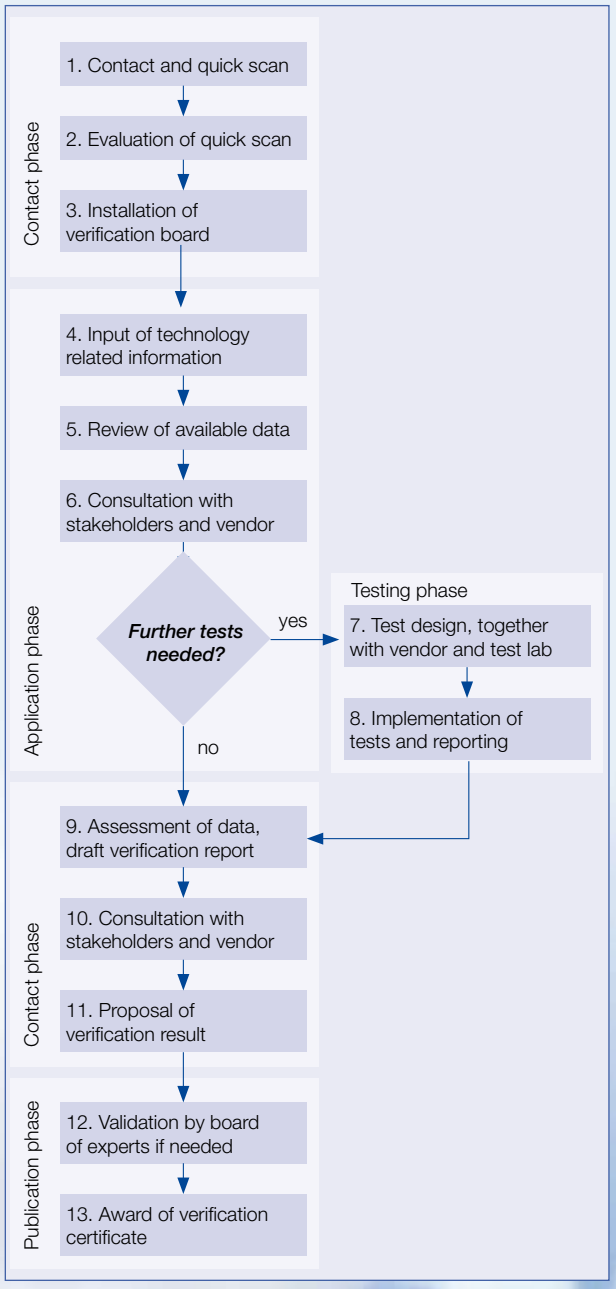


Figure 3: Flow scheme of the verification procedure

Step 3: Installation of VB: After having accepted the Quick Scan application, the EVO installs a specifically targeted VB, considering the complexity of a verification procedure.

Application Phase

The application phase contains compilation and evaluation of all available technology specific documents. In this phase the vendor also defines the performance claims of his technology in cooperation with the VB. The application phase is divided into three steps and ends with the decision whether further test are needed.

Step 4: Input technology-related information: Together with the vendor/producer the experts of the VB review all input data (technical descriptions, manuals).

Step 5: Review of available data: The VB reviews available tests and test results whether they fit the verification strategy and meet quality standards defined in the ETV procedure. The tests results are assigned to the claims.

Step 6: Consultation with stakeholder and vendor: Discussion with the vendor is needed after the review of the available data before deciding on tests. The consultations with stakeholders ensure the acceptance of the verification procedure, if required. In case of large scale verification procedures this can be achieved by arrangement of a workshop.

Testing Phase

In case a verification cannot be done based on the information provided by the vendor, additional tests are needed and a testing phase is inserted. In the testing phase the technology is tested at lab or reference scale and/or in the field.

Step 7: Test design: The VB designs the tests together with the vendor and a test lab. The test lab works on the base of a contract limited to the test design.

Step 8: Implementation of tests and reporting: In agreement with the VB the tests can be conducted by an external test lab or by the vendor's lab. The test results are delivered to the VB in a test report.

Assessment Phase

In the assessment phase all previously available and produced data are finally assessed by the VB against the claims.

Step 9: Assessment of data and draft of verification report: The test report is evaluated by the VB as basis for the verification report. The verification report includes the description of the technology, the performance claim and related test strategy, evaluation of available data and/or test results and the assessment of the performance claim.

Step 10: Consultation: The VB prepares the verification report in consultations with the vendor and stakeholders.

Step 11: Proposal of verification result: The VB submits the verification report to EVO for validation.

Publication Phase

The publication phase is the final phase of the verification.

Step 12: Validation: The EVO validates the verification report in co-operation with the board of experts, if required.

Step 13: Award of verification certificate: The EVO awards the ETV logo to the vendor/vendors technology and publishes the award together with a fact sheet, summarising the verification and the results.

The performance of the steps 2, 6, 7, 8, 10 and 12 depend on nature and scale of the verification procedure. In case of unambiguous decisions no consultation of the board of experts in step 2 and 12 is necessary. Also, the consultation of stakeholders in steps 6 and 10 might be reduced to a minimum if appropriate.

The user's guide

The user's guide leads through the ETV procedure as described before. Various generic protocols, forms and checklists are available to apply the procedure step by step to specific technology verifications (table 2). The protocols refer to the verification of monitoring and site characterisation technologies for soil and groundwater. The verification of remediation technologies follows the same procedure but requires modified checklists.

The protocols are designed to ensure a complete input of technology data into the ETV procedure, the proper assessment of available data, consequent test design combined with a high quality but efficient test implementation, an accurate presentation of test results and a competent test evaluation. The protocols are designed to be used in the different verification steps as follows:

Guidance document (Form, protocol etc.)	To be applied in step
Quick scan input form	Step 1: Contact and quick scan
	Step 2: Evaluation of quick scan
Requirements on product/technology description	Step 4: Input of technology related information
Application and test design protocol	Step 5: Review of available data
	Step 7: Test design
Test implementation protocol	
Protocol for evaluation of manual	Step 5: Review of available data
	Step 8: Implementation of tests and reporting
	Step 9: Assessment of data and draft of verification report
Protocol for evaluation of personnel qualification and strategy	Step 5: Review of available data
	Step 8: Implementation of tests and reporting
	Step 9: Assessment of data and draft of verification report
Protocol for evaluation and reporting	Step 9: Assessment of data and draft of verification report

Table 2: Guidance documents for the different steps of the verification procedure

Testing of portable photometer

REFERENCE VERIFICATION REPORTS

Introduction

During the PROMOTE project a series of technology verification tests were done (figure 4):

- First to test and improve the proposed verification procedure. These tests were run project internal to optimise the workflow of the developed draft procedure, including elaborated protocols and guidelines related to the design, implementation and interpretation of tests.
- Second with external vendors for a final check of the system and related procedures.

All tests were performed as role plays, in which PROMOTE partners according to their field of expertise took over different roles in the verification process as described in the verification procedure, which ensured to proceed always close to reality. The lessons learned in the testing activities were a core element for setting up the recommendations for a European ETV system.

The manifold experiences gained by the testing activities provided valuable input to the ongoing system development process. The stepwise procedures and related protocols and forms could be significantly improved after each testing exercise. This increasing experience also stimulated the elaboration of the CEN Workshop Agreement 32 for site characterisation, monitoring and remediation technologies for soil and groundwater.

Among the internal tests a sampling technology, the Mini Pressure Pump of imw, and a field analytical instrument, the Slandi Photometer were selected to be presented in fully elaborated verification reports as reference reports. From the tests of external technologies, all vendors received publishable verification reports, which can also be considered as reference documents. Hence these reference reports are prepared to provide:

1. prototype reports for the upcoming European ETV system,
2. the vendor with an independent verification of his technology and publishing a best practise example elaborated according to CWA 32.

Aim	**Verification tests during system development, project internal technologies**				**Final verification tests, project external technologies**		
Scale	Lab and/or reference to field				Lab to field		
Technology	Photometer	Ceramic Dosimeter	Mini Pressure Pump	Fluorometer, Metal Oxide Sensor	Direct Well, Soil Corer	BOD- Micro Biosensor	Passive Sampler
	Slandi	imw	imw	VEGAS	Eijkelkamp	Biosensores	Envirogene
Verification tests	X	X	X	X			
Reference report	X		X				
Public report to external vendor					X	X	X

Table 3: Overview on technology testing activities

A reference report example – the Mini Pressure Pump of imw

Product description

The Mini Pressure Pump (MPP) of imw is a miniature double valve pump for low flow groundwater sampling in small diameter wells or any narrow applications (figure 4). The MPP is driven by a pneumatic control unit with a compressor or pressure bottle, e.g. with air or nitrogen and pushes the water up by positive displacement. The drive and vent cycles can easily be adjusted by hand to allow flow rates from close to 0 up to 400 ml/min. Due to the sample being pushed, not drawn or vacuumed, to the surface, the pump allows for precise low flow sampling with comparative high purge rates to obtain a representative sample at e.g. 100 ml/min or less when sampling for VOCs.

These pumps can also be used in depth-determined sampling applications like multilevel packer systems, in conventional groundwater monitoring wells or in lost pump-systems installed by direct push techniques. The small size of only 23 mm in diameter allows the use in narrow applications like 1 inch wells.

Its simple design makes the pump very field serviceable, robust against clogging (e.g. high turbidity water and fine sand), resistant against dry pumping and easy to clean with non-phosphate soap and a brush. All parts are interchangeable and inert for strong solvents and corrosive chemicals. Filters can be easily cleaned and replaced.

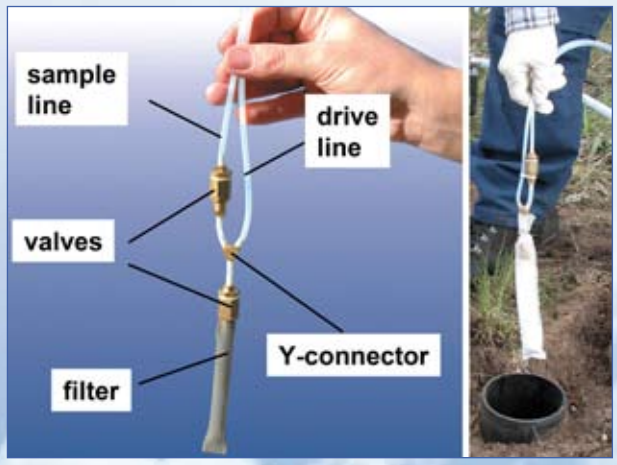


Figure 4: Design of double valve pump: upper and lower one-way valve, Y-connector, pressure and sampling tubing, filter.

Performance claims and tests

Most conventional pumping techniques do affect the concentration of dissolved gases and volatile compounds in the pumped solution, either by introducing energy as turbulence or heat or by reducing the total pressure i.e. by applying suction. By using the MPP these factors can be minimized. The following claims were defined.

Claim no. 1: Using the MPP, the recovery of volatiles is minimum 95 %.
Claim no. 2: The MPP works down to a groundwater table lying 80 m below surface level.
Claim no. 3: The maximum contamination level with O_2 during sampling using the MPP system is 0.1 mg/L or 1% of saturation, whichever is lower at a given temperature.
Claim no. 4: Use of MPP in combination with a Multilevel Packer System: sampling in defined depths provides depth determined chemical concentrations that agree minimum 60% with concentrations that are found by sampling with another depth determined sampling method like the 3-channel CMT wells.
Claim no. 5: Use of MPP in combination with a Multilevel Packer System: sampling in defined depths provides depth determined chemical concentrations that agree minimum 60% with concentrations that are found by sampling with a conventional depth determined sampling method like a packer system in combination with a submersible pump, as long as the layers with the maximum inflow to the well are known and the submersible pump is installed in the depth of these maxima.
Claim no. 6: Use of MPP with a small double-packer-system in a 1 inch-well provides chemical concentrations that agree minimum 60% with concentrations that are found by sampling with a conventional depth determined sampling method like a packer system in combination with a submersible pump in a conventional well (Cost minimizing: because the installation of a 1 inch well is cheaper than the installation of a conventional well).

To verify the claims given by the vendor, tests have been carried out in the laboratory under controlled conditions as well as in the field. In reference scale (VEGAS, University of Stuttgart) the recovery of volatile compounds, the capability to perform oxygen-free sampling and the maximum depth of operation were assessed (claim 1 to 3). These tests were focused on discrete significant properties of the technology. The field tests were performed in Bydgoszcz(PL) at the location of a former gasworks site. At the field site numerous sources of soil and groundwater pollution with Polycyclic Aromatic Hydrocarbons (PAHs), Benzene, Toluene, Ethylbenzene and Xylene (BTEX) as well as Phenols are present. Field tests aimed at elucidating the comparability of the MPP in several application modes with conventional pumping and another innovative depth-determined sampling technique (claim 4 to 6). The MPP and the reference pumping systems could not be operated in the same well. So a number of wells were installed close together (figure 5).
The assessment of the analytical results obtained from these field tests had to consider heterogeneities of soil layers and groundwater contamination as well as effects of different pumping methods on concentrations in the samples.

Evaluation

The claims defined for the MPP could be proven. For the lab tests the results obtained with the MPP could be compared directly to the reference samples and assessed without any data processing. The assessment of field test results included the interpretation of the geological profiles, the pumped volumes, the flow rates and the turbidity of the samples. The influence of these factors was evaluated and lead to an explanation why the claims for the field tests could be regarded as proven although some analyses did not strictly comply with the values defined in the claims.

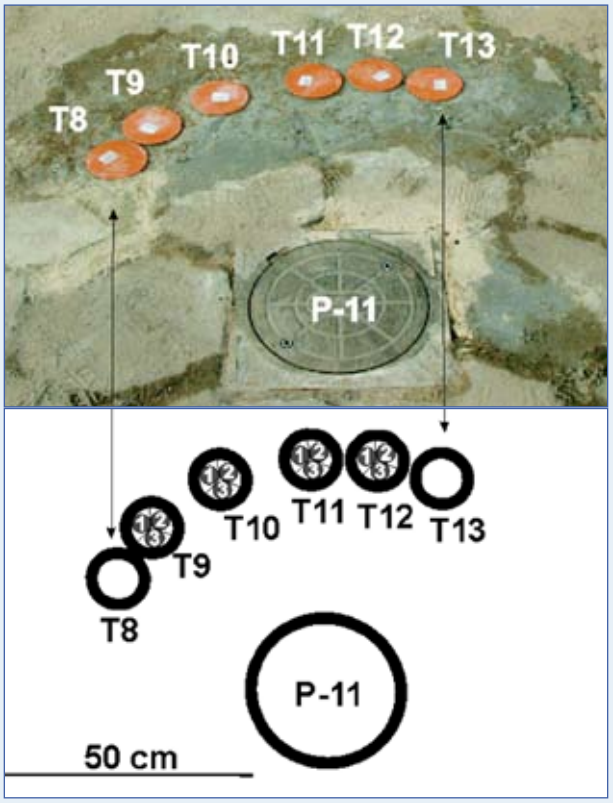


Figure 5: Design of the test field

Conclusions from the tests

- The definition of claims (inclusive precise wording) is a crucial point of verification and requires time and discussion between all involved parties. It should be further possible to revise a claim during the ongoing verification.
- The vendor needs to be involved in design and implementation, as in many cases the vendor is the best expert => 6 eye principle: test lab, verification expert, vendor
- The claims have to be translated into precise (quantitative if ever possible) questions asked for all parts in the design protocol. These questions have to be answered by the tests and should lead directly to a decision on the verification of the claims.
- Most of the tests are small research projects. So unexpected problems can occur and tests can fail.
- Finding a suitable field site takes plenty of time, which can result in significant costs.
- Field tests have to be designed much more in detail than lab or reference scale tests, e.g. logistic aspects, effects of the geological situation (heterogeneities) on the results, potentially strongly varying test conditions etc. have to be considered.

ETV APPROACH FOR REMEDIATION TECHNOLOGIES

Based on the generic PROMOTE verification procedure, an ETV approach for remediation technologies was elaborated. This ETV approach can be described briefly as an evaluation system, which aims to verify the performance of technologies in an objective and reliable way, giving potential customers more confidence.

Brief description of the ETV approach for remediation technologies

To overcome the complexity related to verification of remediation technologies, and especially in-situ remediation technologies, a step-by-step approach was chosen. Different aspects of the remediation technology that need or can be verified are divided in a number of groups or levels, the so-called tiers. The organisations (vendor, consultant, contractor, authority, …) entering ETV can choose which tiers they want to have verified, depending on their needs, possibilities and available budget. The following tiers are being proposed:

- TIER 1: Verification of the technology principle
- TIER 2: Verification of the technology in the field
  - TIER 2A: Verification of the performance of the technology in the field
  - TIER 2B: Verification of the design of remediation technologies (option)
  - TIER 2C: Verification of the implementation of remediation technologies (option)
  - TIER 2D: Verification of the operation of remediation technologies (option)
- TIER 3: Verification of the longevity of remediation technologies

A schematical overview of the different tiers with indication of the chronological order of the tiers is given in figure 6.

TIER 1, the verification of the technology principle, which is expected to help ETV-entering organisations already to a certain extent to introduce a technology faster into the market.

In other cases in addition **TIER 2**, the evaluation of performance in the field, is also required, where TIER 2A is a must. TIERs 2B, 2C and 2D, all to some extent related to soft skills, are optional and are expected to be required less often. They are included for organisations interested in a label for fragments of the remediation technology.

TIER 3 focuses on the longevity effect and can only be applied for when TIER 1 and TIER 2A have been considered.

ETV labels for different tiers can be obtained in the course of time according to the requirements of the verification procedure. This allows ETV-entering organisations to proceed step-by-step based on their needs and available resources.

Remediation technologies considered within PROMOTE

Within the PROMOTE project, a number of remediation technologies were considered to evaluate the ETV-approach that was worked out. An overview of these technologies is given in table 4.

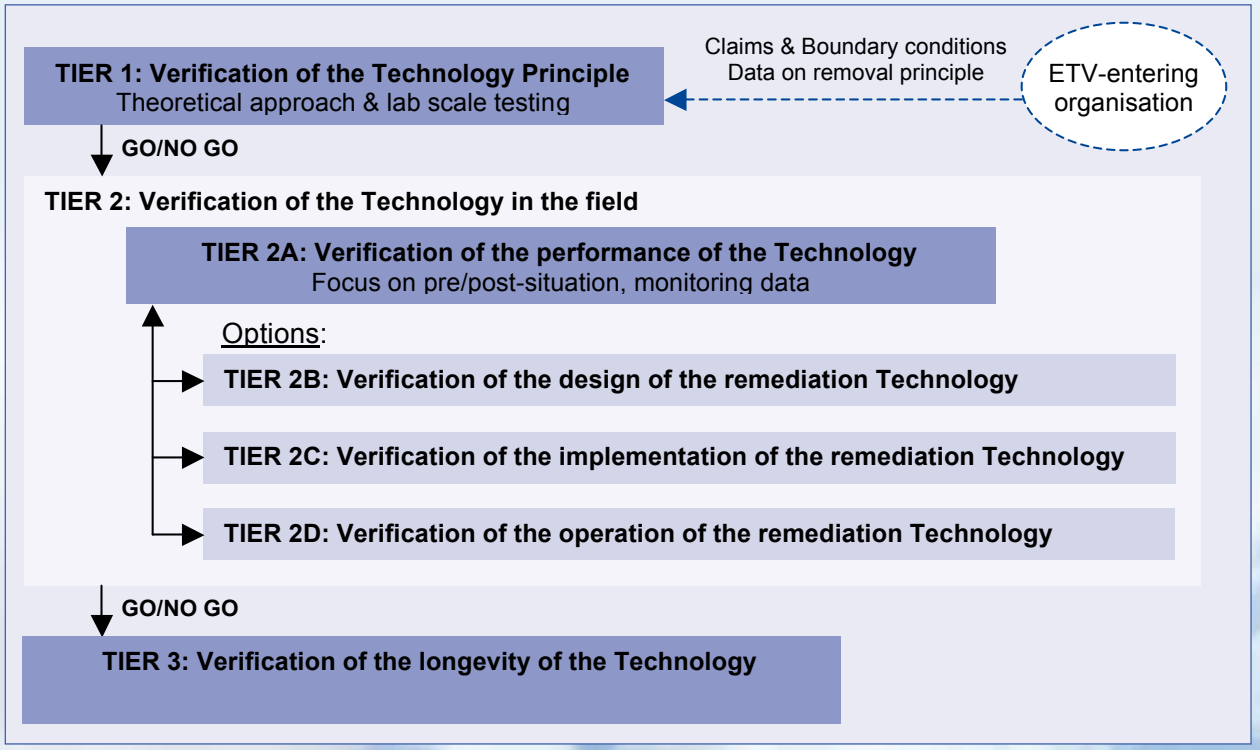


Figure 6: Overview of the different tiers with indication of the chronological order

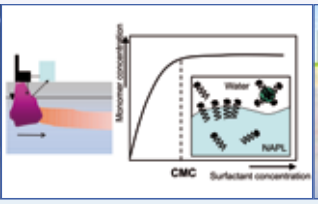
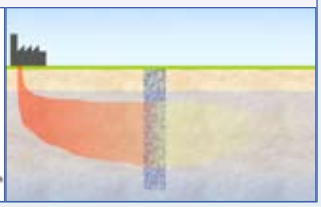
	Ex-situ remediation technologies	In-situ source zone treatment	In-situ plume treatment
TIER 1	Relevant	Relevant	Relevant
Theoretical approach	Required	Required	Required
Lab scale approach	Required Portentially in combination with TIER2	Required	Required
TIER 2	Relevant	Relevant	Relevant
Monitoring protocol	Negotiated with and accepted by verification board	Negotiated with and accepted by verification board	Negotiated with and accepted by verification board
Verification test performed by	Test-lab (and ETV-entering org)	ETV-entering org./test lab Test-lab → independent monitoring rounds	ETV-entering org./test lab Test-lab → independent monitoring rounds
Potential negative side-effects	Volatilization, toxicity additives, pathogens	Mobilisation of DNAPL	Unwanted side products
Required time	1-12 Weeks	1-4 Months	Years
TIER 3	May be relevant	May be relevant	Relevant
approach			• Direct • Simulations
Examples selected for more detailed study	Additives to stimulate bioremediation	Soil flushing	Permeable reactive barriers & reactive zones
			

Table 4: ETV-approach for soil/groundwater remediation technologies

Testing in reference site scale

PROMOTE: CONSORTIUM

CEN – European Committee for Standardization (Belgium)
www.cen.eu

CSIC - Consejo Superior de Investigationes Cientificas (Spain)
www.csic.es

DECHEMA e.V. (Germany)
www.dechema.de

Deltares (Netherlands)
www.deltares.nl

IMW Innovative Messtechnik Weiß (Germany)
www.im-weiss.de

Municipality of Bydgoszcz (Poland)
www.bydgoszcz.pl

Polish Geological Institute (Poland)
www.pgi.gov.pl

Sachverständigen-Büro Dr. Thomas Ertel (Germany)
www.sv-ertel.de

SLANDI Sp. z.o.o. (Poland)
www.slandi.pl

Strasbourg University (France)
www-ulp.u-strasbg.fr

Stuttgart University (Germany)
www.iws.uni-stuttgart.de/Vegas

VITO (Belgium)
www.vito.be

PROMOTE: PROTOCOLS, REPORTS & DOCUMENTS

Further Information

The information provided in this brochure gives an overview on major products of the PROMOTE project. On the website you will find more detailed information, e.g. on:

- Protocols and procedures for verifying site characterisation, monitoring and remediation technologies for soil and groundwater
- Full reference reports of verified products
- Verification reports of third party products
- Stakeholder comments on ETV

www.promote-etv.org
www.eu-etv-strategy.eu

The full description of the CEN Workshop agreement 32 “Environmental technology verification – Soil and groundwater site characterization, monitoring and remediation technologies” is available via CEN:

www.cen.eu

KEY FACTS

Bringing innovation to the market is a challenge for the environmental technology sector. Many new environmental technologies lack proven information on their performance under real or field conditions. This makes it difficult for their manufacturers, especially SME to convince first customers.

The European Commission is preparing a EU-wide voluntary system, offering credible verification of the performance of innovative and new technologies: Environmental Technology Verification (ETV). Verification is to be understood as the independent quantitative assessment of the performance of an environmental technology, based on performance claims and pre-determined protocols.

Funded within FP6 PROMOTE outlines requirements and protocols for verification of site characterisation, monitoring and remediation technologies for soil and groundwater. Just in time for the upcoming European ETV system PROMOTE provides:

- A verification procedure, tailored to soil and groundwater investigation and remediation,
- Generic protocols for all steps of the procedure,
- First reference reports on verified technologies.

Manifold consultations with stakeholders and the pilot verifications result in recommendations for the European ETV system.
Some key messages are:

- ETV has to be voluntary; a mandatory system may hinder innovation.
- A link between ETV and the BREF documents should be established.
- A European system must be time and cost efficient.
- ETV should help opening markets – in Europe and beyond.
- Overcoming the language barrier is a major factor for a successful European ETV system.
- Financial support in verification is mainly important for SME.

To bridge the time until the European ETV system is fully operable, PROMOTE has elaborated guidelines for the performance verification:

- The CEN Workshop Agreement 32: Environmental technology verification – Soil and groundwater site characterization, monitoring and remediation technologies

Find more detailed documents and information on the web:

www.promote-etv.org | www.eu-etv-strategy.eu