

Outline of granted projects in 2009 Program on sustainable production and environmental technologies

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Program on Sustainable production and environmental technologies

CALL 2009

Project Title	APOLINR - Advanced air POLLution control system based on INfra Red quantum cascade lasers
Abstract	<p>Air pollution is currently a major environmental issue. The diversity and importance of atmospheric pollutants were first identified in urban and peri-urban atmospheres leading to recommendations from WHO (World Health Organization). These recommendations are about outdoor pollution levels whereas many studies mention that pollution inside buildings can reach levels 10 to 20 times higher depending on the pollutants. Thus high levels of pollution in confined spaces begin to be taken into account. From these studies, it turns out that formaldehyde is an oxidation product of many Volatile Organic Compounds (VOC), among others reacting with ozone. It is thus a good tracer of pollution by volatile organic compounds. Consequently, recommendation thresholds have been defined notably by WHO and AFSSET (Agence Française de Sécurité Sanitaire de l'Environnement et du Travail) at 30 and 10 µg/m³, respectively. It also turns out that there is no satisfactory way to monitor formaldehyde. The aim of the project is to fabricate a sensor based on Quantum Cascade Lasers able to measure formaldehyde in confined states. The role of the system is double: 1. Providing to institutes a way to monitor short time as well as chronic time exposure to this compound and set recommendations. 2. Providing a cost effective, high performance, compact sensor for public space for monitoring levels of concentration. Even if, within this project, the final gas analyser demonstrator focuses on formaldehyde, it also has a vocation to be flexible. In this sense, it can be adapted to other compound of interest such as NO, N₂O, CO, NH₃, SO₂ etc., by adjusting the optical wavelength thanks to the versatility of Quantum Cascade Laser. From either analysing pollution on-site or process monitoring, the main characteristics of this sensor must be: 1. a very high sensitivity (under the ppb range) and selectivity 2. capable to give fast measurements of pollutant densities (few seconds of acquisition) 3. transportable device to make on site measurements (outdoor as well as indoor) 4. adapted to formaldehyde and sufficiently versatile to detect various molecules of interest. Such a sensor with these stringent characteristics could also be able to address problematic in the domain of health diagnostic if human breath is substituted to air. Thanks to the development of quantum cascade laser with ultimate performances and new high sensitivity optical methods (OF CEAS, Optical Feedback Cavity Enhanced Absorption Spectroscopy), Infra-Red (IR) absorption spectroscopy will meet these needs for air pollutants analysis. In this context, the industrial research project APOLINR has for objective to develop a compact portable high sensitivity-high selectivity gas analysis system based on Medium IR absorption spectroscopy. This project addresses the thematic axis 5 of the present ANR P3N</p>

project call. This challenging and multidisciplinary project relies on the complementary skills of four partners at the leading edge in their respective fields: - Alcatel Thales III-V Lab will coordinate the project and will develop a high-power (>200 mW) monomode QCL, using its unique patented technology of nanostructured metal surface grating; - LSP-UJF Grenoble and its business unit Floralis will integrate the QCL device in a high sensitivity optical spectroscopy set-up of the LSP-patented OF-CEAS technique.- LPTP Ecole Polytechnique Palaiseau will use the developed optical gas sensing system to monitor and to optimise the operation of an original and powerful cleaning up reactor.- Environnement SA, European leader in air monitoring will carry out measurements on the sensor to see how it meets the specifications.

Consortium

Alcatel Thales III-V Lab (coordinator)
 Laboratoire de Spectrométrie Physique
 Laboratoire de Physique et Technologie des Plasmas, Ecole Polytechnique
 Environnement SA

Coordinator

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ANR Grant

554 861 €

Kick off and duration

November 2009 - 36 months

Reference

ANR-09-ECOT-001

Program on Sustainable production and environmental technologies

CALL 2009

Project Title	ASURET - Systemic analysis of technosphere renewable resources use
Abstract	<p>The development of our society depends on the extraction, at the lowest cost, of raw materials and energy from the underground, their transformation and accumulation in the technosphere, and their reject in the environment as waste. The increase of the demand has always been solved by the increase of production. The awareness of the non renewable character of some natural resources, the tensions observed on the markets, the increased legislative pressure stemming from the EU, particularly through the Waste Directives, change this way of thinking. The transition towards sustainable territories and a control of territorial entropy need a reorganisation and a decrease of external flows (inputs and outputs of the system) and internal flows (by optimising the reuse of matter and energy). It is necessary to change the paradigm by progressing towards a systemic approach of the territories, probably more adapted to the definition of a coherent development model. The sustainability of a territory must be described in terms of internal sustainability, but also in terms of external sustainability, taking into account its potential interactions with other territories. This analysis is nevertheless difficult to do, both at the level of the organisation of flows and at the level of the qualitative and quantitative structure of exchanges. An analysis of the metabolism of territories through a systemic approach ("think globally and act locally") would probably favour the development of more virtuous production and consumption models. In the meanwhile, the national market of collection, treatment and valorisation of materials coming from demolition does not take off from an economical point of view. The questions of recycling and valorisation often arise at the scale of a project, a town or a local community of finite extension without having thought to the preliminary questions of the geographic and time extensions to account for the availability and durability of resources. Through a systemic approach, ASURET will draw the basis of a long-term thinking, considering the territories as evolutionary deposits of materials in time and space. These deposits must be characterised, the technical and economic conditions for their exploitation must be discussed (assessment and use of resources built up in the technosphere, anticipation of the impacts of the evolution of construction and deconstruction modes). ASURET, through the example of construction materials (that represent 40% of the total tonnage of materials transported each year), will cope with the questions of geographic and temporal scale at which the recycling and valorisation networks must be thought, the economical, technical and social conditions for their optimisation: Which facilities, which location, which capacities, for which materials? How to develop synergies,</p>

how to measure progresses? Taken into account the number of actors of construction and territorial planning, the only way to create and develop more sustainable practices is a systemic approach. The gathering of these actors, who often have conflicting interests, around common objectives of reducing environmental impacts, goes through the definition of new systems of reference and analysis criteria. Communication around these stakes is a key element in the evolution of mentalities. The work will lead to the building of a prototype of a decision aid tool based on a multi criteria analysis, including the results of an economy wide life cycle analysis of the use of primary and secondary materials. This prototype will be tested within different scenarios simulated on the two case studies chosen in the project (Orléans City and Conseil Général des Bouches du Rhône)

Consortium

BRGM (coordinator)
INSAVALOR SA
Centre Scientifique et Technique du Bâtiment
Université de Technologie de Troyes / Centre de recherche et d'études interdisciplinaires sur le développement durable
TREIZE DEVELOPPEMENT

Coordinator

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**ANR Grant
Kick off and
duration
Reference**

819 866 €
November 2009 - 36 months
ANR-09-ECOT-002

Program on Sustainable production and environmental technologies

CALL 2009

Project Title	CERVEAU NP - How to Purify Anoxic Waste Waters with Green Rusts? Nitrate-Phosphate
Abstract	<p>Harnessing to an industrial process the natural denitrification of underground waters by Fe(II)-Fe(III) compounds that are revealed by their bluish colour in hydromorphic soils is the goal of this project. Fougerite mineral found in gleysols owns unusual properties inherent to green rusts, here the Fe(II)-Fe(III) oxyhydroxycarbonate, $[\text{FeII}_6(1-x)\text{FeIII}_6x\text{O}_{12}\text{H}_2(7-3x)]^{2+} \cdot [\text{CO}_3^{2-} \cdot 3\text{H}_2\text{O}]^{2-}$, where ratio $x = \text{Fe(III)} / \text{Fe(total)}$ can vary in the complete range from 0 to 1. The process is based on the synergy between the nitrate reduction by the oxyhydroxycarbonate that oxidizes FeII and that of FeIII by iron reducing bacteria in anoxic conditions which regenerates the catalyst. The synthesis of the precursor, its coating upon a suitable support such as sand or pozzolane, its transformation into the catalyst, then the determination of denitrification reaction kinetics lie at the heart of this process, which induces no pollution and does not consume much energy. The in situ monitoring of iron speciation during the catalysis is insured by back-scattering Mössbauer spectroscopy analysis using the miniaturized apparatus MIMOS recently launched on planet Mars. Speciation of nitrogen species will be provided continuously and special care will be carried out for determining the working domain that favours the formation of nitrogen gas instead of ammonium. The aim is to validate a tertiary treatment for Rhizostep implant of SAUR group made of reed filters. Special care will be devoted to the transfer of the process for settling waterlogged areas with iron reducing purification (WARIP) where an improved lagooning system should take part to the healing treatment of coastal zones that are invaded by green algae.</p>
Consortium	<p>CNRS Délégation Régionale Centre Est (coordinator) Université Pierre et Marie Curie : Paris VI - Institut de Minéralogie et de Physique des Milieux Condensés PRES de l'université de Lorraine - Service Valorisation Innovation Transfert Société d'Aménagement Urbain et Rural MARION TECHNOLOGIES</p>
Coordinator	<p>Christian RUBY – CNRS Délégation Régionale Centre Est christian.ruby@lcpme.cnrs-nancy.fr</p>
ANR Grant	<p>835 933 €</p>
Kick off and duration	<p>November 2009 – 42 months</p>
Reference	<p>ANR-09-ECOT-003</p>

Program on Sustainable production and environmental technologies

CALL 2009

Project Title	COFRAGE - Integrated assessment of innovative technologies for selective fragmentation of concretes and their recycling in the aggregates and cement industries
Abstract	<p>Hardened concrete is a composite material that contains roughly two phases: the matrix (hardened cement paste) and aggregates (gravels and sand). The liberation and the recycling of these constituents can provide an answer to i) the exploration of new aggregates supply sources imposed by the depletion of natural deposit and the faced difficulties when trying to open new quarries and ii) the reduction of CO2 emissions in the clinker manufacturing process through the substitution of part of the limestone by a non-carbonated lime source in the raw mix. Preliminary matter and energy balances, performed at BRGM, showed that excellent results, in terms of CO2 emissions reduction and energy savings, were obtained with the recycling of cement matrices recovered after the sorting of waste from public buildings and work sector. At present, concrete recycling is performed by selective crushing and size sorting. However, the energy consumption of the process is very high and liberation grade often unsatisfactory. Moreover, no process currently makes it possible to recycle the hardened cement paste. In order to decrease significantly the consumption of natural resources (re-use of aggregates), the CO2 emissions (re-use of the cement paste in the clinker manufacturing process) and the energy consumption related to concrete recycling, it is necessary to develop innovative technologies that marks a break with the current industrial practices of crushing and grinding. Through an experimental development, the COFRAGE project aims at studying two technologies of embrittlement and selective fragmentation of concretes in order to improve the release of the valuable phases while minimizing the associated energy consumption. These technologies are on the one hand, an electrohydraulic technique of selective fragmentation, that applies high voltage pulses, (a few kV per cm), through blocks immersed in water. This technique would make it possible to promote the valorization of the concrete subproducts: the recycled aggregates and re-use of the cement matrix as a component in the raw mix for clinker processing. On the other hand, a second technique of embrittlement that uses electromagnetic energy of microwaves and their selective effects of internal heating on the different mineral phases would be studied. Some mineral phases belonging to the group of dielectric materials with strong absorption capacity of micro-waves, will warm up more quickly than other minerals belonging to the groups of insulating materials and conductive when they are exposed a few seconds to micro waves, for example of frequency 2 to 3 GHz, until a few tens of GHz. The differences in temperature between the mineral phases induce differences in expansion and mechanical constraints between the minerals that weaken the material, contribute to lower the energy of size reduction and make easier a later selective fragmentation in a grinder or a crusher. The assessment of both techniques will integrate the economic aspects (cost of the treatment and transport), the technological aspects related to the physical constraints of the treatment (definition of the operating conditions, compared efficiencies of performances of phases liberation according to the "types" of concretes) and to the constraints of re-use of the sorted elements (cleanliness of the aggregates, rate of carbonation and moisture content of the recovered cement paste), the environmental aspects (avoided</p>

impacts related to the unused raw materials, reduction of CO2 emissions) and the energy aspects related to the consumptions of the recycling line (electric and fuel consumption of recycling, fuel consumption of transport, avoided consumption related to the re-use of a non-carbonated cement paste as a substitute compound in the raw mix of the clinker manufacturing process).

Consortium

BRGM (coordinator)
PICHETA
INPT – LGC
SEFRAG
ENSEIRB

Coordinator

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ANR Grant

578 541€

Kick off and

November 2009 – 36 months

duration

Reference

ANR-09-ECOT-004

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	COPOTERM - Copolymers for effective removal of metallic ions from industrial wastewater
Abstract	<p>COPOTERM is focused on the development of intelligent polymeric block copolymers for the effective removal of metallic ions from industrial wastewater. The goal is to produce thermosensitive phosphonated polymers synthesized by living radical polymerization techniques, especially by reversible addition-fragmentation transfer (RAFT) process. These materials present inverse temperature-dependent solubility as they dissolve when cooled and phase separate at their Lower Critical Solution Temperature (LCST). At the same time they complex metals via phosphonated groups. Separation process is then used to remove precipitated polymers/metallic ions followed by a regeneration step allowing the recycling of the material. Next, the purified water will be used in industrial plants or, according to the local legislation, flowed into rivers. This treatment process could lead to the improvement of the techniques usually used in the removal of metallic ions in wastewater. It will permit to reduce chemicals use by recycling of the complexing copolymers and to minimize the impact of the global process on the environment. A consortium has been worked out, associating three academic partners and two industrials, selected for their background in specific areas: synthesis of macromolecular architectures and functional polymers, process engineering and wastewater treatment, life cycle assessment in relation with an industrial and ecological approach. The industrial partners will bring their expertise in the production in large scale of specific polymers and in the treatment of wastewater. This project perfectly fits with the requirements of "THEME 4" dedicated to a better treatment of polluted environments integrating technical jumps and economical benefits.</p>
Consortium	<p>UM2 - ICG (coordinator) UM2 - LGPEB SPECIFIC POLYMERS GIE ANJOU RECHERCHE Cemagref - UMR ITAP</p>
Coordinator	<p>Jean-Jacques ROBIN – UM2 - ICG Jean-Jacques.Robin@univ-montp2.fr</p>
ANR Grant	<p>694 316 €</p>
Kick off and duration	<p>November 2009 - 48 months</p>
Reference	<p>ANR-09-ECOT-005</p>

Program on Sustainable production and Environmental technologies

CALL 2009

Titre du projet	DEFIVIANDES - Environmental Development of Meat Industries
Résumé	<p>This project is dedicated to the analysis and the improvement of environmental and health performances of the meat sector (breeding and slaughter house) in terms of sustainable development. In a first part, a selection of meat companies will be the subject to both carbon and energetic balances in order to assess their impact on the environment. A second part will be dedicated to the analysis of their effluents, before and after treatment, in order to evaluate potential microbiological hazard. The meat sector is a major consumer of antibiotics and as such it provides an environment favorable to the dissemination of antibiotic resistances. With this respect, 3 lines of investigations will be conducted: (1) the identification of animals-originating E. coli strains, associated to a phenotypic characterization regarding virulence and antibiotic resistances, (2) the bio-molecular identification of integrons, which are genetic structures believed to play major role in the spread of antibiotic resistance, and finally (3) identification effluents/sites, in the different meat processes, that are favorable to the transfer of a model plasmid (pB10) carrying multiple antibiotic resistance genes. A global evaluation of wastewater treatment performances, health impact, green house effect gas emissions due to water and sludge treatment will be achieved with the setting up of pilot plant in situ. Finally, by the end of this project we shall be able to propose management indicators and alternative processes to minimize the impacts of the meat industry on the environment and to reduce health hazard with acceptable economic constraints.</p>
Partenaires	<p>Université de Limoges – GRESE (coordinator) ADIV ENVT IHAP Coli ENSAIA CNRS DR6 Université de Limoges - EA 3175</p>
Coordinateur	<p>Christophe DAGOT – Université de Limoges – GRESE dagot@ensil.unilim.fr</p>
Aide de l'ANR	<p>718 020 €</p>
Début et durée	<p>November 2009 - 36 months</p>
Référence	<p>ANR-09-ECOT-006</p>
Label pôle	<p>INNOVIANDE (ex Viandes et produits carnés)</p>

Program on Sustainable production and Environmental technologies

CALL 2009

Titre du projet	ECO CND – Ultrasonic guided waves as pioneer of novel NDT eco-technologies
Résumé	<p>To develop novel clean NDT technologies by ultrasonic guided waves in order to replace magnetic particule inspection and penetrant testing techniques avoiding both emission and consistent volume of wastes and effluents, and to reduce significantly the energy consumption due to their implementation. The scientific program will consist of 8 tasks:</p> <ul style="list-style-type: none">- A management task and of dissemination & exploitation of the results;- A set up of technical tasks of modelling, realization of a laboratory demonstrator typically laser / EMAT, of a new generation of TOFD multielement equipment of welding inspection, as well as a 3D defect imaging platform, and finally of qualification process. At the end, this new process should allow avoiding a yearly production more than 100 000t organic substances, 100 000m³ of wastewater, 250 000t of wastes and an estimated saving of more than 1000MKWh equivalent of 200Mt CO₂.
Partenaires	<p>IXTREM (coordinator) CEA LIST CNRS – IEMN HOLO3 INSTITUT DE SOUDURE</p>
Coordinateur	<p>Eric CRESCENZO – IXTREM ixtrem@wanadoo.fr</p>
Aide de l'ANR	<p>939 685 €</p>
Début et durée	<p>November 2009 - 36 months</p>
Référence	<p>ANR-09-ECOT-007</p>
Label pôle	

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	GRAIN D'SEL - New approaches and innovative sensors for the knowledge and monitoring of coastal aquifers. Application to salt intrusion survey in the Roussillon sedimentary basin..
Abstract	<p>Important economical and demography development takes place in coastal areas and it is particularly true in Mediterranean ones; for this reason, environment is sensitive to great number of risks, one of these is the salt water invasion of coastal aquifers. The functioning and the size of the salt invaded areas are function of the geometry, lithology, hydrodynamic and transport properties as well as of the aquifer development. Indeed the salt intrusion phenomenon may be local and may change in time according to these above mentioned conditions or more important at a regional scale. Without a management and a survey, this phenomenon may have major environmental and economical consequences. The Roussillon plain is a typical and representative example of coastal sedimentary and heterogeneous aquifers, herited from erosion and deposit following orogenesis of massifs; there are numerous georeferred data, specifically airborne geophysical data gained in the framework of the EUFAR european project. Classically direct point measurements of salinity allow to identify, however not to anticipate risks concerning groundwater resources in the coastal zone. Only a systemic approach based on the knowledge of coastal aquifers in terms of geometry, functioning considering data survey, important for a reasonable and sustainable management of these vulnerable environments may allow to develop management and warning systems. The GRAIN D'SEL project aims to develop and validate new approaches to gain knowledge and on the metrology of coastal aquifers, and this at different scale: (i) first at the regional scale with the interpretation of airborne geophysics (simultaneous of magnetic, spectral radiometry and electromagnetic) carried out in the framework of the EUFAR european project, allowing obtaining a high resolution three-dimensional (3-D) images of structure and salinity and (ii) then at a local scale, carrying out on one hand continuous hydro-geophysical survey (1D) in dedicated boreholes and on the other hand monitoring geochemical data (whose isotopic ones). The coupled and integrated use of these various approaches is a real innovating process in the field of integrated monitoring system: the confrontation and integration allow bringing elements of understanding both on the complex geometry of these aquifers et on their hydrodynamic functioning on a test site, the Roussillon plain. A 3D transient hydrodynamic modelling using the density effect at a local scale will be carried out with the aim tending to develop a survey and warning system dedicated to salt</p>

water intrusion. In order to reach these goals, the project consortium gathers an industry partner specialised in the development of innovating autonomous long term survey systems of underground (imaGeau), an industry partner specialised in the environment, engineering and more particularly in the field of numerical groundwater modelling (BURGEAP), a research team dedicated to the dynamic of coastal environment (UPVD/IMAGES), a research team specialised in the geophysical and hydrodynamic in boreholes (Géosciences Montpellier), and finally a research team (BRGM) in the field of applied geosciences with expertise on complex aquifers and on innovating tools to characterize underground (airborne geophysics, hydrogeochemistry and isotope analysis, etc...). GRAIN D'SEL is then a project in the framework of industry partnership scientific research.

Consortium

BRGM (coordinator)
 imaGeau
 CNRS DR13
 UPVD-IMAGES
 BURGEAP Direction R&D

Coordinator

Nathalie Dörfliger – BRGM
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**ANR Grant
 Kick off and
 duration
 Reference**

862 576 €
 November 2009 - 36 months
 ANR-09-ECOT-008

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	IBISCUS - Biological and chemical indicators of urban contaminations
Abstract	<p>This project responds to the call for ANR ECOTECH project that aims at preserving natural resources and control of environmental risks and supports the development of environmental technologies focusing on control of pollution of environment (water, soil, sea and air). The objective of the project IBISCUS (Biological and chemical indicators of Urban Contaminations), lasting 3 years, is to identify and quantify pollutants [polycyclic aromatic hydrocarbons (PAHs), pesticide residues and fecal contamination] based on the fluorescence properties of representative molecules (phenanthrene respectively, carbaryl / carbofuran and tryptophan) in the organic matrix of coastal waters (EEM), and to develop technologies of their acquisition by continuous fluorescence sensors and their integration into autonomous vehicles for in situ marine assessments ("gliders").</p> <p>The originality and ambition of the project lies in the coupling between the development of methods for the determination of pollutants by spectrofluorimetry, using the results of laboratory experiment for the design of new sensors, and interaction with a company that specializes Optical Instrumentation in (micro), having gained extensive experience in the use of LEDs for measuring fluorescence with very high sensitivity, and a manufacturer of autonomous underwater vehicle (ACSA). Recent technological developments such as the provision of new UV LEDs and the ability of companies to develop sensors fluorescence in situ are the basis of the proposed project. In the context of environmental sustainability, the market for ocean-ographic operation is growing and represents a market of interest to businesses. The collaboration between Micro and ACSA and LMGEM (project Sea Explorer) working on the design of miniaturized sensors of pollutants in response to this request. This project responds to the Focus Theme 5 of the ECOTECH project call for: "Monitor - measuring more and better the quality of the environment", particularly the objectives of this theme that are designed to support projects for the deployment of systems integrated instrumentation (sensors, acquisition, validation, archiving, querying, performance) and innovative research designed to significantly reduce the cost of measurements and analysis.</p>
Consortium	<p>AIX MARSEILLE II - LMGEM (partenaire coordinateur) CNRS - LOBB MICRO MODULE ACSA</p>
Coordinator	<p>Madeleine GOUTX – AIX MARSEILLE II - LMGEM madeleine.goutx@univmed.fr</p>
ANR Grant	<p>550 630 €</p>
Kick off and duration	<p>Décembre 2009 - 36 mois</p>
Reference	<p>ANR-09-ECOT-009</p>
Competitiveness Cluster	<p>Mer PACA</p>

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	LOAC - Light Optical Aerosol Counter
Abstract	<p>The detection of solid aerosols in ambient air is essential for the human health. The continuous measurement of the integrated mass of aerosol by gravimetric techniques provides useful but incomplete information since it is not possible to access to the size distribution and to the nature of the particulates. The available optical counters are expensive and could be inaccurate in particular during the presence of absorbing particulates like soot. Thus, it is difficult to retrieve some of the physical properties of aerosols during scientific campaigns or during specific local event on a small-scale time period. This project, which is in the frame of the industrial research program, proposes to conduct preliminary studies on a new optical method for the optical detection of the aerosols, and to develop a light and cheap aerosol counter (LOAC) easy to use. Campaigns of measurements are planned to better characterize the nature of the solid aerosol in the ambient air. Then, LOAC could be used by air quality networks for the real-time monitoring of the aerosol content, and to determine the size and nature of the particulates. The aim of LOAC is to provide useful information in addition to the gravimetric measurements. LOAC could be transportable, and could be implanted in locations where heavier instruments cannot be used. Also, it could be use for scientific purpose; finally, it could be put onboard atmospheric balloons to provide a vertical profile of aerosols content. This project is collaboration between CNRS laboratories (LPC2E, LA, LSCE) and the society Environnement-SA, with the support of the space French agency (CNES). This project, in the frame of the industrial research program, consists to conduct the preliminary studies, to perform the calibration of a first series of instruments, and to conduct session of measurements on ambient air.</p>
Consortium	CNRS -LPC2E (coordinator) Environnement-SA CNRS - LA CNRS - LSCE
Coordinator	Jean-Baptiste RENARD – CNRS -LPC2E jbreward@cnrs-orleans.fr
ANR Grant	302 414 €
Kick off and duration	November 2009 - 36 months
Reference	ANR-09-ECOT-010

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	MICROCYTOX - Microdevice for the in-situ detection of toxic cyanobacteria
Abstract	<p>The "MicroCytox" project aims at developing and validating a comprehensive, automated and miniaturized device dedicated to the quantification by real-time PCR, the proportion of toxin-producing cyanobacteria (targeting the microcystins and cylindrospermopsin synthesis pathways) during bloom events.</p> <p>Indeed, the current requirement for monitoring of cyanobacterial blooms in water bodies has led to a strong demand for systems of evaluation and monitoring of water quality. However, indicators of biomass and abundance currently used for this survey do not reflect the potential toxicity in case of proliferation. The project includes the development and operational integration of miniaturized modules allowing the preparation of water samples and the evaluation of the toxic clones proportion within populations of cyanobacteria. The system will be the smallest as possible and the technical choices will be made to enable the evolution of the system to an autonomous device. Validation on real samples will be conducted, as well as a market study in order to prepare a subsequent phase of industrialization.</p> <p>Scientific and technical developments of this system will build on past achievements of the partners on the one hand, the monitoring and study of the spatial-temporal dynamics of populations of cyanobacteria and other recent developments in microtechnology (by microfluidic electrowetting in particular). The success of this project will be first demonstrated by the feasibility of an autonomous system to achieve a miniaturized PCR analysis from a real sample applied to environmental monitoring. The extent of the potential proliferation of toxic cyanobacteria detected and the speed of the measure, which may be done in-situ, are key strengths of this new instrument.</p> <p>The system developed can be applied to the monitoring of lakes and rivers known as "at risk" and used as a resource for drinking water or for recreational activities. Used in research, such a device will also allow to better identify the factors and processes involved in the variations of toxicity observed during the blooms of cyanobacteria.</p>
Consortium	<p>SUEZ Environnement (coordinator) CNRS - UMR BIOEMCO MNHN CEA-LETI</p>
Coordinator	<p>Sophie COURTOIS – SUEZ Environnement sophie.courtois@suez-env.com</p>
ANR Grant	<p>495 682 €</p>
Kick off and duration	<p>November 2009 - 42 months</p>
Reference	<p>ANR-09-ECOT-011</p>

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	NANOFREZES - Nanoscale zero-valent iron particles for groundwater remediation
Abstract	<p>The Nanofreses project aim is to improve fundamental, experimental and procedural knowledge in the mechanisms of reactivity, transfers and toxicity of nanoscale zero-valent iron particules which are used for the treatment of ground water polluted by recalcitrant organic pollutants and in particular those of which the biodegradability or the natural attenuation are weak or are delayed because of the specific conditions of the pollutants and/or the medium.</p> <p>The partners involved in this project are 5: 2 UMR CNRS, respectively CEREGE and ISM2, and three socio-professional partners, INERIS, SERPOL and HYPHEN. The program includes several critical phases: i) a phase of fundamental research on the synthesis and the preparation of the nanoparticules formulated on the surface, ii) a study of global reactivity, putting in glance the rates of degradation to the products formed at the end of reaction, iii) a study of the molecular mechanisms and the kinetics of the evolution of the metal and oxidized phases (\pm partially) and organic contaminants iv) an experimental laboratory study using columns in order to determine the formulations limiting the interactions with surrounding media and thus increasing the transfer distances. Following this part, v) the most promising formulations will then be evaluated in laboratory at the ecotoxicological level.</p> <p>After this selection, the most interesting formulations will be tested on a site by implementing an injection technology and a monitoring of the chemical reactions within the porous environment. A consequent work on the evaluation of the risks for the manipulator of the nanoparticules Fe⁰ and the impacts on the micro-organisms and the microfaune of the medium will be made.</p>
Consortium	UPCAM (coordinator) CNRS DR12 INERIS SERPOL HYPHEN
Coordinator	Pierre DOUMENQ – UPCAM pierre.doumenq@univ-cezanne.fr
ANR Grant	623 233 €
Kick off and duration	November 2009 - 36 months
Reference	ANR-09-ECOT-012
Competitiveness Cluster	Risk management, vulnerability of territories

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	PECCOVAIR - Optimum coupling of plasmas and catalysts for VOCs abatement in air
Abstract	<p>The PECCOVAIR project deals with the treatment of Volatile Organic Compounds (VOCs) rejected by a number of industrial activities, in particular effluents from workrooms and manufacturing, for which the use of a centralised evacuation device and of high power electric fans induces high flows of polluted air.</p> <p>It is a research program for a three years duration, and concerns the treatment of a gas flow ranging typically from 100 m³/h up to 10000 m³/h, with a total VOC concentration value lower than 1 g/Nm³. In such conditions the coupling of a non-equilibrium plasma to a catalyst, which may be placed downstream of the plasma, should be an efficient process to clean up the polluted gas stream. However studies must be performed to determine the best way to reduce the electrical energy deposition in the discharge and to optimise the catalyst as function of chemical species coming out of the plasma reactor. Another question to be address is the treatment of complex mixtures of pollutants, with different chemical formula. A dielectric barrier discharge in a multipoint-to-plane geometrical configuration will be used in a first approach of the problem. This device is interesting with respect to the very low reduction of gas velocity and pressure drop it may induce. However studies on a low gas flow (some L/mn) will be performed first. The goal is to design a new discharge electrical power supply generating high voltage pulses (monopolar or bipolar) with controlled time shape, repetition frequency, and amplitude characteristics. Optimisation of the coupling between the power supply and the plasma reactor will be carefully examined, as well as the effluent composition at the reactor exit together with the chemical activity of the "cold" catalyst (working temperature below 60°C). Simple (1 type of VOC) and complex mixtures (several VOCs of different chemical formula together in the air stream) will be studied. Thanks to the results obtained, these works will be followed by the design of experimental arrangements for the treatment of high speed flows. Studies on relative importance of the device parameters will bring to determine the maximum energetic efficiency achievable with the plasma-catalytic deVOC process for an industrial use. Three scientific laboratories in France (LPGP Orsay, LACCO Poitiers, ESE department from Supelec Engineering School at Gif-sur-Yvette) and an industrial laboratory (EDF RetD at the Renardières near Paris) will work together, with complementary abilities in electrical power supply, cold plasma physico-chemistry, heterogeneous catalysis, and engineering.</p> <p>Aims of the project are : 1/ to develop knowledge about physical and chemical mechanisms for VOC conversion and</p>

for plasma/catalysis synergy, 2/ to design a reactor in order to obtain, for the lowest energy consumption, the best VOC plasma conversion with the production of species needed to activate the catalyst, 3/ to make high voltage pulse generators with measurement of the internal electrical efficiency and of the effects upon the discharge, upon plasma produced species and their densities, and upon reactor energy efficiency, 4/ to study treatment and recombination mechanisms in mixtures with several types of VOCs, 5/ to develop formulations for a downstream-plasma catalyst working at low temperature, 6/ to study the method of catalyst phase deposit on a three-dimensional support allowing a low loss of pressure. The main difficulties are : 1/ the making of low temperature catalysts working without additional energy supply, 2/ the minimization of the pressure loss, 3/ the optimisation of the energy deposit in the plasma. The project is organised in four tasks : coupling of the electrical power supply with the plasma reactor, physical and chemical characterisations of plasma reactors, optimization of the coupling of the plasma reactor with the catalyst, and search for the best total energetic efficiency at high flows of polluted air,

If the reduction of energetic consumption is high, applications for higher effluents flows are conceivable. Industrial and economical effects are expected to be important.

Consortium

LPGP (coordinator)

SUPELEC

CNRS – LACCO

EDF R&D

Coordinator

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**ANR Grant
Kick off and
duration
Reference**

665 359 €

November 2009 - 36 months

ANR-09-ECOT-013

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	PHOSPHOR - Development of processes of recycling of the phosphor under a shape valorisable in agriculture (farming)
Abstract	<p>Utrophication is becoming e real problem in several parts of France. Often the limits defined by the OMS to use the water for leasure or drinking are exceeded. To protect the water resource and avoid toxic injury by involuntary intake, P limits to reject effluents in surface water are decreasing. In the same manner the authorized amount of phosphorus spread as sludge or slurries are decreasing.</p> <p>In some areas where agriculture and food industry are dominant, this constraint could become a limit to economic development. However, in the same time and the same areas, mineral phosphorus fertilizer are imported. the aim of this project is to increase the knowledge about phopshorus recycling to allow to food industry and to agricultural sector to develop recycling process to be in compliance with environmental regimentation without limiting their economical development.</p>
Consortium	<p>Cemagref (coordinator) INSA – LISBP INPT – LGC INRA – LBE VALBIO SOLAGRO EVALOR ODIPURE</p>
Coordinator	<p>Marie-Line DAUMER – Cemagref marie-line.daumer@cemagref.fr</p>
ANR Grant	<p>1 147 370 €</p>
Kick off and duration	<p>November 2009 - 48 months</p>
Reference	<p>ANR-09-ECOT-014</p>

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	POLHSAR - Oil detection at sea by airborne and satellite SAR mode
Abstract	<p>Maritime pollutions with hydrocarbures are still a crucial problem. In mediterranean sea, voluntary pollutions are estimated by French CEDRE to be more than "125 Erika" or "35 Prestige" per years. And voluntary pollutions can only be fight by airborne and satellite intensive control. The project intend to study new technical solutions to extend airborne and spatial radar capacities in oil spill detection. These innovative evolutions are based upon Synthetic Aperture Radar technics and fine modelisations of electromagnetic waves interactions with sea or oil. The project relies upon real in flight data records to justify modelisation work and to develop and to prove new algorithms. Currently, no airborne classical radar are used in such a way for oil detection, only specific SLAR radars are used for such missions and few aircraft are equipped with. The advantage of innovation is to give oil detection capability to a large part of current airborne surveillance radars and so to increase control capacity of existing surveillance assets. For satellite, the goal is to extend radar detection capacities to low grazing angles and so to largely increase revisit frequency, giving to satellite surveillance a larger effectiveness.</p>
Consortium	TSA/MAS/DSPM (coordinator) CLS / DAR UN/IREENA
Coordinator	Gabriel MARCHALOT – TSA/MAS/DSPM gabriel.marchalot@fr.thalesgroup.com
ANR Grant	172 042 €
Kick off and duration	November 2009 - 24 months
Reference	ANR-09-ECOT-015
Competitiveness Cluster	Mer Bretagne

Program on Sustainable production and Environmental technologies

CALL 2009

Project Title	TRIPTIC - Tracers Distributed for Identification of Polymers and Industrial Sorting in step
Abstract	<p>End-of-life vehicles (ELV) directives demand to recycle 95% of the ELV in 2015 with objectives of recycling for use of recycled materials in the new vehicles. Project TRIPTIC aims at recovering the purest matter either after operations of disassembling, or after crushing & sorting (to date, approximately only 8% of the plastics from ELV are recycled...). As current technologies do not have the potential to sort polymer materials according to their formulations as well as their rheological properties which are very important parameters for their valorisation, it is necessary to use signature with tracers that should be detected by spectrometric (X-ray or UV Fluorescence) detection. Sorting with tracers should enable to sort polymers more quickly and with a better quality. TRIPTIC is made of three experimental work packages devoted to 1- Dispersion of a few tens or hundreds of ppm of tracers commercially available in polymer matrices. 2- Optimisation of spectrometric (X-ray or UV Fluorescence) detection. 3- Study of the industrialization of sorting by spectrometric detection (X-ray or UV fluorescence). LCA (Life Cycle Analysis). Another work-package aims at studying the extension of tracing technologies to other polymer materials and other industrial sectors such as Electric and Electronic Equipments (EEE) and packaging. The last work-package is devoted to diffusion of the results in order to elaborate a new standardisation aiming at developing sorting with tracers. This study will be made with the concern of developing processes respectful of human health and environment in conformity with the specifications of industry.</p>
Consortium	<p>INSA Lyon - IMP (coordinator) ENSAM RECORD Renault POAES TT PST CEA List</p>
Coordinator	<p>Valérie MASSARDIER – INSA Lyon - IMP valerie.massardier@insa-lyon.fr</p>
ANR Grant	<p>913 999 €</p>
Kick off and duration	<p>November 2009 - 45 months</p>
Reference	<p>ANR-09-ECOT-016</p>
Competitiveness Cluster	<p>AXELERA and PLASTIPOLIS</p>

