Chair in biogeochemical sensors for environmental quality sensing

For more information:
http://www.andra.fr/international/
http://www.ressources21.univ-lorraine.fr/en.html
http://www.otelo.univ-lorraine.fr/

Deadline for project submission:
30/04/2014

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TABLE OF CONTENTS

A) General Framework / Actors Page 3

B) Job summary Page 4

C) Responsibilities Page 5

D) Requirements Page 6

E) Eligible Costs and available means Page 6

F) How to apply Page 6

G) Monitoring Committee and contact details Page 7

H) Steering Committee Page 7

I) Evaluation and selection process Page 7

J) Next steps Page 8

INFORMATION SHEET Page 9

A) General Framework / Actors

This industrial research Chair is based on a scientific partnership between the **National Radioactive Waste Management Agency (Andra)**[1] and the **University of Lorraine** in the framework of the **LABEX RESSOURCES21**[2] Priority Research Action-PRA n°6 the objective of which is to develop new sensors for field experiments that permit analysis of the response of ecosystems to anthropogenic perturbations, acquisition of observational data by an operational observation system.

[1] The National Radioactive Waste Management Agency (Andra)

Established by the December 1991 Waste Act, the Andra is the public body in charge of the long-term management of all radioactive waste and is under the supervision of the Ministry of Ecology, Energy, Sustainable Development and the Sea and the Ministry of Research. Its three basic missions are:

- **a R&D mission** to propose safe definitive solutions for the radioactive waste categories not covered by current disposal facilities; in particular long-term deep geological storage for high and intermediate level, long half-life wastes;
- **an industrial mission** concerning, on the one hand, waste acceptance criteria and control and, on the other hand, siting, construction, operation, closure and monitoring of repositories. This mission also includes a public service mission dedicated to (1) collection of waste produced by "small-scale nuclear activities" and (2) clean-up and rehabilitation of orphan polluted sites;
- **an information mission**, notably through the regular updating and publication of the National Inventory of radioactive materials and waste. This mission includes as well an active policy of dialogue with stakeholders both at national and local levels.

[2] LABEX RESSOURCES21

The LABEX RESSOURCES21 was selected by the French Ministry of Research and Education in the framework of the "Laboratoires d'Excellence" initiative. RESSOURCES21 proposes an integrated scientific and educational approach to the understanding, exploitation and environmental management of strategic metal resources for the 21th century. It is supported by 4 research laboratories of OTELo[3] and the teaching departments in Geoscience and Environment of the University of Lorraine.

[3] The Lorraine Earth and Environment Observatory (Observatoire Terre et Environnement de Lorraine: OTELo)

OTELo is an Observatory of Sciences of the Universe (OSU) CNRS-University of Lorraine established in 2010. OTELo is also the scientific pole of the University of Lorraine gathering research units in Earth Sciences in a broad sense around issues such as the dynamics of the Earth, the chemistry of the Earth's mineral and energy resources, the cycle of resources and waste disposal in deep geological environment, hydro, land soil and sub-soil, environmental management of land resources, water, ecotoxicology and biodiversity. As an Observatory of Sciences of the Universe, OTELo's mission is to contribute to the advancement of knowledge through:

- acquisition of observational data
- the development and operation of means of observation : experimental and monitoring infrastructures as GISFI (French Scientific Interest Group - Industrial & Wasteland soils), Long-term environmental research monitoring and testing system (OPE), testing river system (ZAM), analytical platform
- the development of theoretical tools

The observatory is also responsible for:

- providing services related to their research
- providing training for students and research staff
- ensuring the dissemination of knowledge to society
- developing cooperation activities at national and international level

Since January 2013, OTELo brings together four research units and two joint and national services units:

- CRPG: Petrographic and Geochemical Research Centre
- Georesources the laboratory results from the combination of staff from laboratories G2R, CRPG, LAEGO and LEM;
- the LIEC: Interdisciplinary Laboratory of Continental Environments from the merger of LIEBE, LIMOS and half of the LEM;
- LSE: Soils and Environment Laboratory;
- The Service d'Analyse des Roches et des Minéraux (SARM) which is the CNRS Analytical Research facility and part of the CRPG
- Ion probes

B) Job summary

The chair is focused primarily on research concerning methods for sustainable observation, experimentation, archiving and data processing in the context of environmental research to be carried out within Andra's project for deep geological disposal of radioactive waste. Chair activities will therefore be closely linked to a 900 km2 national environment observatory (OPE, see below) in the eastern region of France dedicated to long-term environmental monitoring.

One of the great challenges of Andra is to implement a deep reversible disposal facility for high-level and intermediate level long-lived radioactive waste in the Meuse/Haute Marne District (north-eastern part of France). The geological disposal project involves a specific environmental context:

- Long-term monitoring
- Low-level chemical and radiological releases,
- Large scale construction (dust, transport,…),
- Environmental and human health protection

In order to (i) establish a reference status of the environment (from a physical, chemical, biological and radiological standpoint), over a ten-year period, prior to the construction of the disposal facility and (ii) plan and design the environmental monitoring programmes that should be implemented during the operational phase of this project. A Long-term Environmental Research Monitoring and Testing System named Observatoire Pérenne de l'Environnement (OPE) was set up in 2007 (http://www.andra.fr/ope/index.php?lang=fr).

The chair holder will be tightly associated with the SOERE (Observation and experimentation system for long-term environmental research) OPE research missions and could, if the person's experience fits, become the chairman of the Scientific Committee.

The overall objective of the observation system is to furnish a dynamic view of the zone's ecosystem monitoring facilities and the characteristics shown by continental surfaces (critical zones) over the long term (up to a hundred years). The chair aims at increasing the observation system monitoring capacity based on a variety of innovative experimental approaches and a wide range of sensors, including back-ups, designed to supply spatially resolved and real-time information about hydraulic, mechanical, thermal, biological and chemical behaviour of all environmental media (atmosphere, soils, sediments, surface and groundwaters…) in a diversity of site-specific ecosystems: forest and agricultural open fields and pastures …. In many cases, functional rather than analytical information is ultimately desired. The chair will be involved in the work of RESSOURCES21 and will reinforce the research competences of OTELo (the Lorraine Earth and Environment Observatory - http://otelo.univ-lorraine.fr/) on environmental issues linked to major innovation and research projects.

C) Responsibilities

The Chair's scientific and technical programme is associated with the process of achieving project information integration within a regional observatory and to furthering knowledge progress through:

- the acquisition of observation data and its interpretation for environmental processes
- the development and exploitation of appropriate sensors or through the elaboration of appropriate theoretical tools.

The chair holder will be responsible for:

i. initiating and developing the "Biogeochemical sensors" topic within Otelo, being involved in implementing observation missions mainly in association with the SOERE OPE (the Andra Perennial Observatory of the Environment) at the site of Meuse/Haute-Marne.

ii. developing scientific research aimed at qualifying mineral, organic or biological agents which can be a point of departure for environmental sensors (due to their sensitivity to various physical-chemical local variations). It will focus on considering integration conditions of those agents in measuring instruments that must show characteristics such as: ready integration within studied systems, non-invasive (do not impact the functioning of the system), stable and long operating life.

iii. initiating and developing a research topic on the development of innovative physical-chemical, optical and electrochemical methods to obtain functional information on subsurface environments (i.e. information about the effect of a disturbance on ecosystem health). Possible perspectives are: application of microsensor technologies and signal/data processing routines to environmental diagnosis and monitoring (benchmarking)*, validation of measurement devices or systems in which a biological, organic and mineral component will be used as the recognition element, development (with industrial partners if necessary) of new scalable and non-invasive environmental sensors or sensor networks, hard sensors, and remote sensing.

iv. participating in training programmes provided by the University of Lorraine on a basis of 64 hours/year (Master degree, engineering school and PhD). Teaching subjects should be linked to observation topics and environmental data acquisition or signal processing.

A permanent position as an associate professor in the University of Lorraine may be open after the chair

The candidate must have knowledge of the French research, academic and other, in the context of future research collaborations, and, incidentally, possible sources of funding.

D) Requirements

Applicants must hold a PhD (or equivalent) as at the date of application (i.e. dissertation successfully defended).

- The candidate must justify recognized skills in the field of Biogeochemistry (environmental physicochemistry, physics of condensed environment, mineralogy and/or biology) and/or of environmental sensing (optical and electrochemical measurements, spectrometry, multi-functional sensors, micro-fluidics, chemometrics …
- Applicants must be fluent in one of the working languages of the host laboratories; fluency in French or English.
- Experience and quality of the candidate: the candidate must demonstrate that he distinguishes hisrself as a world-class researcher or as a leader in his field
- Quality of the project / Research programme proposal
- Complementary skills and competences in metrology, programming and data processing system will be appreciated
- The candidate must demonstrate his good knowledge of the state of the art in the field of environmental sensors (water, air and soil quality monitoring)
- Knowledge in multivariate statistical processing could be a plus.

The project will show a short-term approach (2 years max) with the identification of the sensitive parameter with regard to the target (impact on water or soil chemical quality, long term evolution of ecosystems), the development of the way of transduction of the physical or biological chemical signal in the electric or luminescent signal, signal processing, development of the protocol regarding the OPE site, deployment of the sensor, (finalization, design). Collaborations with other academic institutes or even private enterprises can be envisaged especially if there is an integration of the sensor into an industrial and commercial development

A middle term Approach (4-5 years) with more risk can be raised with regard to the state of the art, on speciation of the trace metallic elements with regard to the organic matter degradation or evolution.

E) Eligible Costs and available means

- Salary for the invited researcher: between 3000 € and 4000 € net/month (The remuneration will depend on qualifications and experiences of the chair holder)
- Professional travel expenses (national or international)
- PhD grant at the start of the chair and/or credits for experimental programme
- Access to technical and scientific means of OTELo
- Expenses of documentation and publication expenses

F) How to apply

Applications are to be sent per mail to ressources21-contact@univ-lorraine.fr. Each file must include:

1. the information sheet
2. a curriculum vitae
3. a cover letter
4. a list of publications
5. a detailed research project proposal in English or in French: describe the program in detail (5 to 10 pages) including objectives, context, methodology, and calendar of actions.
6. An estimation of necessary technical and human means

G) Monitoring Committee and contact details

Frédéric Villiéras OTELo and RESSOURCES21 Directeur Frederic.Villieras@univ-lorraine.fr Tel : +33 (0)3 83 59 62 89	Patrick Lebon R&D director ANDRA patrick.lebon@andra.fr Tel : +33 (0)1 46 11 80 82
Christian Mustin Responsible for the Projet “Biogeochemical sensors” Chair christian.mustin@univ-lorraine.fr Tel : +33 (0)3 83 68 42 94	André Mariotti andre.mariotti@upmc.fr Tel : +33 (0)6 86 08 65 13
Fabien Thomas Director of the LIEC (Interdisciplinary Laboratory of Continental Environments) Fabien.thomas@univ-lorraine.fr	Operational contact: Laurie Wolff, Engineer – Development Manager RESSOURCES21 Laurie.wolff@univ-lorraine.fr Tel: +33 (0)3 83 59 62 87

H) Steering Committee

Name	Research field / Skills	University / Company / Organisation
Laurent Charlet	Environmental geochemistry	LGIT Grenoble
Jocelyn Chanussot	Digital imaging and signal processing	INP Grenoble – GIPSA-lab
Philippe Behra	Aquatic chemistry and environmental sensors	INP Toulouse - ENSIACET
Sarah Dewonck	Geochemistry / R&D deputy R&D director and chair of OPE	ANDRA
Elisabeth Leclerc	Environmental researches, radioecology, assistant manager of OPE Environmental Survey and Disposal Monitoring Department	ANDRA
Yves Thiry	Transfer processes in biosphere / Transfer & Migration Department	ANDRA
Michel Cathelineau	Scientific director of the labEx RESSOURCES21	Université de Lorraine
Corinne Leyval	Soil science and microbiology	Université de Lorraine
David Brie	Instrumentation and signal processing (biology and geosciences)	Université de Lorraine - CRAN

I) Evaluation and selection process

Selection criteria (Incomplete or late applications will not be accepted):

1. Experience and quality of the candidate: demonstrate that you distinguish yourself as a world-class researcher or as a leader in your field
2. Quality of the project / Research programme proposal
3. Complementary skills and competences

Criteria to take into consideration:

- Only one project will be selected among the applications
- A permanent position as a(n associate) professor in the university of Lorraine may be open after the chair

Applications/proposals will be reviewed and selected by the monitoring (see G) and steering committee (see H) of the chair.

J) Next steps

- Deadline for application : 30 of April 2014
- Analysis of application by steering committee: May / June 2014
- Results: July 2014
- Beginning of contract: September 2014
- Simplified activity report to be hand-in every year + mid-term and final activity report

INFORMATION SHEET

Title:	.....	Position	.....
First Name:	.....	Family Name:	.....
Date of Birth:	.....dd/mm/yyyy.....	Gender:	☐ M ☐ F
Country of Citizenship:	.....	Region:	.....
Country of Residence:	.....	Street:	.....
City:	.....	State:	.....
Zip:	.....		.....
Work phone number:	.....	Personal phone number:	.....
Work Email:	.....	Personal Email:	.....
Name and address of employer	.....		
Current position	.....	Rank / grade	.....
Research discipline:	.....	Area of application:	.....
Current research subject	.....		
Research project summary Provide a 100 word summary, describing the research program. This summary may be used for publicity purposes.	.....		
Keywords Provide keywords which describe the proposed research program	.....		