

# TC Project Achievements Report

## Project Number:

LEB8004

## Project Title:

*Improvement of Groundwater Management and Protection through the Use of Isotopes and Nuclear Techniques*

## Project Objectives:

*To establish nuclear techniques for the study and management of water resources including technology transfer; to develop a national strategy for the use of isotope techniques in water management and development studies; to develop a water management framework; to solve problems related to water shortage, overexploitation, management and rapid quality deterioration; to evaluate the sources, recharge rates and renewal of groundwater reservoirs; to resolve the problems of mixed aquifers, the quantity of mixing and the exchange reactions between groundwater reservoirs and their matrix; to strengthen the role of the CNRS within national institutions and water authorities.*

## Project Background (Optional):

The absence of water management and strict laws for groundwater pumping is increasingly detrimental to the water quality in aquifers. Lebanon does not have any surface water reuse policy projects at present but it is considering the establishment of long-term projects to resolve water pollution and shortage problems. As the National Council for Scientific Research (CNRS) is the official national scientific counterpart, it needs to incorporate a national isotopic analysis centre for all water projects with the cooperation of ministries and other national institutions. To achieve this goal, this project aimed at developing technical capabilities through the acquisition of a benzene synthesizer for carbon-14 and tritium enrichment to establish the status of groundwater reservoirs and their renewal and through measurements with an isotope ratio mass spectrometer to evaluate the links between groundwater reservoirs and surface water and to determine the potential sources of water pollution.

## Project Outputs (Required):

[The 'deliverables' of a project, i.e. its immediate products or services delivered to target groups and constituents in Member States as a consequence of the project's activities.]

- 1- Installation of a tritium enrichment system consisting of :
  - 20 stainless steel electrolytic cells
  - Electrolysis control unit
  - Distillation units
  - Complete set of glassware necessary to run the enrichment process
- 2- Installation of a low level liquid scintillation counter (Tricarb 3180 TR) with BGO Guard detector, and Alpha Beta discrimination for the detection of gross Alpha and gross Beta.
- 3- Reception of a Liquid –Water Stable Isotope Analyzer. This instrument was installed in the Hydrology laboratory in order to analyze  $\delta^2\text{H}$  and  $\delta^{18}\text{O}$  in water samples.
- 4- Synthesis Line for Chemical preparation of benzene for C-14
- 5- Expert missions:
  - Expert from The University of Science and technology of Poland has installed the Tritium enrichment system. From 2 to 14 February 2009, the system was installed during the first days, and then a first complete run was done in order to check the whole system.
  - Expert from Perkin Elmer has installed the LSC in 30 and 31 Mars, testing and tuning the instrument was done.
  - Expert mission will take place this year to install the benzene line for C-14 dating, waiting to finalize the lab infrastructure .
- 6- Fellowships and scientific visits:
  - One Fellowship: (Hydrology Laboratory IAEA), Practical training on water sample treatment for tritium analysis and data evolution, Preparation and measuring techniques for low level tritium.
  - Three Scientific Visits:
    - a) Improve the understanding of the several IRMS interfaces (Hydrology Laboratory IAEA).
    - b) Improve the understanding of the Tritium Sample preparation line (University of Science and Technology, Krakow- Poland)
    - c) Understanding of Laboratory techniques for isotopes (Hydrology Laboratory IAEA).

**Project Outcomes (Required):**

[The intermediate benefit or changes resulting from the project's outputs which relate to the achievement of the objective.]

Within the framework of this project an Isotope Hydrology Lab was established at the LAEC, able to perform the necessary analysis useful to develop a strategy for the use of isotopes techniques in water management and dating. The several analyses and studies carried out in this lab are the framework of Research projects, International collaborations , monitoring and Services.

In addition to the tritium enrichment system and liquid water isotope analyzer that have been installed in the hydrology laboratory, a benzene synthesizer line for radiocarbon dating was received and planned to have an expert mission during this year to install the system and make on site training. Thus , the laboratory will be able to perform age dating of different water samples. .

Gross alpha/Gross beta determination in different mineral waters and in potable water collected from different lebanese regions are carried out using the received Liquid scintillation Counter Tricarb (3180 TR), also several beta emitters in environmental samples are analyzed.

On the other hand, we started a quality control program including performance tests through intercomparison and proficiency tests .

Finally, a water mangement framework will be established to solve water problems: deterioration, evaluation of sources, mixed aquifers, recharge rates and renewal of groundwater reservoirs.

**Remarks (Optional):**