

Development of radiotracers methodologies for the evaluation of industrial units in oil and natural gas industry (exploration- refining-transport)

L. E. B. Brandão¹; C. M. Salgado¹; A. C. H. Nascimento¹; R. C. Nunes¹
e-mail: brandao@ien.gov.br

¹ Division of Radiopharmaceuticals – IEN

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The entire cycle, from prospecting to the final processing of petroleum, is a natural field for application of radiotracers because they are dynamic areas where operating problems arise unexpectedly and require rapid solutions

All over the world several studies illustrate the successful implementation of this methodology in evaluating oil distillation towers, pipeline transportation of oil, natural gas and oil and reservoir storage. A major advantage of this technique is the possibility of interventions performed without influencing the normal operation of the installation.

During the biennium 2011/2012 group of radiotracers in IEN was contemplated with a project subsidized by the FINEP in the field of applications of radiotracers in the petroleum industry and different methodologies using radioisotopes have been developed:

- **Flow Measurement:** Injecting an appropriate radioactive tracer is possible to study the displacement of different compounds (gases, fluids and solids) and to measure the flow mean velocity in a pipeline in the oil industry. This information enables the measurement and the calibration of flow meters installed in line to determine the distribution of flow in pipeline networks. Also, it calculates the mass balance in industrial plants and determines the efficiency of pumps. Furthermore, two different software were developed to be used in an appropriate situation: considering the geometric parameters of the detection system FLOWTRACER1 computes flow in pipelines, applying the transient time technique (using two scintillator NaI detector) and FLOWTRACER2 to calculate the flow in pipelines by cross-correlation technique by means of only one NaI detector).
- **Locating points of obstruction and quantify channeling inside oil processing units:** Difficulties in finding leaks in oil processing units is one of the most required, where radiotracers methodology is better than conventional techniques, especially because the technique could be applied without compromising the operation of the unit. By employing suitable labeled compounds and positioning NaI scintillation detectors on the outside of the unit is possible to perform the inspection unit without interrupting production. That is, for example, to measure the residence time in each stage of the tower and to determine the existence of operational problems such as blockages, channeling due to defects in the components inside the tower. In addition, it is also possible to evaluate the operational efficiency of the plant.
- Different methodologies were employed by the group to mark crude oil with ⁸²Br, ¹²³I and ¹⁹⁸Au to be used in studies of distillation towers and measure oil flow in pipelines in order to develop organic compounds (petroleum products) with radioactive isotopes.
- Studies oil transportation in pipes lines: another area that the radiotracer methodology is the most applicable is the flow profile inside pipe lines and the study of the displacement and the evaluation of interface between different means of transport pipeline (as in a multiple compound pipelines). The knowledge of the region of the interface between different mediums is important to determine the time at which the mixture of products being transported is discarded. By selecting different radioactive tracers with different energies, the mixture between the means can be studied and measured the transition time between transported components.