STUDY OF SEDIMENTS IN A SUB-BASIN OF THE PANAMA CANAL USING NUCLEAR TECHNIQUES

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Background. Waste waters contribute to serious pollution problems not just in Panama Canal basin but also at the Panama Bay influencing marine and coastal environment[1]. One of the goals of this study is to contribute in reducing contamination level to international water quality standards, through an efficient sediment transport monitoring program in a Panama Canal basin. To achieve this goal, it is necessary to study and compare methods, non-nuclear and nuclear techniques, using nucleonic gauge, and comprehend all the processes involved in sediment transport along the Panama Canal basin.

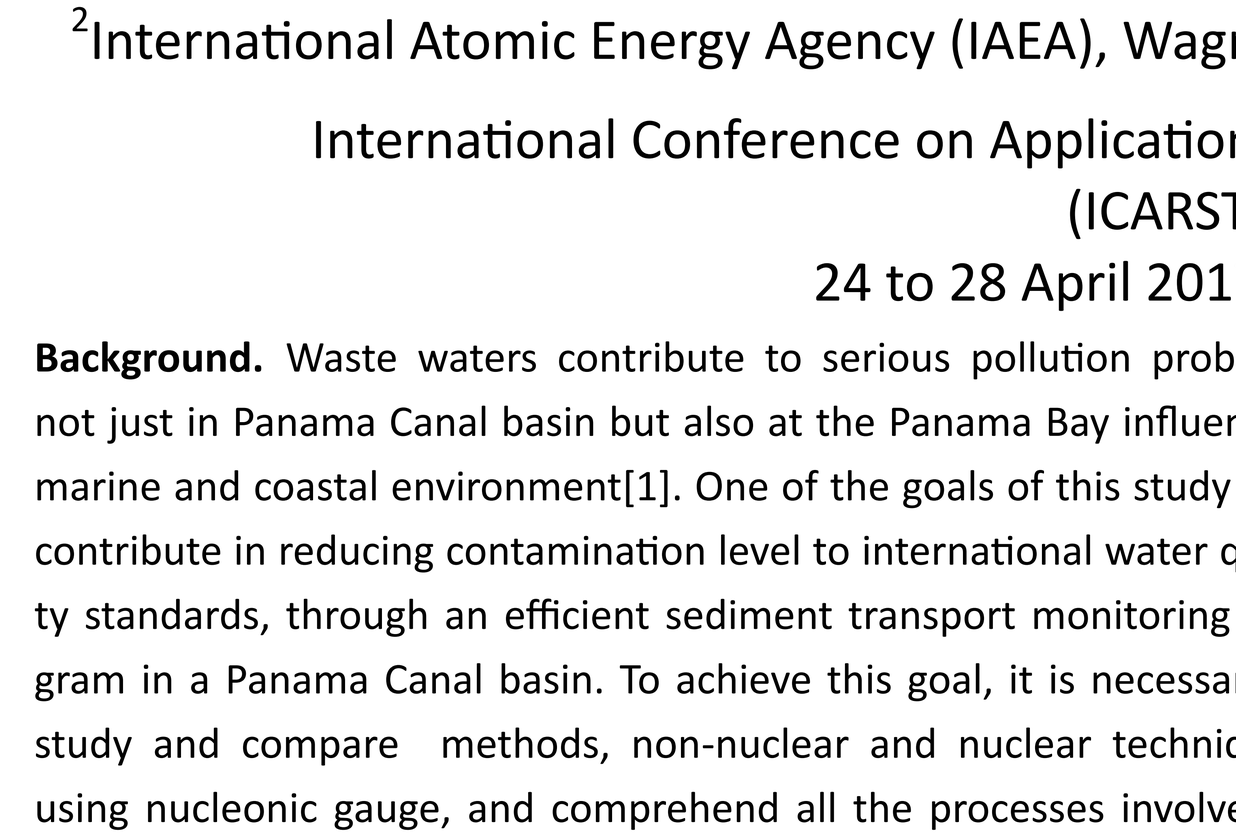

Fig. 1. A view of Alhajuela Lake and a possible sites to study the sediment transport (By Thomas Römer/OpenStreetMap data, CC BY-SA 2.0, https://commons.wikimedia.org/w/index.php?)curid=19678675

Study Sites. Alhajuela Lake: The Alhajuela reservoir, was created by means of the construction of the dam Madden in 1935. It has an area of contribution of sediments of 976 km². Its current water storage capacity is 657.5 Mm³ (Fig.1). At present, it is losing storage capacity due to the great amount of sediments that enter it. [2]

Dredging Pacific and Atlantic sites:Dredging activities to enable safe navigation by Post-Panamax vessels upon completion of the Panama Canal expansion are vital. A total of 8.7 million cubic meters of underwater material were dredged.

Methodology: Nucleonic Gauge. Nucleonic gauges based on the principle of the absorption of X or γ radiations are known as transmission gauges (Fig. 2) [3]. In the present study a X- Ray Density Profiler Model XDP 30, hooked to a whinch held over a boat, will be used (Fig.

Radiotracers. The radiotracer technique for sediment transport investigation involves preparation of a radioactive particulate tracer[3]. The Technetium- 99m (^{99m}Tc) and NaI gamma probes will be used (Fig. 4).

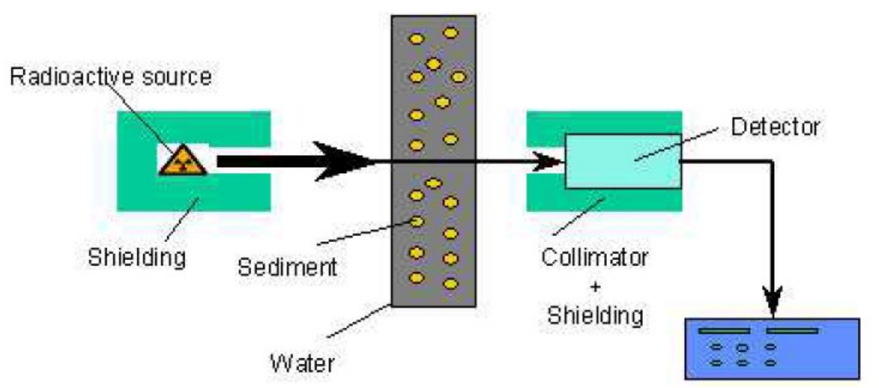

Fig. 2. Scheme of the radiation transmission [3]

Fig. 3. X Ray profiler and winch system/Altaix System

Fig. 4. NaI gamma probes and the acquisition equipment

Conclusions: **Nuclear techniques**. **Advantages**: easy to detect in-situ at very low levels without any sampling; radiation detectors are easy to install, and nuclear gauges allow evaluate the load efficiency of a particular dredging practice. **The main disadvantages are**: the public concerns; the strict regulation which impose a clearance from the national nuclear safety Authority[3].

References : 1. IAEA Project PAN 7003, Supporting the Panama Bay Contamination Monitoring Program (2012-2013). **2**. Impacto de la sedimentación del lago alhajuela en la operación del canal, Reporte HID-011-2013, ACP (2013). **3**. Radiotracer and Sealed Source Applications in Sediment Transport Studies , IAEA, VIENNA, IAEA-TCS-59, (2014).

Acknowledgments

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