



Nuclear
Sciences and
Applications

Radiation Technologies: Contributing to a Cleaner Environment and Better Health Care



Coastal area protection and management

Radioisotopes and radiation technologies, including radiation processing, radiotracers and nucleonic measurement systems, underpin a variety of industrial and environmental applications and contribute to the development of countries worldwide by providing environmentally friendly solutions. The Radioisotope Production and Radiation Technology Programme of the IAEA assists and advises Member States in assessing their needs for capacity building, research, development and deployment of environmentally sustainable technologies for socio-economic benefits.

In the specific field of coastal protection, the main technologies involved are radiotracers and nucleonic measurement systems.

The investigation of sediment transport in sea and rivers is crucial for civil engineering and shoreline protection and management. Coastlines and sea beds are dynamic regions with sediments undergoing periods of erosion, transport, sedimentation and consolidation. The main causes of erosion in beaches include storms and human actions such as the construction of seawalls, jetties, and the dredging of stream mouths. Each of these human actions disrupts the natural flow of sand. Current policies and practices are accelerating the coast erosion process, but there are viable options available to mitigate this damage and provide for sustainable coastlines.

Addressing Coastal Area Protection with Radiation Technology

Radioactive methods can help in investigating sediment dynamics, providing important parameters for better designing, maintaining and optimizing civil engineering structures. Radioisotopes as tracers and sealed sources have been useful and often irreplaceable tools for sediment transport studies. The data obtained through these techniques, directly on-site, provide precious knowledge on the physical phenomenon. This knowledge can thereafter be incorporated into numerical or physical models involved in the design of structures and in the prediction of coastal system response to human activity.

Radioactive tracer is the only unequivocal method of direct real time assessment of sediment transport pathways. Due to their heightened sensitivity, radiotracers provide more accurate parameters than conventional tracers. During the last few decades, many radiotracer studies for the investigation of sediment transport in natural systems have been conducted worldwide, and various techniques for tracing and monitoring sediment have been developed by individual tracer groups.



Erosion on a sandy coastline



Longshore sediment transport



Radiotracer injector



Radiation Detector

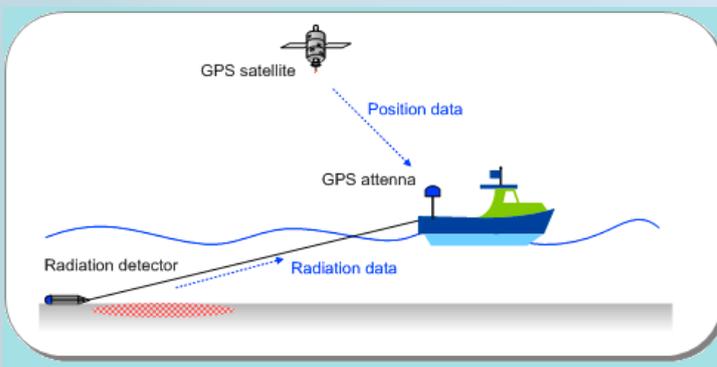


Data Processing



GPS

Principle of radiotracers detection for bedload sediment transport investigation



Survey boat

From the evolution of tracer map versus time and hydraulic events:

- Nature, direction and speed of transport,
- Thickness of the moving layer,
- Sediment mass flow rate.

Harbour management

In addition to radiotracers, sealed source techniques can provide information on the density of the sediments deposited in a channel of navigation or harbour basin, as well as the concentration of sediments circulating in suspension.

Typical problems where radiotracer and sealed source techniques contribute are:

- Shorelines in many countries are subjected to erosion, and undergo long-term retreat, which often leads to beach loss or more,
- Improper selection of a dumping site for dredging operation at harbours may cause the return of dumped material to the dredged channel.
- Nucleonic systems help in the optimisation of dredging works in industrial harbours, improving savings and minimizing pollutants released from contaminated fine sediments.



Dredger in operation



Nucleonic measurement system for dredging works optimization and QC