



# IMPLEMENTATION OF A COMPREHENSIVE SYSTEM FOR RADIOLOGICAL CONTROL AND MONITORING ON THE COAST

## / CONTEXT

Coastal nuclear sites, be it civil or military, are all equipped with environmental radiation monitoring networks. If radiation controls on the landward side are sufficient to guarantee a close area monitoring, most facilities lack radiation measuring equipment on the seaward side. To improve radiation monitoring on the coast, Bertin Instruments designed an autonomous station for marine radioactivity monitoring, consisting in two probes (GammaTRACER XL2-2 and SpectroTRACER Aqua) mounted on a buoy (GISMAN GBM-2000). Highly resistant, this floating station allows for continuous dose rate measurement in air and water, in extreme climatic and operational conditions (Strong waves, salty winds, fierce currents, etc.). It is also adapted to the monitoring of maritime borders, especially when the population needs to be protected from the nuclear risk caused by a neighboring country.

## / GISMAN GBM-2000 BUOY

The GISMAN GBM-2000 buoy is composed of:

- An aluminum longeron and a top mark:

The data processing unit is concealed by a robust cabinet, which has a special opening to facilitate the access to the equipment (electronics, embedded computer). The latter are powered by solar panels, installed on the longeron. Compliant with the recommendations of the International Association of Marine Aids to Navigation and Lighthouse Authorities, the buoy's top mark, aluminum central structure and self-contained lantern provide an excellent night and day visibility. In addition, the containers encapsulating the probes are specifically designed to meet the constraints imposed by the marine environment.

- A galvanized steel central structure:

Made of SAT steel, the central structure is intended to reinforce the buoy's stability by lowering its center of gravity. It is equipped with an anode, two mooring points, a concrete ballast to optimize the immersion and the equilibrium of the system, as well as two lifting eyes to facilitate handling operations.

- A 2-meter diameter modular float:

The float consists in polystyrene encapsulated in a polyethylene envelope.

This specific composition allows the buoy to resist to impacts and to float, even in case of serious damages to the polyethylene envelope.

Top mark

Self-contained LED lantern

GammaTRACER XL2-2

Aluminum longeron

Access door to the data processing unit

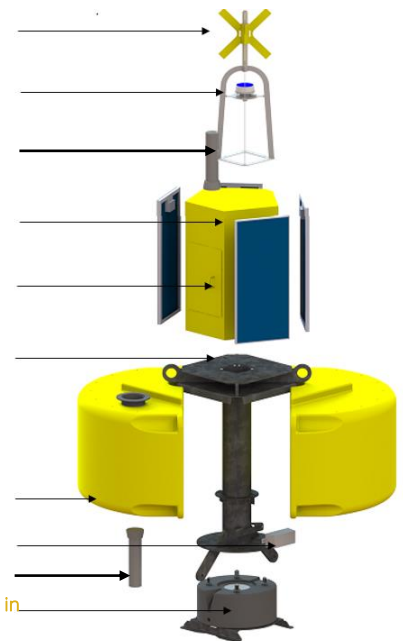
Galvanized steel central structure

2 polyethylene floats filled with polystyrene foam

Anode

SpectroTRACER Aqua

Concrete ballast encapsulated in a polyethylene envelope



Composition of the GISMAN GBM-2000 buoy

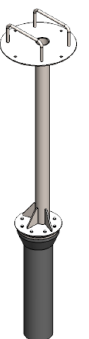
## / GAMMATRACER XL2 & SPECTROTRACER AQUA PROBES

Including two energy-compensated Geiger-Mueller tubes, the **GammaTRACER XL2-2 probe** measures, records and transmits the environmental  $H^*(10)$  gamma dose rate. Hermetically sealed, this probe is ruggedized, watertight and earthquake-resistant, for it to be used in the most extreme climatic and environmental conditions (High humidity, wide temperature range). Data reading and setting of the probe are done through RS232/485 communication, with a connector resisting to marine environment (IP68). The GammaTRACER probe has an internal storage capacity (up to 10 000 values can be saved), and a 10-year battery life, thanks to internal solar panels and a low consumption chip.



The **SpectroTRACER Aqua NaI(Tl) 2"x2"** is a continuous measurement system for Gamma radiation detection in water. This spectrometric probe can also identify the detected radionuclides. Thanks to an hermetic cabinet and a low energy consumption, the SpectroTRACER Aqua probe can be immersed up to 100 meters underwater and connected to the control and power supply unit by cable. The probe is also covered with a layer of Teflon, enabling it to be in direct contact with water. As for its electronic equipment, it is detached from the detector and placed in a specific box which is powered by solar panels and includes a battery for 24/7 operation.

By their robustness and high sensitivity, those two probes are well suited for emergencies.



## / CONCLUSION

Designed for the beaconing of sites that are semi-exposed to radiological dispersions, this early warning system for environmental monitoring is aimed at detecting radiological dispersions and informing the population in case of an accident. The hybrid and modular GISMAN GBM-2000 buoy provides enhanced stability and visibility thanks to a top mark and a lantern mounted on a galvanized steel structure. Together, the GammaTRACER XL2 and SpectroTRACER Aqua probes bring a double benefit: the dose rate measurement significantly improves reactivity in the event of an alert, whereas the analysis of the detected radionuclides helps to characterize the radiological emergency, thus facilitating decision-making. Developed by Bertin Instruments in 2019, this sea water monitoring station has already been successfully deployed in Asia, offering attractive prospects in the improvement of radiological monitoring in the marine environment.