



## RADIOACTIVE CONTAMINATION OF THE GUATEMALAN MARINE ENVIRONMENT

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As part of the IAEA TC project GUA/2/005 "Radioactivity and Contamination of the Marine Environment in Guatemala", concentrations of artificial and natural radionuclides have been determined in marine water and sediments, giving important information to establish the base line of the natural radioactivity and the radioactive contamination in this area that not have been studying.

During July 1995 and July and December 1997 sampling work was performed in 6 stations, located 1 in the Atlantic and 5 in the Pacific Ocean. Fig. 1 Shows the area and sampling stations. Large volume water sampling and seabed sediment was collected in each station.

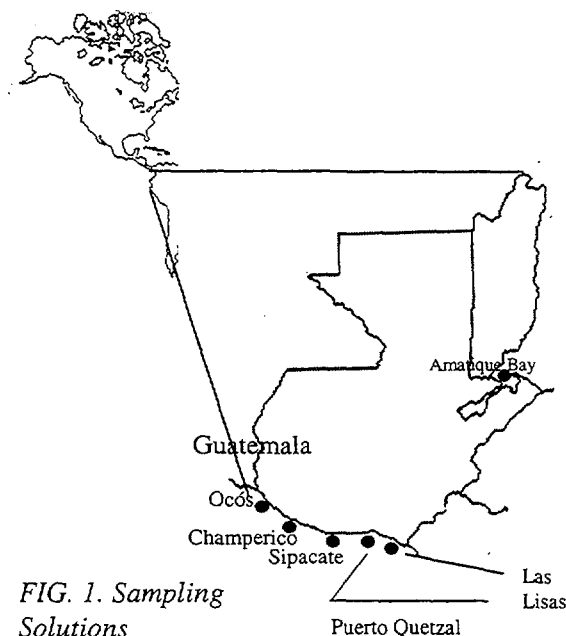


FIG. 1. Sampling Solutions

Table I shows the results obtained of Cesium-137 concentrations in marine water taken during three samplings. Cesium was collected using ammonium molybdophosphate (AMP) to precipitate it, it was dried and measured by gamma spectrometry. The determination of July 1995 correspond to 100 liters of water and 120,000 seconds to measure, the determination of July 1997 correspond to 100 liters of water and 250,000 seconds and the determination of December 1997 correspond to measure of 200 liters of water and 250,000 seconds, which improved the detection limit and the standard deviation. Although it seems like the concentrations decreased, probably is due to a better distinction between background and area in the gamma spectra, and the uncertainty is given by only standard deviation, (the value of the 1995 sample could be in a wider range); and the Minimum Detectable Concentration (MDC), in 1995 was about 1.2 mBq/L, in July 1997 it was about 0.7 mBq/L and in December 1997 it was about 0.3 mBq/L.

TABLE I. CESIUM-137 IN MARINE WATER (CONCENTRATIONS ARE REPORTED IN MILIBEQUERELS/LITER)

Sampling site	July 1995	July 1997	December 1997
Amatique Bay *	1.7 ± 0.3	1.2 ± 0.2	1.3 ± 0.1
Puerto Quetzal **	2.7 ± 0.3	2.5 ± 0.2	2.2 ± 0.1

\*Atlantic \*\* Pacific Ocean (microbequerels/Liter)

TABLE II. SHOWS THE RESULTS OF PLUTONIUM CONCENTRATIONS IN MARINE WATER SAMPLING IN 1995.

Sampling site	Pu- 239+240	Pu-238
Amatique Bay *	19.7 ± 6.7	1.8 ± 0.6
Puerto Quetzal **	4.7 ± 1.6	Not detected

\*Atlantic \*\* Pacific Ocean

Table III shows the results of Cesium-137 in marine sediments. The samples determination of 1995 were carried out using 200 g of sample and measuring during 75,000 seconds. The determination of 1998 were carried out using more sample and measuring by 250,000 seconds. The precision was improved.

TABLE III. CONCENTRATION OD CESIUM-137 IN THE SEABED SEDIMENT SAMPLES (IN DRY WEIGHT) \* ATLANTIC \*\* PACIFIC OCEAN

Sampling site	Cs-137 (Bq/Kg) (1995)	Cs-137 (mBq/Kg) (1998)
Amatique Bay *	8.7 ± 0.5	
Puerto Quetzal **	<1.1	0.46 ± 0.07
Las Lisas **	1.7 ± 0.3	1.09 ± 0.17
Sipacate **	< 0.9	0.22 ± 0.06
Champerico **	< 1.2	
Ocós **	< 1.4	

\*Atlantic \*\* Pacific Ocean

Table IV shows the Plutonium-239+240 and Plutonium-238 in marine sediments, collected in July 1995.

TABLE IV. CONCENTRATIONS OF PLUTONIUM IN MARINE SEABED SEDIMENTS (IN DRY WEIGHT) \* ATLANTIC \*\* PACIFIC OCEAN

Sampling site	Pu-239-240 (mBq/Kg)	Pu-238 (mBq/kg)
Amatique Bay *	663.8 ± 21.7	28.6 ± 2.6
Puerto Quetzal **	164.0 ± 8.1	2.8 ± 1.0
Las Lisas **	347.9 ± 9.7	11.3 ± 1.2
Ocós **	199.8 ± 8.7	8.1 ± 1.4

\*Atlantic \*\* Pacific Ocean

The content of natural radionuclides in the Atlantic Ocean determined by gamma spectrometry are Ra-226, Pb-210 and K-40 which concentrations are  $59.9 \pm 5.9$ ,  $224.5 \pm 7.3$  and  $431.2 \pm 10.8$  Bq/Kg in dry weight, respectively. The range for Ra-226 in the Pacific sediments is among 33.2 and 48.7 Bq/Kg, for Pb-210 between 101.9 and 151.28 and for K-40 between 291.32 and 356.99 Bq/Kg.

The results show that the sediment of the Atlantic presented the highest concentrations for the artificial and natural radionuclides; which probably is due to the difference between the size particles of both sediments since the Atlantic one shows finer particles and higher content of organic matter due to the location of the sampling site, in the middle of the bay where current is weak and the sediment layer is thick. The Pacific sediments in Guatemala are sandy, so the particles is larger. It is important to remark that the difference between the concentrations of Lead-210 and Radium-226 is much higher in the Atlantic sediment, which seems to indicate that there is a stronger sedimentations process.

The ratio between the concentration of the radionuclides Plutonium-239+240 and Plutonium-238 was always higher than 10:1 which indicates that the origin of the radioactive contamination in the Guatemalan marine environment comes from the nuclear test and the global accidents, and not from discharges of radioactive wastes as some ambientalist groups claimed are occurring in Guatemala.

**References:**

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