The International Laboratory of Marine Radioactivity in Monaco

A look at the origins and work of the IAEA's "arm to the oceans of the world"

by Alan Walton

"Beyond all things is the ocean." — Seneca
"Man's knowledge of the oceans is meager indeed compared with their importance to him." — Committee on Oceanography of the US National Academy of Sciences, 1959.

In the heady days of 1960, in the midst of nuclear testing on all sides, the IAEA Board of Governors responded to international concern regarding our profound ignorance of the fate of radioactivity in the oceans. It agreed to the implementation in Monaco of a joint research project on this very broad subject. What was so interesting at the outset about this project was that it was governed by an agreement between three parties, one of which — the Foundation Albert I Oceanographic Institute in Paris, which owned the Musée Océanographique in Monaco — was a private institution. The other parties were the Government of the Principality of Monaco and the IAEA.*

It was thus in 1961 that the International Laboratory of Marine Radioactivity (the name actually came later) began its work within a legal framework that from time to time over the next 25 years gave rise to hiccups of one sort or another but which nevertheless was an excellent example of "bonne volonté" on the part of all participants and adherents.

The Laboratory was housed in the Musée Océanographique in Monaco — a museum with an outstanding and worldwide reputation and founded by an oceanographer of international renown, Prince Albert I of Monaco (the great-grandfather of the present Prince Rainier III of Monaco). Sir William Herdman in his book *Founders of oceanography and their work* described the museum structure: "The museum building is a mass of white masonry, about 100 metres in length and over 70 metres high, planted actually on the face of the cliff, on the seaward side of the rock of Monaco. It rises sheer from the sea, and its lower three storeys are below the level of the top of the rock on which the old town and palace stand, so that the main entrance from the streets of the town is halfway up the building".

For those who have never visited Monaco, the Laboratory is situated in those lower three storeys as described by Herdman (as well as a further six storeys below ground level occupying a total area of about 600 square metres linked by a narrow winding staircase).

In the forefront of its field

With a "mammoth" budget of US $100 000 (US $60 000 from the Agency and US $40 000 from the Government of Monaco) the Laboratory began an approved programme related to the environmental factors "influencing the passage from sea water through various marine organisms and ultimately to man of the most significant radioisotopes that will be

Home of the Laboratory: Musée Océanographique in Monaco, built on the face of a cliff on the Mediterranean Sea.

Dr Walton is Head of the IAEA's International Laboratory for Marine Radioactivity in Monaco.

* A further point of interest to those with a legal bent and a knowledge of Mediterranean geography was the absence of the Government of France as a party to this tripartite arrangement.

Laboratory scientists on a radionuclide tracking mission.

disposed from reactors, both land based and such as might be installed on nuclear ships". Agency funds were designed to cover personnel and running costs. Government funds were to be used for general project expenses, and the Institute agreed to contribute ship support and the use of library facilities.

At the outset there was considerable intermingling of technical and scientific staff of the Musée Océanographique, the Centre Scientifique de Monaco, and the Agency. The French Government's Commissariat à l'énergie atomique (CEA) contributed substantial quantities of radiation measuring equipment to the project in the early days. It is worth noting that marine science as such was in its infancy at this time with many of the world's major oceanographic institutions having barely come into existence and others not even being on the drawing board. Thus the Agency with its laboratory in Monaco was at the forefront of this new field, albeit in a restricted portion of the subject.

Evolution of the "project"

In 1963 the research project was extended for a further five years and by 1966 an operational laboratory had become quite well-established with total personnel of four scientists and 10 technical and administrative assistants. Total funds available for the project had reached US $140 000 (US $95 000 from the Agency and US $45 000 from the Government of Monaco). By 1971 the total staff had become 18, and by 1975 it had reached 21 (eight scientists). The budget in that year was US $400 000. Periodic reviews of the project were conducted in 1963, 1966, 1967, 1971, 1979 and most recently in 1984.

The number of scientific trainees and fellows at the Laboratory has doubled in recent years.

Over the years, principally as the outcome of these reviews, project objectives have evolved from an initial basic research activity to one which now incorporates:

- Provision of analytical quality control service
- Training of personnel and provision of assistance and advice
- Performance of relevant studies on radioactivity in the oceans.

The Laboratory's role is therefore one which has relevancy for many IAEA Member States. From the very beginning, the quality control services have given the Laboratory its unique character and at the same time its considerable international renown. All marine radioactivity laboratories around the world need to know that they are producing high quality results. Through the provision of marine reference materials — in the form of sediments, sea water, and marine tissues — for a wide variety of radionuclides, together with the conduct of interlaboratory comparison exercises, the Monaco Laboratory has substantially assisted many hundreds of institutions throughout the world. Each and every year institutions in up to 50 countries participate in these exercises and use the reference materials in their day-to-day monitoring and research programmes.

Coupled with these services has been the ongoing development of suitable analytical methodology for marine investigations. A wide spectrum of radiochemical methods for natural and artificial radionuclides have been developed and published. In recent years the emphasis has been devoted to technetium and isotopes of plutonium, neptunium, americium, and curium.

Eras of scientific growth

From a strictly scientific perspective, three eras can be distinguished as being significant highlights in the life of the Laboratory over the past 25 years. Initially it contributed substantially to advancing scientific understanding

of fission product behaviour in the oceans with the gradual realization that biogeochemical considerations were the key to the understanding of radioactive contamination of marine biota and sediments. The potential hazards arising from the occurrence of transuranic elements in the marine environment led to a switch in emphasis to this subject in the mid-1970s. Noteworthy contributions were made in terms of the marine behaviour of plutonium and americium, the use of radionuclides as tracers of geochemical and oceanographic processes, and in the development of laboratory analytical techniques for the determination of transuranic elements at extremely low concentrations. Uptake and depuration studies of transuranics in many marine species represent a fundamental data requirement in hazard assessments, and the Laboratory continues to make a major contribution.

The environment makes no distinction as to whether its chemical components are radioactive or otherwise. Thus in the oceans the behaviour of radionuclides are intimately and inextricably linked with their stable counterparts. Having gained a substantial insight into the marine transport of radionuclides, it was natural that the Laboratory's experience could be exploited in related fields. With the establishment of other international pollution programmes in the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization (IOC-UNESCO) and the United Nations Environment Programme Regional Seas Office (now known as the UNEP's Oceans and Coastal Areas Programme), the unique capacity of the Laboratory came under demand. Over the past 8 years, these extra-curricular activities and extra-budgetary resources have expanded the Agency's ongoing programme by about 40% with activities now being carried out in most parts of the world. It also became necessary to have modern and well-equipped laboratories to meet these new demands. Once again the Government of the Principality stepped forward with additional premises in the Fontvieille zone of Monaco. It was thus in 1983 that the new facilities in "Aigue Marine" were officially opened. Significantly the improvements in facilities have permitted the Monaco Laboratory to upgrade and expand its services to Member States, particularly with respect to the training of technical and scientific staff in marine activities. In the past 6 years the number of trainees and fellows has in fact doubled over those in the immediate prior years.

In 1986, Monaco Minister of State M.J. Ausseuil (seated right) and IAEA Director General Hans Blix (seated left) sign the historic Seat Agreement for the Laboratory.

From a "project" to an "entity"

1987 marks both the IAEA's 30th anniversary and more than 25 years in the lifetime of the International Laboratory of Marine Radioactivity. In 1986 the IAEA Director General and the Minister of State on behalf of the Government of the Principality of Monaco signed a historic Seat Agreement that finally established the terms and conditions for the existence of the Laboratory. It is no longer a project. It is an entity — and an arm of the Agency extending to the oceans of the world. If anyone should doubt the IAEA's interest in the marine environment the following quotes should provide convincing enough evidence:

- "More than half of the world's nuclear power plants are present in or on the oceans aboard nuclear submarines or other vessels and the majority of the remainder are either located in coastal areas or on rivers draining to the sea." — *Goldschmidt Report, 1980.*
- "To dispose first and investigate later is an invitation to disaster, for once radioactive elements have been deposited at sea they are irretrievable". — *R. Carson, 1960.*