

# ASSESSING RADIOLOGICAL CONDITIONS AT BIKINI ATOLL AND THE PROSPECTS FOR RESETTLEMENT

## REVIEW AT BIKINI ATOLL

BY PETER STEGNAR

**S**ome testing during the development of the atomic bomb was done in countries that do not have the infrastructure and expertise for evaluating any associated radiation risks. In such cases, outside expertise is needed to obtain independent advice about the radiological situation caused by residual radioactive material from nuclear testing.

The IAEA has been requested by the governments of a number of its Member States to provide assistance in this context. Among the former nuclear test sites which the IAEA has reviewed is the Bikini Atoll of the Marshall Islands.

### BACKGROUND AND HISTORY

Bikini Atoll is located 850 kilometers northwest of Majuro on the northern fringe of the Marshall Islands and is composed of more than 23 islands and islets. Four islands (Bikini, Eneu, Nam and Enidrik) account for over 70% of the land area. Bikini and Eneu are the only islands of the atoll that have had a permanent population.

In 1946, Bikini Atoll was the first site in the Marshall Islands used for nuclear-weapon testing by the United States. In 1948, Enewetak Atoll, a neighboring atoll, replaced Bikini Atoll as the test site. In

1954, Bikini Atoll was reactivated as a test site until the US terminated nuclear-weapon testing in the Marshall Islands in 1958.

Prior to the first nuclear test in 1946, the 167 Bikinians living on Bikini Island were evacuated to Rongerik Atoll, about 200 kilometers to the east, seemingly to reside there until an unspecified future date when the testing would be completed. The Bikinians remained on Rongerik Atoll for a period of two years. In 1948, they were moved briefly to Kwajalein Atoll and later in the same year to Kili, a small reef.

Problems arose, however. They included the fact that Kili has no lagoon, no protective reef and no fishing grounds. The small beach is frequently subject to high waves. The Bikinians saw the move to Kili as a temporary relocation and were reluctant to change from being fishermen to being farmers.

By the time nuclear-weapon testing in the Marshall Islands was terminated in July 1958, sixteen nuclear-weapon tests had been conducted on Bikini Atoll over a 12-year period. All of these tests were surface or atmospheric tests. They were conducted in or over the Atoll lagoon, thereby dispersing the explosion's effects over all of the islands of the Atoll.

The history of the radiological assessments and the movement of the local population is very important in understanding the overall concerns. In August 1968 — following a number of radiological surveys that had been carried out since 1958 to assess the impact of the US programme of nuclear-weapon testing — it was announced that Bikini Atoll was safe for habitation and approved for resettlement. The atoll was cleared of debris and fruit trees were replanted. A further radiological survey of Bikini Atoll was carried out in 1970.

Eventually, 139 Bikinians resettled on the Atoll. However, the Bikinian people remained unconvinced of the safety of the Atoll, and in 1975 they initiated a lawsuit against the US Government to terminate the resettlement effort until a satisfactory and comprehensive radiological survey had been carried out.

Additional radiological data were collected for evaluation in 1975, 1976, and 1978. In September 1978 it was decided to relocate the 139 Bikinians who had returned to Bikini Atoll back to Kili Island and to Ejit Island at Majuro Atoll.

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After a second relocation, a new radiological survey, sponsored by the United States, was performed. This survey consisted of using detectors mounted in helicopters to plot contours of external gamma dose rates. Also, samples of vegetation, marine foods, animals and soil were collected and analyzed. Revised radiation dose evaluations were published in 1980 and 1982. They indicated that — should the Bikinians decide to resettle their island — the terrestrial food chain would be the most significant exposure pathway. This dose assessment was most recently updated in 1995 on the basis of a continuing measurement programme at the Atoll.

Following the US survey, the Government of the Republic of the Marshall Islands commissioned a separate radiological assessment. By this means, Bikini Atoll, as well as all other atolls in the Republic, were to be monitored for radioactive residues. A Scientific Advisory Panel of well-known and respected scientists provided oversight. Laboratory quality control programmes were implemented to ensure that the surveys could provide accurate measurements and reproducible data. In general, the study confirmed the findings of earlier measurement programmes. The findings of the survey were published and a report on Bikini Atoll was released in February 1995.

In August 1995, six months after the survey report was issued, the Nitejela (Parliament) of the Marshall

Islands considered the survey findings but it did not accept them.

## REQUEST FOR AN INTERNATIONAL REVIEW

In 1994, the Government of the Marshall Islands requested the IAEA to conduct an independent international review of the radiological conditions at Bikini Atoll, and to consider and recommend strategies for the resettlement of the atoll. The IAEA responded to this request by convening an Advisory Group, which met in December 1995. The Group was convened under the framework of an IAEA technical cooperation project.

There were three main objectives of the international review:

- To assess the radiological conditions on Bikini taking into account the information submitted by the Republic's Government;
- To ascertain whether any corroboration of the available information on the current radiological conditions at the Atoll is needed; and
- To determine whether any remedial actions for the purpose of radiation protection were required and, if so, the form, scale and duration of such an intervention.

The international review took into account all of the available data from the Marshall Islands' survey, as well as of a large number of other assessments made by scientists from around the world.

## IAEA SURVEY OF BIKINI ATOLL

In May 1997, the IAEA sent an environmental monitoring

team to Bikini Atoll to perform a limited programme of environmental measurements and sampling. Measurements were made of the absorbed dose rate in the air and of the concentration of the most radiologically significant radionuclides in representative samples of soil and foodstuffs.

The purpose of this survey was to validate the data that had been previously collected. Measurements taken during the survey were generally in good agreement with previously reported values.

## CONCLUSIONS

Based on its review, the IAEA Advisory Group determined that no further corroboration of the measurements and assessments of the radiological conditions at Bikini Atoll is necessary. The data that have been collected are of sufficient quality to allow an appropriate evaluation to be performed. The limited IAEA monitoring of the area provided a good quality assurance verification of the previously collected data.

It was recommended that Bikini Island should not be permanently resettled under the present radiological conditions. This recommendation was based on the assumption that persons resettling on the island would consume a diet of entirely locally produced food. The radiological data support that if a diet of this type were permitted, it could lead to an annual effective dose of about 15 mSv. This level was judged to require intervention of some type for radiation protection purposes.

There are a number of remedial actions that could be



performed that could lead to permanent rehabilitation of the island. These include the periodic application of potassium-based fertilizer where edible crops are grown or the removal of the topsoil from the island. It is generally felt that the most reasonable approach would be to use potassium fertilizer. Since most of the radioactivity in the plants is due to the uptake of the radioactive cesium, the

potassium would replace this element, thereby reducing the overall exposure to the population. The scraping and removal of the topsoil would cause serious environmental harm to the island and have social consequences.

*Photos: As part of the IAEA's international review of Bikini Atoll, expert teams collected and analyzed environmental samples at a number of sites. Shown here is the preparation of coconuts for the measurement of radioactivity and soil profile sampling on Bikini Island.*

*(Credit: G. Winkler/IAEA)*

If it is determined to remediate Bikini Island through the use of fertilizers, it was recommended that a simple monitoring programme of the foodstuffs and the population be continued. The purpose of this programme is to provide assurance to the local population that there is no significant uptake of radioactive material into their bodies.

This project was an example of a study where the IAEA was asked to provide an assessment of an existing radiological situation arising from the presence of radioactive residues. It provided this service to a Member State that had legitimate concerns about these situations. By providing this service, the IAEA has helped provide guidance to national authorities on possible actions that can be taken for the purpose of resettlement in areas where there are concerns about existing environmental conditions.

In 1998, the IAEA issued a report — *Radiological Conditions at Bikini Atoll: Prospects for Resettlement* — that covers the international review in greater detail. (See this edition's IAEA Books section for ordering information.) Additionally, in July 1997, the official journal of the Health Physics Society, *Health Physics*, devoted a special edition to the subject, including papers of direct relevance to questions of resettlement for the people of Bikini Atoll. □