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Greenpeace

Testimonies : witnesses of French nuclear testing in the South Pacific

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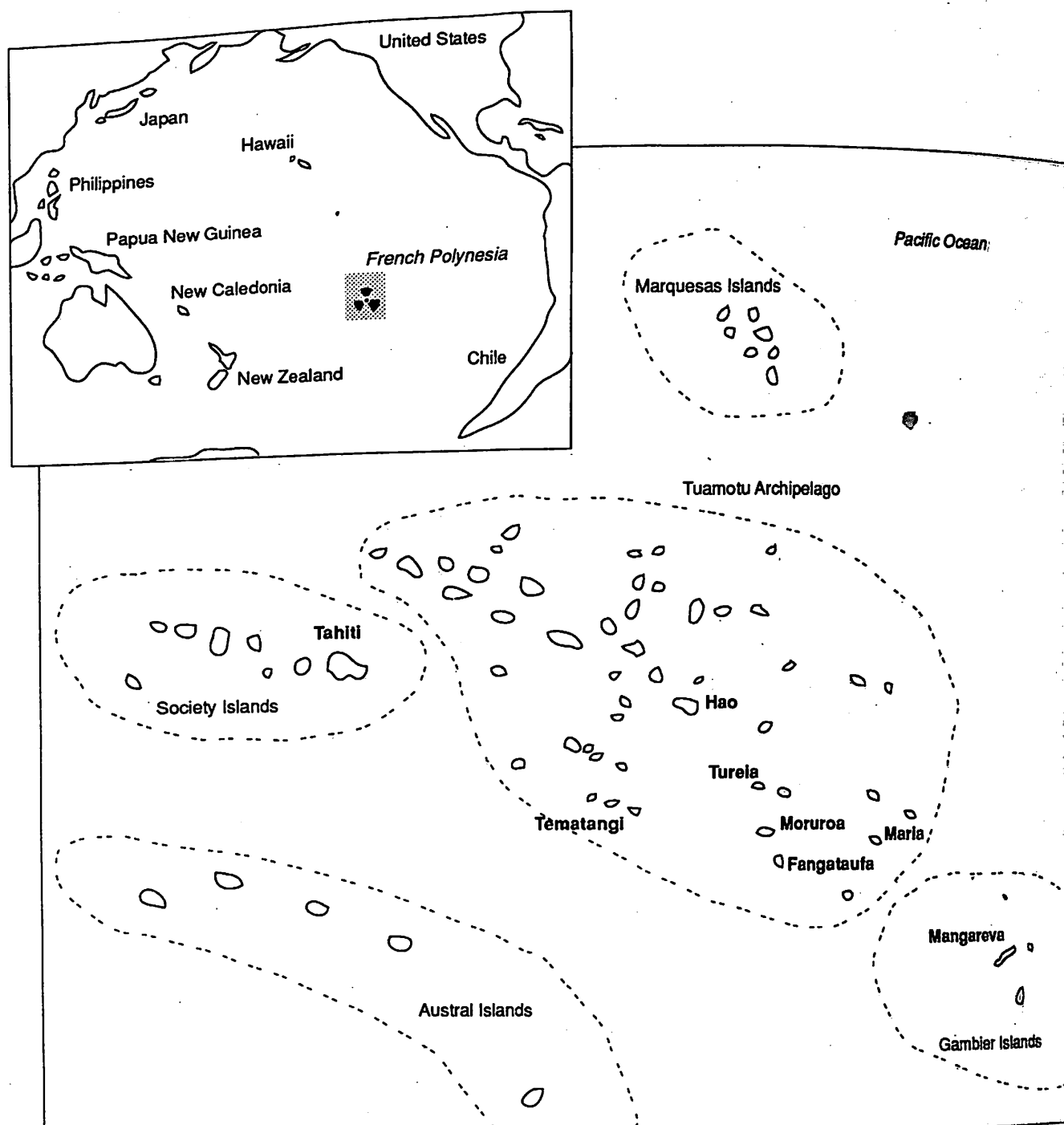
MORUROA - PLACE OF THE GREAT SECRET

TESTIMONIES

*Witnesses of French nuclear testing
in the South Pacific*



TESTIMONIES



Cover: After Gauguin by Bobby Holcomb, 1986.

This painting hangs in the office of the mayor of Faa'a, Oscar Temaru.

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The interviews in this book were collected by Dr Andy Biedermann for Greenpeace in 1987. The testimonies have been edited by Stephanie Mills, Julie Miles, Madaleen Helmer and Saskia Kouwenberg.

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Testimonies

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in the South Pacific*



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Introduction

"The traditional spirit of Polynesians is that the land is like our mother. People come from the land. We must respect our mother, not explode bombs in her belly. Our good way of life comes from the land. Destruction of the land will lead to the destruction of life, and the way of life of Polynesian people."

Jacques Ihorai

President, Evangelical Church of Polynesia

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Moruroa, in the Maohi language of Polynesia, means the Place of the Great Secret. Today this is a cruelly appropriate name for a once-beautiful palm covered atoll in the Tuamotu Islands of French Polynesia. At Moruroa and nearby Fangataufa atoll, France has conducted 44 atmospheric and more than 120 underground nuclear tests, and these test explosions are continuing at the rate of about six a year.

In the face of strong local and international opposition the French authorities have succeeded in maintaining the test programme by protecting Moruroa's great secret and concealing the full medical and environmental effects of its nuclear programme. The little independent scientific evidence available shows that the Moruroa tests have released dangerous levels of radiation into the atmosphere and into the sea, shattered the base of the atoll, and contaminated people living and working around the test sites.

For many years Polynesian leaders in Tahiti, political leaders in other Pacific countries, the Pacific Conference of Churches, organisations such as the Nobel Prize-winning International Physicians for the Prevention of Nuclear War (IPPNW) and many others have expressed their concern about the effects of French tests. The attitude of the French government has remained unchanged since the tests began: there is no danger, trust the authorities.

Yet the dangers of atmospheric testing were already well-known in 1966, when France began conducting atmospheric tests at Moruroa. The United States, the Soviet Union and Britain had all banned nuclear testing in the atmosphere three years earlier, when they signed the 1963 Partial Test Ban Treaty.

In 1972 and 1973, Greenpeace sailed into the French testing zone at Moruroa to protest against continued atmospheric testing. These protests strengthened regional opposition and eventually, in 1974, after two years of sustained public, political and legal pressure, the French government halted its atmospheric testing programme.

Unlike the United States and Britain, however, who had moved their nuclear testing programme from the Pacific to the Nevada desert because they believed the fragile geology of coral atolls was not suitable for underground explosions, the French stayed at Moruroa. Scientists have claimed that Moruroa is now like a Swiss cheese, riddled with more than 100 holes and threatening to disintegrate.

When construction of the Pacific Test Centre (Centre d'Experimentation du Pacifique or CEP) at Moruroa began, public health statistics previously freely available through Tahiti's "Journal Officiel" ceased to appear. At the request of the World Health Organisation, publication of the statistics started again in 1983, but international scientific authorities have criticised the health records as being incomplete and inaccurate. No statistics at all are available for the twenty years of atmospheric testing, or for the first eight years of underground testing.

The Fri in the test zone at Moruroa, 1973.



However, stories from the people of the inhabited islands near Moruroa and Fangataufa, and from Polynesian workers at the CEP, have trickled out of the French overseas territory to contradict the assurances of the French authorities. This book is based on interviews with people who have worked at Moruroa, or who live on islands near the site. It describes the effects of the nuclear test programme on their lives, and the lives of their families and friends. The interviews took place in 1987, when Dr Andy Biedermann, a Swiss doctor and crew member of the Greenpeace campaign ship *Rainbow Warrior* in 1985, made two trips to Polynesia, visiting Tahiti and some of the outer islands. At the end of his stay, Dr Biedermann was expelled from the territory for alleged "interference" in French defence affairs.

Most of the people interviewed are Polynesian; their ancestors have lived in these islands for centuries. This is the first time many of them have spoken out about their experiences. Many fear the possibility of official repercussions, and so their names have been changed to protect them.

They describe the environmental and health problems they have witnessed since the test programme began, and the effects it has wrought on their society. The presence of the CEP has dramatically changed the traditional economy and social system of Te Ao Maohi, the land known today as Tahiti-Polynesia, or French Polynesia.

Initially the establishment of the CEP created jobs for the Maohi people, but the sudden influx of more than 10,000 soldiers, engineers and technicians, bringing with them cheap alcohol and an illusion of prosperity, soon meant a host of new problems. France pours US \$55 million a month directly into Tahiti's economy, with the CEP alone providing 55 percent of the country's

Housing conditions on the coast near Papeete: the prosperity brought by the CEP has been unevenly distributed.



external financial aid, while exports cover only 10 percent of imports. In 1962, before the CEP moved to French Polynesia, the primary sector provided 54 percent of jobs and the tertiary sector only one third. Today the service sector provides nearly 71 percent of all jobs, and the primary sector only 11 percent. The CEP has been described as a "social bomb": much of the inflation, unemployment and slum conditions seen in Tahiti today can be attributed to the economic distortions and social upheaval caused by the nuclear test programme.

The tests themselves brought a virulent fish poisoning called ciguatera and land so polluted by radioactive material that it is unlikely ever to be used again. Many of the people interviewed here believe that the tests have seriously affected their health, and that of their children and friends. They talk about mysterious illnesses, unexplained deaths, stillbirths and a large increase in the number of handicapped children born after the tests began.

These testimonies, like all authentic human stories, contain discrepancies and contradictions. Some of the people interviewed are talking of events that occurred more than 20 years ago, and of incidents which, because of the secrecy surrounding the testing programme, are difficult to verify.

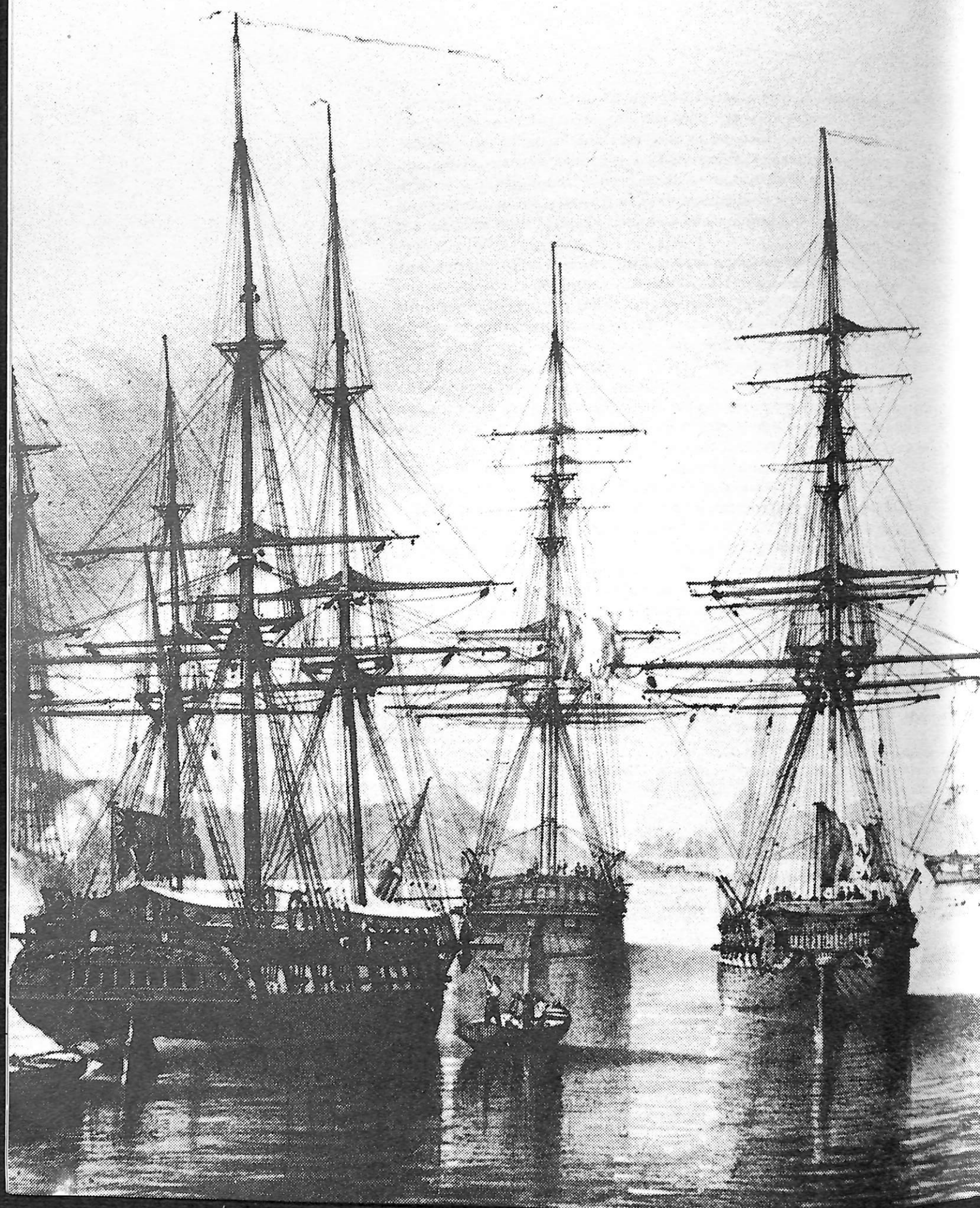
They are not the testimonies of scientists or health experts, and they do not scientifically "prove" a relationship between the nuclear tests and increased rates of cancer, stillbirths or other medical complaints described here. A thorough survey of the 12,000 people who have worked on the test site, and full analysis of health statistics for the last 30 years could alone provide evidence of that, but the French government will not allow this.

Until it does, these personal testimonies and the well-established scientific evidence of the danger of even small amounts of radiation for humans stand to challenge the authorities. If nuclear tests are as harmless as claimed, why not allow a comprehensive test survey? Why not publish the health statistics from 1963 to 1983? Why conduct the tests far from French soil?

Ultimately, the burden of proof rests not with the people of Te Ao Maohi but with the French government. It is not the responsibility of the people who have worked at the test sites to prove that their health has been damaged, but of the French government to prove that the ill-health and deaths occurring in French Polynesia in the last thirty years are not a result of their nuclear test programme.

French military jeeps in Papeete: the military presence is inescapable.





History and Background

The 130 islands and atolls of Te Ao Maohi, or French Polynesia, are scattered over an area of the South East Pacific as large as Europe. They form five distinct archipelagos: the Society Islands (which includes Tahiti); the Australs; the Gambiers; the Marquesas; and stretched over an enormous arc, the low, flat atolls and reefs of the Tuamotus.

Tahiti is the central and largest island of Te Ao Maohi. Its volcanic mountains, covered with tropical trees and bush, rise more than 2,000 metres above sea-level. Seventy-five percent of the 180,000 people of French Polynesia live on a narrow strip of land between Tahiti's lagoon and the mountainous backbone of the island.

Parts of Te Ao Maohi were probably first settled around 1300 AD by the early Polynesians, who are linked by common ancestry and culture with people living as far away as Hawaii, Aotearoa (New Zealand) and Rapa Nui (Easter Island). The explorer Magellan was the first European to visit Te Ao Maohi on his first voyage around the world in 1521. At that time, people were living in family groups of varying size on nearly every habitable island.

The first Europeans to settle in these islands were traders, whalers and slave traders, closely followed by Protestant missionaries. The Europeans brought previously unknown fatal diseases which decimated the populations on many of the islands. The estimated pre-European population of the Marquesas, for example, was about 80,000 people; by 1939, there were only 3,000 left.

Missionaries from the London Missionary Society and other British settlers were the dominant European influence in the first decades of the nineteenth century. After a difficult start, Christianity was adopted by the Polynesians, and the influence of the Protestant church on Polynesian society is still very strong. The French came later to protect the establishment of a Roman Catholic mission.

Neither the British nor the French Governments were particularly eager to colonise the islands. It was only when the French Admiral Dupetit-Thouars convinced his government that some of the islands could serve as a penal colony that France decided to take possession of Polynesia. In 1842 Te Ao Maohi became a French protectorate, and in 1880 the French changed its status from territory to colony and its name to French Oceania.

There was strong resistance to the French occupation, particularly in the Society Islands. At first, the Tahitian Queen Pomare refused to surrender, and it was only under threat of the bombardment of Tahiti that she was forced to accept French rule. As a result, thousands of Society Islanders were deported to New Caledonia (another French occupied territory in Melanesia that became a penal colony instead of Polynesia).

European merchants and colonists were not very optimistic about the economic potential of Tahiti and the surrounding islands. Attempts to set up large plantations failed because local Polynesians could not be induced to work on them. The Chinese, who were imported to do this work, changed their occupations within a short time and set up their own small businesses, eventually dominating the commercial sector and service occupations.

There was not enough land on the islands for large-scale immigration of European farmers, unlike other colonies such as New Caledonia, New Zealand and Australia. And apart from pearls, there were no precious minerals to exploit.

Tahiti never became the important shipping centre for vessels coming through the Panama canal that the French authorities had hoped.

Opposite: The French takeover of Tahiti 1843

(Lithograph by Louis Le Breton)

Below: Queen Pomare

(watercolour by Moerenhout)





General Charles de Gaulle visited Tahiti in 1966, en route to witnessing a nuclear test at Moruroa.

Consequently, the impact of the French presence on the Polynesian way of life was relatively small to begin with.

However, drastic changes occurred after 1962, when France decided to test its nuclear bombs on the coral atolls of Moruroa and Fangataufa in the Tuamotu archipelago.

In 1945, France established an atomic energy commission, the Commissariat l'Energie Atomique (CEA). In 1954, a secret decision was made, charging the CEA with the build up of France's own "independent" nuclear weapons programme, the "force de frappe".

The first French nuclear device was exploded in 1960 above the Sahara desert in southern Algeria. A total of four atmospheric and thirteen underground tests were conducted in Algeria between 1960 and 1966.

Two events precipitated the move to another test site. The first was a miscalculation of weather conditions which carried radioactive fallout across the Mediterranean to Europe and particularly to France. The second was of decisive importance: after a bloody war of independence, the French and their tests were no longer welcome in Algeria.

So in 1963, President de Gaulle chose Polynesia – "a paradise on earth" – as the replacement site for the continued testing of the most destructive weapons humanity has ever known.

In the same year, the Partial Test Ban Treaty (PTBT) prohibiting atmospheric tests was signed by the Soviet Union, the United States and Britain, as a move to reduce the arms race and stop the harmful health effects of atmospheric nuclear testing. Neither France nor China signed the PTBT or conformed to the treaty's intentions until 1975 and 1985 respectively.

The Territorial Assembly, the Polynesian parliament in Tahiti, did not welcome the nuclear tests. Leaders of a pro-independence party which had a majority at that time were concerned about the health effects of nuclear testing and wrote to scientists all around the world to ask for more information. French government authorities would only repeat constantly that the tests were harmless and that no radioactive particle would ever reach an inhabited island. The famous French doctor and theologian Albert Schweitzer replied: "Those who claim that these tests are harmless are liars".

In May 1963, the French Governor of Polynesia wrote to the Speaker of the Territorial Assembly: "I should like to repeat my assurances here, in the name of the Republic, that all necessary measures are being taken to guarantee that the population will not suffer in the slightest degree from the scheduled experiments".

Yet later that year, the French suddenly stopped publishing French Polynesian public health statistics. This action and other information about the damaging effects of nuclear testing only increased the concern and protests of Polynesian leaders, but they were ignored by the French. Instead, those opposing the tests were subject to unjust imprisonment, surveillance and harassment, and economic and political pressure.

The arrival of the nuclear test programme had a tremendous impact on Polynesian society, which then numbered about 85,000 people. Eight thousand military personnel, among them many French foreign legionnaires, came to Tahiti, Moruroa and Hao (an atoll halfway between Tahiti and Moruroa which became a military base), as well as some of the other islands. About 3,000 civil servants and technicians followed them.

For many Polynesians the nuclear test programme became the vehicle from

a traditional, subsistence economy lifestyle on the outer islands to a Western lifestyle in the city of Papeete on Tahiti. Thousands of Polynesians were offered jobs on Moruroa, Fangataufa, Hao or Tahiti to help construct the facilities needed for the tests. When the work was finished, most of those who did not get a job with the Centre d'Experimentation du Pacifique (CEP) went to live in Tahiti and did not return to the islands they had come from. On the outer islands fishing and the cultivation of food crops decreased considerably and the subsistence way of life largely came to an end. On Tahiti there was hardly any room to grow crops. Today about 85 per cent of food is imported at great expense. The high cost of living, inflation and unemployment has led to the development of large slums around Papeete.

The Tahitian economy changed dramatically with the sudden increase in spending power of Polynesians who were being well paid for their work for the French military administration and in other service jobs. The French who came to work in Polynesia also had a lot of money to spend and the French Government's financial support to the territory increased. The prosperity of Polynesia today is almost 90 per cent dependent on money from France which in turn depends on the continuation of the nuclear tests.

On 2 July 1966, the first French nuclear test in the Pacific was conducted in the atmosphere above Moruroa. On 10 September 1966, a nuclear test was to take place in the presence of General de Gaulle. The weather conditions, however, were unsuitable and the test was postponed. The next day, the weather conditions were even worse, with an easterly instead of a northerly wind, but pressure to fit in with de Gaulle's schedule meant the test was conducted anyway. In the path of the wind, stations of the New Zealand National Radiation Laboratory measured increased radioactivity in Western Samoa (over 3,000 kilometres from Moruroa), the Cook Islands, Niue, Tonga and as far away as Fiji and Tuvalu. However, the French authorities did not tell the people of Tahiti of the blast, or of the possible dangers they faced.

In 1968, France conducted its first thermonuclear (hydrogen bomb) tests at Fangataufa and Moruroa. The yields of these blasts were far bigger than previous tests. The first test conducted at Fangataufa on 24 August had a yield of 2.6 megatons, more than 150 times the power of the bomb dropped on Hiroshima. The population of Tureia was evacuated to Tahiti shortly before the test took place. It was several months before they were permitted to return home.

In the early 1970s, international protests against the French atmospheric tests intensified. France was condemned at the International Court of Justice in The Hague (Netherlands), while the United Nations and Pacific and Latin American governments took diplomatic measures, some withdrawing their ambassadors from France. Finally in 1974, after 44 atmospheric tests and under pressure from international public opinion, French President Giscard d'Estaing decided to transfer the tests underground. However, Pacific countries have continued to protest at the dangers posed by conducting underground testing on coral atolls, given their vulnerable geology.

Coral atolls are fragile ecosystems which can easily be damaged – a fact that was demonstrated by a serious accident in 1979, when a bomb which got stuck halfway down its shaft was detonated, creating big fissures in the structure of the atoll and a tidal wave. Two years later, the French trade union CFDT, which represents workers at Moruroa, revealed that cyclones had ripped up tarseal covering the radioactive waste depository on the atoll. As a result, some 10 to



Inflation and high prices, as well as the nuclear test programme, have hampered Tahiti's attempts to develop a tourist trade.



Captain Jacques Cousteau looks at photographs of nuclear tests at Moruroa, after observing one at first hand aboard his yacht Calypso in 1987.

20 kilogrammes of plutonium, the most toxic substance known to humans, was spread into the lagoon and over parts of the atoll.

In 1982, after repeated demands by local politicians and leaders of the Pacific countries for an independent research team to investigate the state of Moruroa and the possible effects on the health of the Polynesians from the nuclear tests, the French government organised a three day visit to Moruroa by a seven member team picked by French defence minister Charles Hernu. The geologist who led the team, Dr Haroun Tazieff, generally downplayed the risks of the tests, but nevertheless was highly critical of the safety and environmental monitoring of French tests. He admitted there were significant amounts of radioactivity in the environment because of past atmospheric tests, and said further study was needed to ascertain the risk of radioactive releases into the ocean through cracks in the coral and basalt basement of the atoll.

In 1983 the French Government gave permission to a team of scientists from Australia, New Zealand and Papua New Guinea to study the atoll. The Atkinson Commission (named after its chairman) spent eleven days in Polynesia, but only four actually on Moruroa. The Atkinson Commission concluded that parts of Moruroa had been impaired by fissuring, subsidence and underwater slips, but that radiation leakage would not occur for about 500 to 1,000 years. These conclusions have been heavily criticised since they were published, particularly by two New Zealand-based scientists, Professors Michael O'Sullivan and Manfred Hochstein, of Auckland University who calculate that radioactivity could be released within 10 to 100 years. Their computer model has never been refuted by French officials.

In 1987, Captain Jacques-Yves Cousteau conducted a further study of Moruroa. Again, scientists were limited to a few days of investigations, and seriously restricted over where they could visit and take samples. Cousteau's report, released in November 1988, described premature and accelerated ageing of the atoll as a consequence of the tests, with severe fissuring, underwater slides and subsidence. Abnormally high levels of radioactive iodine were detected in sediment – a result of accidental leaks during test drilling, French officials said. Cousteau concluded that there were no short- or mid-term risks posed by nuclear testing, a conclusion which was used by the French authorities to justify their claim that testing is perfectly safe.

However, a re-evaluation of Cousteau's data published in August 1990 by US scientist Norm Buske, showed that Cousteau had not sufficiently emphasised the evidence of leakage. Buske concluded that the significant amounts of cesium-134 and cesium-137 found in the lagoon suggest that the atoll contains cesium-134 for probably less than six years, a much poorer containment than the French have suggested. This finding seriously challenges the technical feasibility of nuclear testing beneath coral atolls.

The scientific reports have not stopped the critics. On the contrary, the South Pacific Forum (the annual meeting of leaders of independent Pacific countries) signed the South Pacific Nuclear Free Zone Treaty in 1985, which prohibits nuclear testing in the region, including French Polynesia. The Pacific Conference of Churches has repeatedly condemned French testing and in Tahiti itself, more and more people have spoken out against the tests despite their economic dependency on "la bombe".

Chronology

A Brief Chronology of French Nuclear Testing

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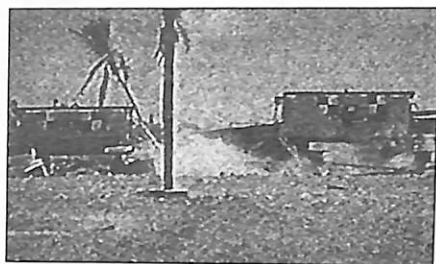
- 1945 Establishment of CEA.
- 1948 Uranium deposits discovered in central France.
- 1952 "Peaceful" plan for CEA to produce 50kg of plutonium.
- 1954 Official decision taken in secret by Prime Minister Mendes-France to construct French nuclear weapons.
- 1955 Prime Minister Faure publicly states there is "no nuclear weapons programme". In May he signs a secret protocol giving the CEA funds from the defence budget to build nuclear weapons.
- 1957 A range of nuclear test sites selected in Algeria, mainland France, Kerguelen Islands, Clipperton Island and Tuamotu Archipelago. French scientists visit US test site at Nevada.
- 1958 Public decision taken to test nuclear device at Reggane, Algeria. Testing moratorium initiated by USSR, US and UK. United Nations calls on France to abandon its proposed tests.
- 1960 First of four French atmospheric nuclear tests at Reggane in Algeria.
- 1961-1966 13 underground tests in Algerian desert.
- 1962 Algerian independence won after bloody war; however Evian Accords allow testing to continue in Algeria until 1966.
Pacific test site officially established (Centre d'Experimentations du Pacifique (CEP)).
- 1963 Limited (Partial) Test Ban Treaty signed, banning atmospheric and underwater tests.
President de Gaulle announces France will continue to test in the atmosphere, using Moruroa atoll.
- 1966 First French atmospheric test at Moruroa atoll.
Safety test of July 21 codenamed CANYMEDE disperses plutonium on the surface of Moruroa.
- 1966-1974 44 atmospheric tests, 39 at Moruroa and five at Fangataufa.
- 1968 First French thermonuclear test, and France's largest known explosion to date, CANOPUS.
- 1972 President Pompidou orders Army to find suitable site for underground testing. Exploratory drilling undertaken at Eiao in the Marquesas group, but is rejected as a test site.
- 1974 President Giscard D'Estaing announces testing will move underground in 1975.
- 1975 Two exploratory underground tests take place at Fangataufa.
- 1976 The Commander of the CEP officially closes the Fangataufa test site.
- 1976-1981 51 underground tests conducted in outer rim of Moruroa atoll.
- 1979 Fatal accident on July 6 kills two workers and disperses radioactive fallout over the atoll.
Tidal wave caused by large blast on July 25 when bomb is detonated half way down the shaft after getting stuck at a depth of only 400 metres.



(Top) A gendarme and dog stand guard in front of the tower used for detonating nuclear weapons at Reggane, Algeria

(Centre) Scientists with 'Gerboise Bleue', France's first nuclear bomb

(Bottom) An Algerian worker in a tunnel drilled into the side of the Hogar Massif mountains, Algeria, where France's first underground tests were held.



(Top) During atmospheric tests at Moruroa, bombs were suspended from hot-air balloons and detonated over the atoll.

(Centre) Concrete buildings collapse during an underground test.

(Bottom) The Marara, a biological control ship for obtaining marine samples, operated by the Service Mixte de Sécurité Radiologique.

(Right) Moruroa atoll

- 1981 Cyclones sweep radioactive garbage from Moruroa's northern rim into the atoll.
Mitterand's socialist government elected on "no testing" policy. This is abandoned after four days in office.
- 1981-2 Protective walls erected to prevent living area and industrial zone from the risk of cyclones.
- 1982 Three day scientific mission of French scientists led by Haroun Tazieff visits Moruroa atoll.
- 1983 Four day scientific mission from Papua New Guinea, Australia and New Zealand led by Atkinson visits Moruroa.
- 1987 Five day mission to Moruroa led by marine explorer Jacques-Yves Cousteau.
- 1988 Admiral Thireaut admits previous tests near edges of the atoll may have contributed to underwater slides of coral limestone on the flanks of the atoll. Future large blasts will be undertaken at Fangataufa, he announces.
- 1989 European Parliament narrowly rejects a resolution calling for establishment of an independent mission to investigate the effects of testing in French Polynesia.
- 1990 The Nuclear Non-Proliferation Treaty Review Conference takes place in Geneva. For 20 years France has refused to sign the treaty. France announces it will reduce tests from eight to six in 1990, and that it will publicly announce when they occur, and their approximate yield.



'The dead are placed in metal coffins'

The first dozen interviews are with men who have worked at Moruroa and Fangataufa. They describe the construction of facilities at the two atolls, the atmospheric tests themselves, and the severe environmental contamination which followed. Working conditions, major accidents, the shift to underground testing, and the fissures and subsidence which repeated explosions have caused are also described. The interviews record the men's concerns about their own health and that of their families.

Ruta was interviewed in November 1987, just two weeks after returning from a stint of three months work on Moruroa. He first went to Moruroa in 1976 and has worked there for the past 12 years. For ten years he worked there all year around with a short break in Tahiti every two to three months. Now he works in Tahiti for most of the year, and only spends a few months on Moruroa going home for long weekends every three weeks.

"My first job was waste management. After each explosion, when the specialists with their geiger counters had gone, we had to go round the atoll and clean the dead fish and other rubbish off the beaches. It was usually two to three days after the explosion. Depending on which way the wind was blowing, the fish would be swept ashore at different places – several tons of dead fish at a time. Once, not very long after a test, three dead whales were swept ashore, on the ocean side. They were very big, and we had to get cranes to move them away.

The wind and fish didn't respect which zones were forbidden and contaminated... so my colleagues and I often had to expose ourselves to radiation, because we had to go and pick up fish in highly contaminated areas. Sometimes there were leaks after the bomb explosion and the sand on the beach where we normally were allowed to swim was contaminated. The sand had to be taken away on big lorries and new sand was brought in. We didn't have any protective clothing... No dosimeters measured our exposure to radiation. The specialists had protective clothing but we didn't get any. The only thing we sometimes got were gloves.

While I was working there, politicians and journalists came to check out rumours about the contamination of the atoll and the lagoon. To prove

The number of workers employed by the CEP has dropped from around 10,000 in 1968 to 2,000 in 1988. (*Dominion* 24.8.88)

La Depeche de Tahiti (18.6.71) reported an eye-witness account of an atmospheric test: 'When the bomb was detonated... all the water in the lagoon basin was sucked up into the air, and then rained down. The islets on the encircling reef were all covered with heaps of irradiated fish and clams, whose slowly-rotting flesh continued to stink for weeks.'

In 1970, French Defence Minister Michel Debre swam in the lagoon at Moruroa in front of a party of French journalists six hours after an atmospheric test, to try and placate critics of the testing. (*Poisoned Reign*, p145)



Safety-suited technicians inspect the atoll after an atmospheric test.

In February 1984, 2,000 people marched through Papeete in an anti-testing demonstration. (*Poisoned Reign*, p311).

The symptoms Ruta describes are compatible with respiratory illness as a result of toxic poisoning. The major risk from plutonium is via inhalation. Jean Prince is the military hospital, staffed by army doctors, in Papeete. Mamao is the hospital run by the Territorial Government, the locally elected parliament of French Polynesia. All except four doctors in Tahiti are seconded to the military (*Sunday Star* 29.11.87). Serious illnesses are routinely treated in France and most cancer patients are sent there, although some get treated in Australia and New Zealand. (*Australia Sun-Herald* 27.12.87, *NZ Times* 7.11.82).

A group has been set up to befriend Tahitian patients in French hospitals: contact Mlle Claude Walter, 12 bis rue Fabret, 92170 Vanves, France (La Depeche de Tahiti 21.2.90).

France's official position on waste disposal is: "Nuclear waste is produced in the normal course of operations on the test site. One source is the tools used in the post-shot drilling for radioactive samples, another being the decontamination operations carried out in the zone affected in the days of atmospheric testing. All such waste is sealed into steel and concrete canisters, which are lowered in to 1200 metre vertical shafts in the basalt and buried there".

Protective walls were erected in 1981 and 1982 to protect the living area and industrial zone on Moruroa from cyclones. These walls face both the ocean (mean height of 4m, total length of 4.5 km) and the lagoon (mean height of 2m, total length of 3 km). (*FNT* p15) Two "safety firings" in 1966 and 1971 dispersed plutonium without any detonation, and this area was subsequently used as a "safety trial area" to train personnel in accident procedures. To prevent the plutonium from blowing away it was "fixed" in place with a layer of tar. (*FNT* p11)

everything was safe, the military brass would go swimming in the lagoon. But afterwards they took showers in special containers. Later I had to go and clean up the containers and I noticed they used special soaps or creams. They were tubes containing a yellow liquid which were never used in the normal showers.

In 1983, anti-nuclear opposition started to grow and people in Tahiti became more outspoken. The workers on Moruroa became more aware of the health risks we were running. After the demonstrations on Tahiti we refused to go to the contaminated and forbidden zones any more. As there were a lot of us, the French military couldn't dismiss us all. From then on teams of French workers — with proper protective clothing — did the job.

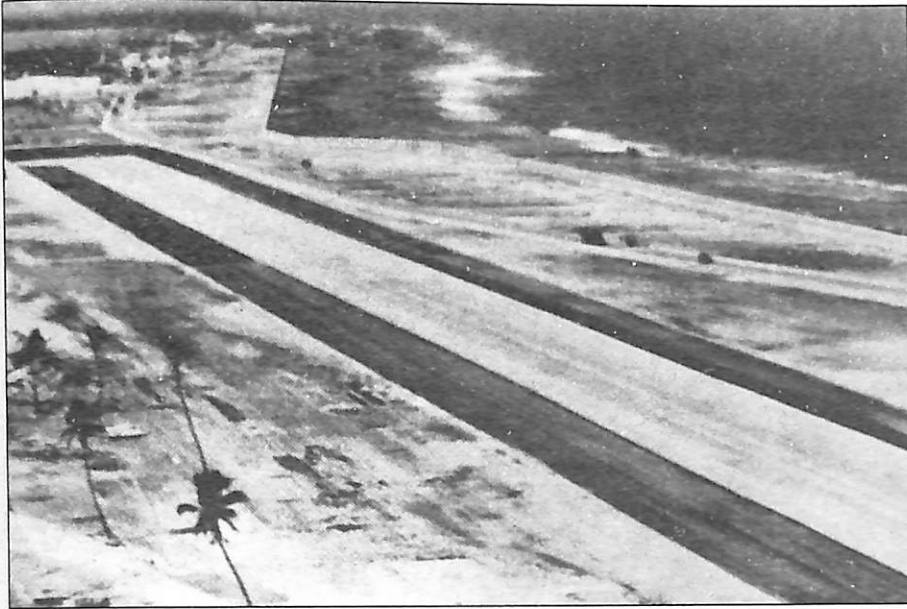
People seem to be becoming more aware of the medical risks involved in working on Moruroa and Fangataufa. That's why more and more Polynesians refuse to go back.

After working in the waste teams for five years I started working at the incinerator, from 7am to 5pm every day. We burnt almost everything, even the red plastic bags containing radioactive material. This was mainly contaminated clothing and shoes that the workers had worn while working with radioactive materials. There were a lot of fumes and at one stage I became so ill with headaches all the time and pains in my chest that I was sent to Jean Prince, the military hospital in Tahiti. They even wanted to send me to France but I didn't want to go. After a while away from the incinerator I got better.

We weren't given instructions to take any special precautions for the incineration work. The ashes from contaminated materials were mixed with other ashes and thrown out into the waste dump and mixed with sand. They weren't even buried. They were just left there in a heap. I think there's a strong possibility that all this waste could be blown away with the next cyclone, though the walls that have been built to keep the water out may hold it back.



Anti-nuclear protest in Papeete



Airstrip and facilities at Moruroa, February 1966.

15

Radioactive material has already been spread over the atoll by a cyclone. There was a general alarm to let everyone know that a cyclone was coming and to warn us to stay inside. People came out of their houses when it was over and we saw that boats had been lifted on to the rocks and that all sorts of barrels were floating around. The waves had washed them out of the repository where they had been buried. It was hard work to retrieve them and store them away again, this time in the blockhouse. We were not told that they contained radioactive materials.

I know of another accident that took place in the blockhouse. Some welding work was being done inside when a high tension cable got damaged and there was an explosion. One person died on the spot and some others died later. A lot of people were burnt. They were put into plastic oxygen tents and immediately flown back to France. A few Tahitians who were working outside were also injured but not as seriously. Afterwards, people from the CEA wearing protective clothing went inside the bunker to get the rest of the bodies and clean up. I never heard what happened to the people sent to France.

My job for the past three months has been to drive the workers from the living quarters to the work area which is about six kilometres away on the northern side of the atoll. About two kilometres further on from the work area, monthly checks are made for radioactive contamination because radioactive material is uncovered or washed ashore after every storm and nuclear explosion. Whenever they find any radioactive material it is put in special red plastic bags and taken to the blockhouse where it is checked again and then stored away.

From time to time, a French military plane arrives to collect the radioactive waste and take it to France... I don't know where. By the way, it's the same plane that brings the nuclear bombs from France, a DC8. The planes can carry five large containers as well as some legionnaires and their weapons. Inside the plane is lined entirely with plastic so that if anything spills, the plane stays clean. The material has to go by plane because all the boats at Moruroa are loaded by Polynesian dockers who refuse to work with radioactive materials. The dockers are brought to Moruroa especially to unload boats; they are not on the military payroll all the time.

At the moment, the workers that I have been driving to work are drilling

Details of a severe cyclone in March 1981 which swept radioactive garbage from Moruroa's north rim into the lagoon were made public by the Confédération Française Démocratique du Travail Union (CFDT), a French trade union representing technicians employed at Moruroa in October 1981. In 1981, a French official confirmed the story by stating that "some of the nuclear waste left by the atmospheric explosions made before 1975, may have crossed the lagoon to the eastern side of the atoll" (*PIM* October 1981). Previously, nuclear waste had not officially existed at Moruroa. The CFDT statement also said radioactive waste including metal scrap, wood, resin, plastic bags and clothes was stored in a huge heap on the north coast of the atoll, eventually covering 30,000 square metres. The Tazieff mission gave a figure of between 10 and 20 kilogrammes of plutonium lost in the lagoon as a result of the cyclone damage (*New Scientist* 14.7.83). French defence minister Charles Hernu subsequently agreed to improve measures to prevent such damage in future.

The French newspaper *Le Matin* (8.8.79) described such an accident, when in early July 1979 DIRCEN decided to decontaminate a concrete bunker used in detonation experiments. These experiments result in the release of unknown quantities of plutonium. Usually bunkers were sealed and abandoned after such experiments, but "for economy reasons" this bunker was to be used again. When a decontamination team entered the bunker, a spark was caused igniting the acetone gas still filling the chamber. The blast killed two workers, injured four others, and spewed radioactive fallout over the atoll.

Monitoring of radioactivity in the air, ground, rainwater and seawater at Moruroa is undertaken by the Service Mixte de Sécurité Radiologique (Joint Radiological Safety Unit or SMSR). The SMSR is composed of personnel from the Army and the CEA and is based at Menthéry, France, and at Moruroa.

Radioactive waste taken to France would presumably be stored at existing radwaste sites such as La Hague and Cadarache.

- 16 Following each underground test, radioactive samples are taken from the cavity to obtain a more accurate measure of the yield of the device. For this purpose, a second shaft is drilled down at an oblique angle to the cavity. A new technique called COSMOS (Colonne Oscillante Support de Mat de Forage "Off Shore") was developed in 1983 to perform this drilling when tests are conducted under the lagoon. (FNT p10). The Atkinson Report (p100-101) describes sub-surface sampling by the French to establish predictive models of the permeability of the atoll.

Tila (right) is an off-shore drilling platform, similar to those used for oil drilling. In October 1986, a new barge entered service for both drilling shafts and post-test sampling use (FNT p10). The new barge meant all tests could be conducted in the "zone centrale" of the lagoon.

holes in order to gauge the extent of damage to the atoll from previous bomb explosions. This is done all over the atoll and even on the reef.

The holes for future bomb tests are being drilled in the lagoon. For this, the French have a large boat, called Tila. But now Supertila has been brought out. It's newer, bigger and more powerful so it can dig deeper holes in the lagoon.



Ruta's suspicions of a move to testing at Fangataufa were later confirmed when in March 1988 Vice Admiral Pierre Thireaut, the Commander-in-Chief of the French Navy in the Pacific, revealed that in future the most powerful blasts would be conducted at Fangataufa. Cousteau's report (p50) concluded: "The premature and accelerated ageing of the atoll [Moruroa] explains, certainly, in great part, the imminent transfer of high-yield nuclear tests to the atoll of Fangataufa..." The lagoon at Fangataufa was totally enclosed until the French blasted a 400 metre gap through the reef in 1964-1966. The Tazieff report stated that "a careful inventory should be made of the effects caused by the opening up of the atoll of Fangataufa with a pass before any reactivation of this test site". If this was done, it has never been made public. The last test of 1988, with a yield of 100 kt, was made at Fangataufa. The two largest-yield tests of 1989 (70kt and 90kt) were also made at Fangataufa, while the lower yield tests (under 30kt) were made at Moruroa.

Fangataufa was heavily contaminated in 1968 by France's first thermo-nuclear explosion, the three tonne, 2.5 megaton yield device code named CANOPUS. After this, Fangataufa is said to have been so heavily contaminated that it was declared off-limits to humans for the next six years. (FNT p28). Wild vegetation tends to be more efficient at concentrating radioactive material than domestic crops, and contamination is also more concentrated in nuts and fruits. The degree to which caesium is able to get into plants depends very much on the nature of the soil. On a clay or loamy soil, it tends to be locked away in the soil structure and is less available for absorption by plants. But where the soils are lacking in minerals (for example in the sandy non-absorbent soils of coral atolls), caesium remains far more available and higher contamination of plants can be expected. (Health Guide p107, 109-110.) In figures for 1988 released in 1990 by the SMCB, it was noted that coconuts accounted for more than 50 percent of the ingested radiation dose for inhabitants on the atolls of Reao, Makemo and Tureia. The "big machine" referred to is likely to be the "spectro", described by other interviewees. The medical services of the armed forces and the Atomic Energy Commission are responsible for monitoring all personnel working on the firing ranges. (FNT p21).

On Moruroa, the holes are quite close to the entrance now... they will probably have to continue on the atoll again soon because of the lack of space. Although there are a few holes ready at Moruroa, I am sure that they are going to test at Fangataufa next. For quite a while now the French have been working on extending and deepening the pass into the lagoon at Fangataufa, blasting the coral away with dynamite. They want Tila and maybe Supertila to be able to enter the lagoon. This will mean they can drill holes in the lagoon there and explode bombs. They had to broaden the entrance to allow Supertila to enter the lagoon there.

Fangataufa is still heavily contaminated. Nobody is allowed to stay there for long. In 1976, I was told by my boss to take coconuts to Fangataufa to plant, as everything had been destroyed in the previous tests. We planted 200 coconuts but they never grew. There are now only a few pine trees that were planted years ago.

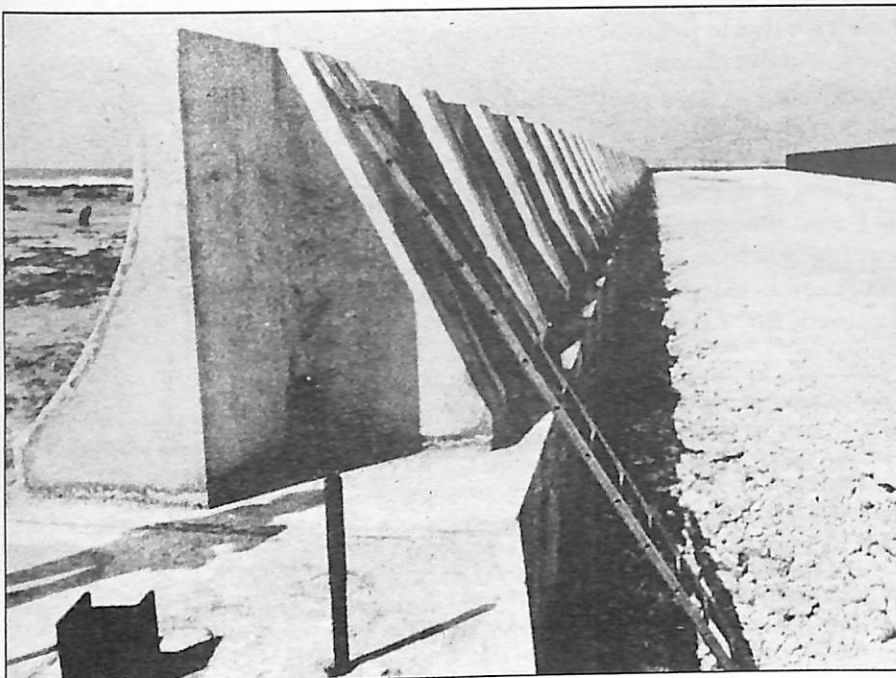
In 1982 I was sent back to Fangataufa for a month. Polynesian workers were sent there in rotating shifts. We were called back after a month because Fangataufa is much more contaminated than Moruroa. When we returned we all had to go into a big machine to be checked for contamination.

Moruroa is less contaminated. There have been a lot of holes drilled all over the atoll. After they have been used, they are filled up with concrete. This has left scars and a number of fissures. One fissure that can be seen from the airport is two kilometres long and a few centimetres wide. The military have filled up the deeper places. The French told the workers that the tar-sealed road had been split open by heat but we don't believe them.

Entry to a lot of areas is prohibited although the road that runs through them is in use. It is prohibited to leave the road. If you do and are seen by the police, you will lose your job and get sent back to Tahiti immediately.

In heavily contaminated areas everything has been burnt and now there is only one kind of bush growing there, called mikimiki. We planted several coconut trees but they haven't grown well and don't bear coconuts. In the areas where the coconut trees have survived, the coconuts are constantly cut down. This is supposedly for safety reasons – so they don't fall and hit someone on the head. I've never seen it happen in the 12 years that I've worked there and they don't cut them down in other places. An officer told me that I would become ill if I ate a coconut but I tried anyway and immediately got diarrhoea. That never happens in Tahiti.

Nowadays, it is impossible to see the sea from the village. There is a protective wall about 13 kilometres long running along the ocean side to prevent flooding. A two kilometre long wall has even been built along the lagoon shoreline. On one occasion, the wall collapsed in a storm and the whole village was swamped with salt water. The road was damaged and the high tension wires were floating in the water. It was a difficult moment. Twenty years ago these problems didn't exist, but now the island is constantly sinking and the sea level keeps rising. The old road that leads to the airport is now submerged and a new one has had to be built two metres higher. Most of the underground tests have taken place on the northern part of the atoll, so this area has sunk more than the southern part. It is for this reason that a second big airstrip was built on the southern part of the atoll.



Fissures were reported by both the Atkinson and Cousteau missions. *The Guardian*, September 1981, reports a fissure 15-19 inches wide and over half a mile long. Reuters puts the crack at 2,600 feet long and 1-2 feet wide. The official French position is that fissures have occurred, but that they are a natural process, superficial and confined only to the outer coral lawyers. *The Atkinson Report* (p93) said claims that fissures up to 8km long and 3.5 m wide existed could not be borne out, but noted that: "...the substantial modification of the atoll surface for constructional purposes might make such cracks difficult to identify." Cousteau reported intensive underwater fissuring of the atoll's coral and volcanic platform.

The Atkinson Report (p95) notes: "The north-eastern margin [of the atoll] in 1968 is described as being high. During the flight over the atoll in October 1983 it was observed that much of the northern margin between "Francoise" and "Camelia" is now low and submerged, indicating a submergence of this northern margin of approximately 1 m, or even slightly more..." The report continues "Between "Iris" and "Eider" features such as high islands (+3 m), eroded parts of the reef plate, exposed niggerheads on the outer platform, testify to the relatively high nature of parts of [the southern] margin relative to sea level. During the flight around the atoll, two observations were made which are pertinent. First, in the region approximately between "Irene" and "Yvonne", many of the above-mentioned features had disappeared... Secondly, the road appeared to have been rebuilt and elevated in places, but was awash in other places... There appears little doubt that much of the south-west margin between "Irene" and "Yvonne" has experienced subsidence, probably of the order of 1 m and affecting an area greater than 1.5 km."

The seawall erected in 1981 to protect Moruroa against tidal waves caused by underground tests and cyclone damage.

- 18 The King of Tonga, the politically conservative King Taufa'ahau Tupou IV was invited to Moruroa by the French in July 1987. The Finance Minister of Western Samoa at that time, Tagaloa Pita, and other Tongan and Samoan officials joined the King on a tour of the atoll.

Eating fish at Moruroa was banned in June 1966, after the first test. In a 1971 interview in *La Depeche*, the head of the French Service Mixte de Controle Biologique (SMCB) said that massive destruction at point zero and the dispersal of various fission products had led to secondary contaminations, following which the eating of fish was prohibited. In August 1968, scientists at the University of Baja, California, blamed French tests for high degrees of radioactivity detected in fish caught along the Baja Peninsula (Mexico). The majority of fish poisoning cases reported in French Polynesia are from ciguatera. Ciguatera fish poisoning is caused by eating tropical fish that have fed on a particular algae which grows on damaged or dead coral. The dinoflagellate organism, *Gambierdiscus toxicus*, which causes ciguatera, is named after the Gambier Islands where there was a serious ciguatera outbreak in 1968. Ciguatera outbreaks are linked to natural ecological disturbances such as storms, earthquakes and tidal waves, and to human activities such as construction work, explosions and dredging.

Severe outbreaks of ciguatera have followed military activity and nuclear testing in the Marshall Islands. For the period 1973-87 rates of ciguatera were more than three times the South Pacific average in French Polynesia and the Marshall Islands. After the French military began conversion of the Hao atoll in the Tuamotu group for use as a staging base for Moruroa and Fangataufa, an out-break of ciguatera occurred. By mid-1968, 43 percent of the population of Hao had been affected by ciguatera. Moruroa has had a high incidence of ciguatera over

I was there when the French invited the King of Tonga to visit Moruroa. They never showed him the contaminated areas, only a drilling site which of course wasn't contaminated. He wasn't shown the places where I and others went to pick up dead fish a few days after an underground test... It would be embarrassing for the French to contaminate the King of Tonga. After he arrived at the airport he was driven to the living area in a fancy car brought in for that purpose. Then they took him by helicopter to Fangataufa. On the way back they landed on Tila, the drilling boat, and he was shown around. But the king didn't really know what was going on and knew nothing about radiation. Some people have been there for more than ten years. The King was there for twenty minutes.

It's still forbidden to fish at Moruroa, but you can't stop Polynesians eating fish. Of course, we all knew that it was dangerous to eat fish but the food we got from the military was bad. The fish was old and we always got potatoes. So most of us ate local fish when we were on Moruroa and Fangataufa. And most of us got sick. I remember a group of ten people on Fangataufa who ate fish. They all got seriously ill and had to be evacuated to Tahiti for treatment.

People died from eating contaminated fish. One of my friends ate a crab and became ill. His skin started to itch and he scratched himself so much that he started to bleed but he couldn't stop scratching. Then he got problems with his eyesight and soon afterwards he died.

I know of four people who have died from eating poisoned fish, and many others who have had symptoms of fish poisoning. When people die on Moruroa they are put in metal coffins and the seams are welded so that nobody can open them any more.

Even now, in the last three months that I was there, there were people who got ciguatera. An ocean-going fishing boat was brought to Moruroa so that the Tahitians could get fresh fish from outside the lagoon. But it's the French who eat those fish now, so we continue to fish in the lagoon.

My uncle has been working on Moruroa for about 15 years. He can't have kids. He had his sperm analysed and the doctor told him that he was sterile. I think it was due to radioactive contamination.

I've had five children. The youngest was born with a kidney missing and no anus. He had to have an artificial intestinal opening made in the wall of his stomach. Hopefully, in a few months time, this artificial opening can be closed and a normal one reconstructed.

I know, of course, that there are a lot of bad things happening on Moruroa but I need the money. There is a lot of unemployment in Tahiti and I have a large family to look after. Before each test everybody was warned not to tell our friends and family about it. If the French find out that I've been talking, I'll be dismissed. But I don't care. I think it is important to tell people what is happening.

the past two decades, during which time there has been extensive coral damage caused by the building of military infrastructure and the nuclear test explosions themselves. The only reported study of whether radioactivity is related to ciguatera was conducted 30 years ago by the US Atomic Energy Commission; no correlation was found, but the link deserves further study. Ciguatera symptoms include acute vomiting, diarrhoea and stomach pain, accompanied by sensory and/or motor disturbances including paralysis and joint pain. Weakness may necessitate ventilatory support. Abnormally slow heart beats, depression of the heart muscle and collapse of nerves controlling the blood vessels may occur. Ciguatera during pregnancy may result in abortion, premature labour and neurological disease in the newborn, and the disease may be transmitted by breast-feeding. Ciguatera is occasionally fatal, but more commonly it runs for weeks, months, or years, with constitutional symptoms, diffuse tingling pain, hot and cold flushes etc. Subsequent attacks tend to be more severe than first attacks, and symptoms may recur with ingestion of non-toxic fish, alcohol and other foods, or with illness. Such "sensitisation" may persist for years after an attack of ciguatera. (Ruff p3,5,22)

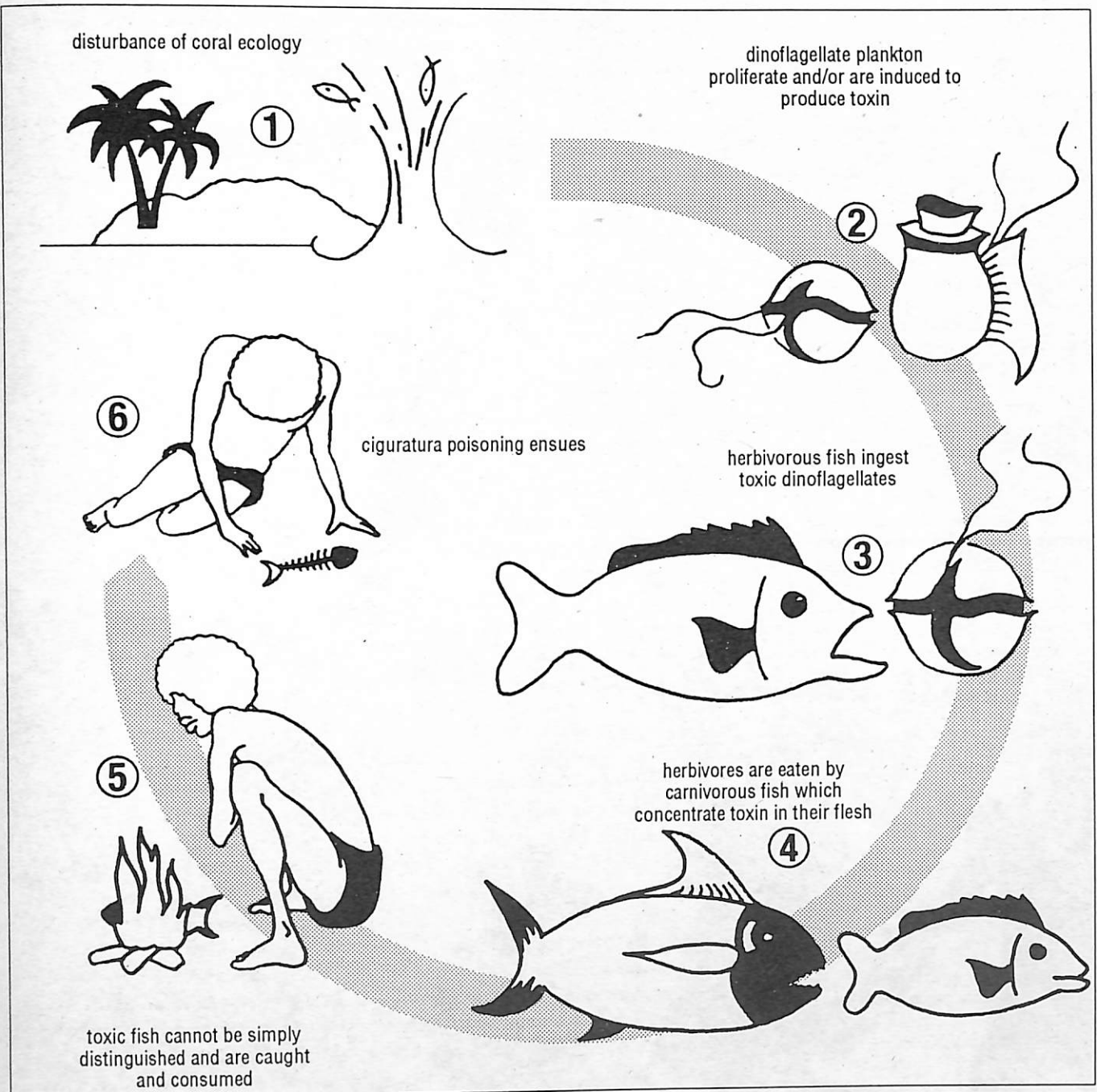
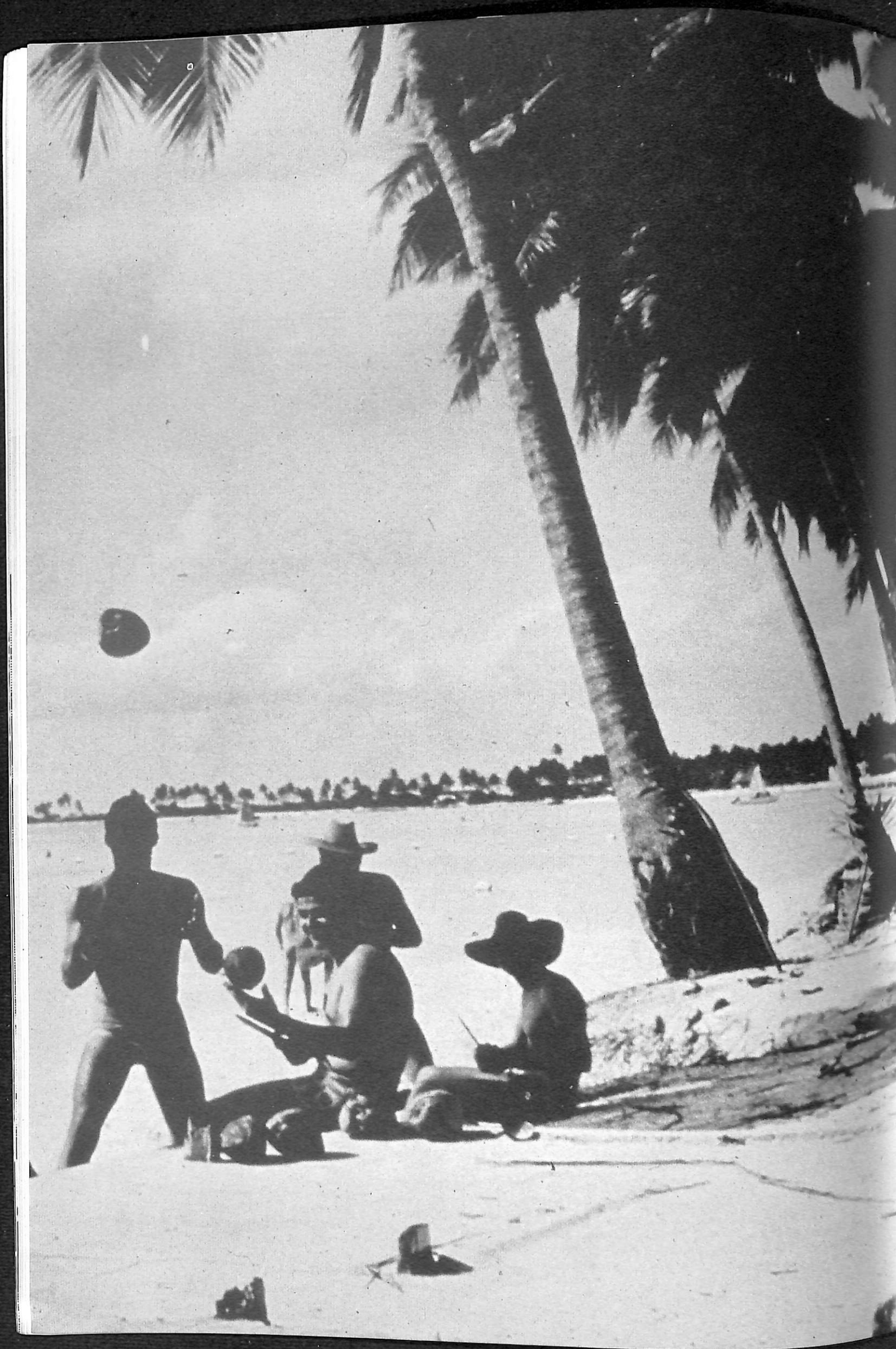


Diagram of the ciguatera cycle

The long-term effects of exposure to radiation include increased incidence of sterility, cancer, cataracts, miscarriage and still births and genetic defects in children such as abnormal body parts, lack of eye development, tumours of the thyroid, leukaemia, slow mental development and small head size.

The unemployment rate in French Polynesia is 15 percent, made up largely of young Tahitians, particularly those arrived recently from the outer islands. Tahiti is estimated to need 2,300 new jobs annually to meet demand but can only expect 1,000 at most. The CEP now provides 12.5 percent of local jobs, 55 percent of all the territory's external financial aid and accounts for 22 percent of GDP. Half the population of 190,000 is under 20, and many live in insanitary slums around Papeete and Faa'a. This is in spite of the fact that Tahiti is touted as having one of the region's highest per capita incomes. (*PIM* June 1990 p8-12).



'All the alarms went off'

21

Manutahi started work as a welder on Moruroa in 1965 at the age of 32. That was before the tests had started. He worked on the construction of the blockhouses "Dindon" and "Denise".

"We worked day and night. There were a lot of Tahitians working there and funnily enough, a lot of Portuguese too.

In 1965, there was an accident in one of the blockhouses which I think was caused by dynamite. Three people died: the foreman, a man from Paea and another guy from one of the outer islands. More or less at that time I was sent to work on Fangataufa.

The construction of the blockhouse was almost completed but I was involved in building the canal from the blockhouse to the lagoon. This is where the cables which ran from the blockhouse to the bomb were laid. At that time the bombs were exploded hanging from a balloon over the lagoon.

In 1966, when the blockhouses had been constructed, everyone was moved to Hao. We took most of the building material with us. None of the Polynesians went back to Moruroa until seven months later after the first atmospheric test had been exploded. From Hao we couldn't see or hear anything because it's too far away.¹

In February 1967, we returned to Moruroa. The areas around Dindon and Denise, where the bombs had been tested were totally burnt, almost grilled. They were now prohibited zones, off limits to the workers. All the coconut trees and other vegetation in the area had completely vanished.

In 1965 and at the beginning of 1966, we were allowed to eat all the fish in the lagoon but when we returned in 1967, we were forbidden to eat any.

In 1965, I worked mainly on Fangataufa where we were building a new blockhouse called 'Emperor'. It was on Fangataufa that I saw the areas of worst contamination when I went with the guys checking the atoll with geiger counters. When there was contamination the light would go on and the indicator started to move. In one area the indicator went very high. It was forbidden to touch anything and there were barriers to prevent people from entering the area. The area where I worked was right next to this contaminated zone and it and the living quarters had been decontaminated. This meant the whole area had been tarsealed as it was not possible to actually get rid of the contamination. One area of tarseal was about 4,000 square metres. In spite of the 'decontamination' we still had to wear gloves and special boots all the time and when we dug holes we got into the contaminated ground anyway. I'm sure that working so close to the heavily contaminated zone we would have inhaled a lot of radioactive dust which was carried over the area by the wind.

Sometimes we had to work in the contaminated zones. We weren't forced to do so but we got extra money if we did. Another incentive was the shorter working hours as you could only work there for two hours at a time in the morning and then again in the afternoon. This was because of the radiation danger and also because of the difficulty of working in a full protective suit in the hot sun. A special list was made of those who did volunteer to work there so that they would be looked after if, in the future, they should become unemployed. The main problem was inhaling the radioactive particles. We were

In 1965, plans were being formulated to import labourers from Portugal because Tahitians were deserting farming and plantation work for wage employment with the nuclear testing facilities.

This incident could have been confused with an accident which occurred in 1979 and resulted in two deaths. If it did occur in 1965, it was before France's first nuclear test at Moruroa, which took place in July 1966.

At the end of 1966 there were three large blasts of 120, 150 and 300 kilotons, which used plutonium and thermonuclear material. By comparison, the bomb dropped on Hiroshima was just 12 kilotons. After the 1968 CANOPUS blast, France's first true thermonuclear explosion, Fangataufa was said to have been so heavily contaminated that it was off-limits for six years. After a similar blast at Moruroa, there was no testing during the following year, 1969. (FNT p28)

¹ La Base Interarmées de Hao (BIA) at Hao Atoll served as a rear base for Moruroa. It is located 410 kilometres north-west of Moruroa. Facilities on Hao included an army camp for 2,000 soldiers, a large airfield with a 3,500 metre runway, piers etc. It is the largest military base in the South Pacific. Construction work began in 1963.

(Opposite) Workers sunbathe at Moruroa

The living quarters were at "Fregate". Both Fangataufa and Moruroa have wharfs and airstrips built by the military.

Earlier atmospheric tests in Algeria were exploded from towers of approximately 100 metres high. At Moruroa and Fangataufa they had previously been detonated from either a barge, a balloon or a Mirage aircraft.

Other sources put drilling time for a 700 metre shaft at 4-6 weeks. (FNT p10)

In a Japanese survey of ciguatera toxin distribution in French Polynesia in 1981-2, the highest densities were found in samples from the Gambiers and from Moruroa. In a letter to the Territorial Assembly on 9 October 1963, General Thiry, the man responsible for choosing the Moruroa test site, wrote: "If the islanders frequently eat contaminated fish there is a risk that after a few years the number of cases of leukaemia and cancer will increase. That is why the fish will be kept under observation in the areas where radioactive fallout is likely to occur so as to prevent the inhabitants from eating contaminated seafood." Francis Perrin of the CEA wrote to Tahitian politician Teariki that he envisaged "temporary prohibitions against the eating of certain species of seafood". (*Poisoned Reign* p171)

told that there was no danger if we followed the rules.

As a welder, my work was to cut away what had been destroyed in previous blasts and repair or replace them. After two hours work, we went into a decontamination chamber where machines checked whether we had been contaminated. If there was contamination, the alarm light would come on, a bell would ring and the indicator would say how bad it was.

Work on Fangataufa was slow because the living quarters, the docks and the airport were three to four kilometres from where Emperor was being built and as the land was so heavily contaminated we had to travel from one area to another by boat.

In 1968, I returned to Tahiti to work for a few years but I returned to Moruroa in 1971. That is when I first saw a nuclear test. Previously, in 1966 and 1967, the workers had been sent to Hao while the tests were in progress but in 1971 we were put on a ship which hove-to off Moruroa. We were quite far away, but it was close enough to see the mushroom clouds. We were allowed to stay on deck to watch them and I remember seeing three of them. The tests would usually take place in the morning and the ship would stay at sea for 24 hours and then return to Moruroa. We were told that the village was never contaminated but there were a lot of other areas that were sealed off.

They asked me to come back to Moruroa in 1971 to work on a huge metal tower that was being constructed in the lagoon near Dindon. They had changed their policy and wanted to explode the bombs from the top of the tower instead of from balloons.

However in 1972, all work on the tower stopped and they started to drill holes for underground testing. In the beginning it took us about 18 months to drill a single shaft about 700 metres deep.

It was during this drilling work that I got contaminated. I was working in a little hole trying to dismantle an old pipe. I wasn't careful enough and got splashed by some water that had been left in the hole. It was mainly my hair that got wet as I wasn't wearing any protective gear on my head. I tried to wash it but it was difficult to get the stuff out. When I went into the decontamination chamber all the alarms went off. I washed my hair three times but it was still radioactive... So a specialist had to use some special product to decontaminate me.

I returned to Moruroa again in 1977 and worked there until 1980. During that time I got a pulmonary disease, probably due to gases that I inhaled while doing some welding. I was evacuated to Jean Prince, the military hospital in Tahiti. They treated me really well there and I think that they must be some of the best doctors you could have. It's certainly better there than at Mamo but that's not surprising as the admiral and the other high-brows get treated there so they would make sure that they had first class doctors.

I know of quite a number of people who have got sick working at Moruroa and Fangataufa but I don't know what was wrong with them. I think that a lot of them had been poisoned from eating contaminated fish. I had regular medical checks all the time I was working for the military. They took samples of blood, faeces and urine and I was checked in the spectro machine.

'He was scarcely recognisable as a human being'

Tehiura was 65 years old at the time of the interview. He worked as a docker at Moruroa from 1963 until 1968.

23

"I didn't stay very long because I didn't like the life there. Eating coconuts and fishing was forbidden, many parts of the atoll were closed off and people talked about the possible dangers from radioactivity. At that time, we had to return to work almost immediately after the explosions and had to work very close to contaminated zones. We weren't given any masks or protective clothing and I was never given a badge for measuring the radiation, although other people were. I think it was mainly those in more superior positions who got protective gear.

I remember an incident that really disturbed me. One day, a friend of mine, Basinas, ate scarcely any lunch because he was sick of the boring metropolitan food. After lunch, he went and got some shellfish to eat and then, only a few hours later, he started to feel sick. He vomited and had diarrhoea and then his body started to itch all over. He scratched himself so much that he had sores all over his body. He went to hospital where he stayed for a while. Normally patients were not allowed visitors but I stole in to visit Basinas. What I saw was no longer recognisable as a human being. Basinas could not talk and his whole body was black and suppurating. He had pains in his joints and he was still scratching and pulling his skin off. Usually, patients who arrived at the hospital sick from eating fish, got sent straight to Tahiti and dismissed but it was probably not possible with Basinas because he was so sick. Later, he vanished from the hospital. We thought that he had been sent to Tahiti but we heard later that he had died. The doctors never gave any explanation.

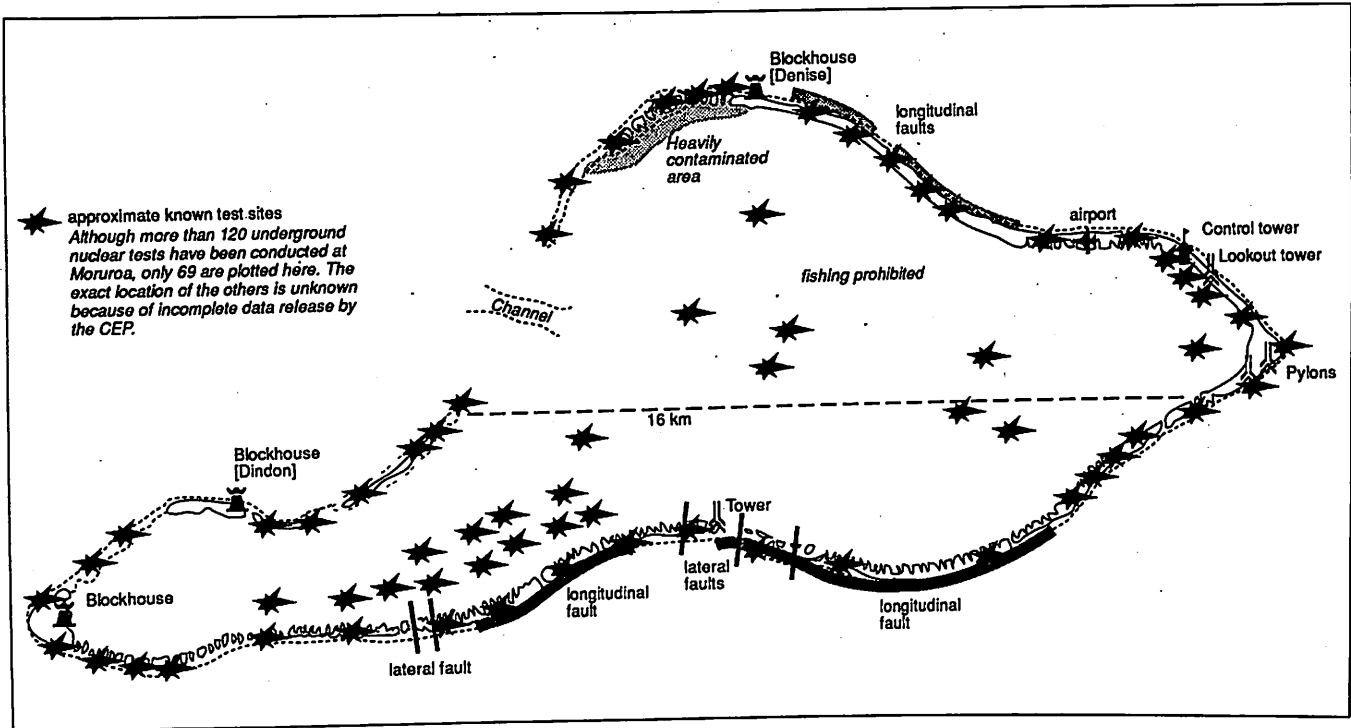
I know of other people with similar problems who have vanished.

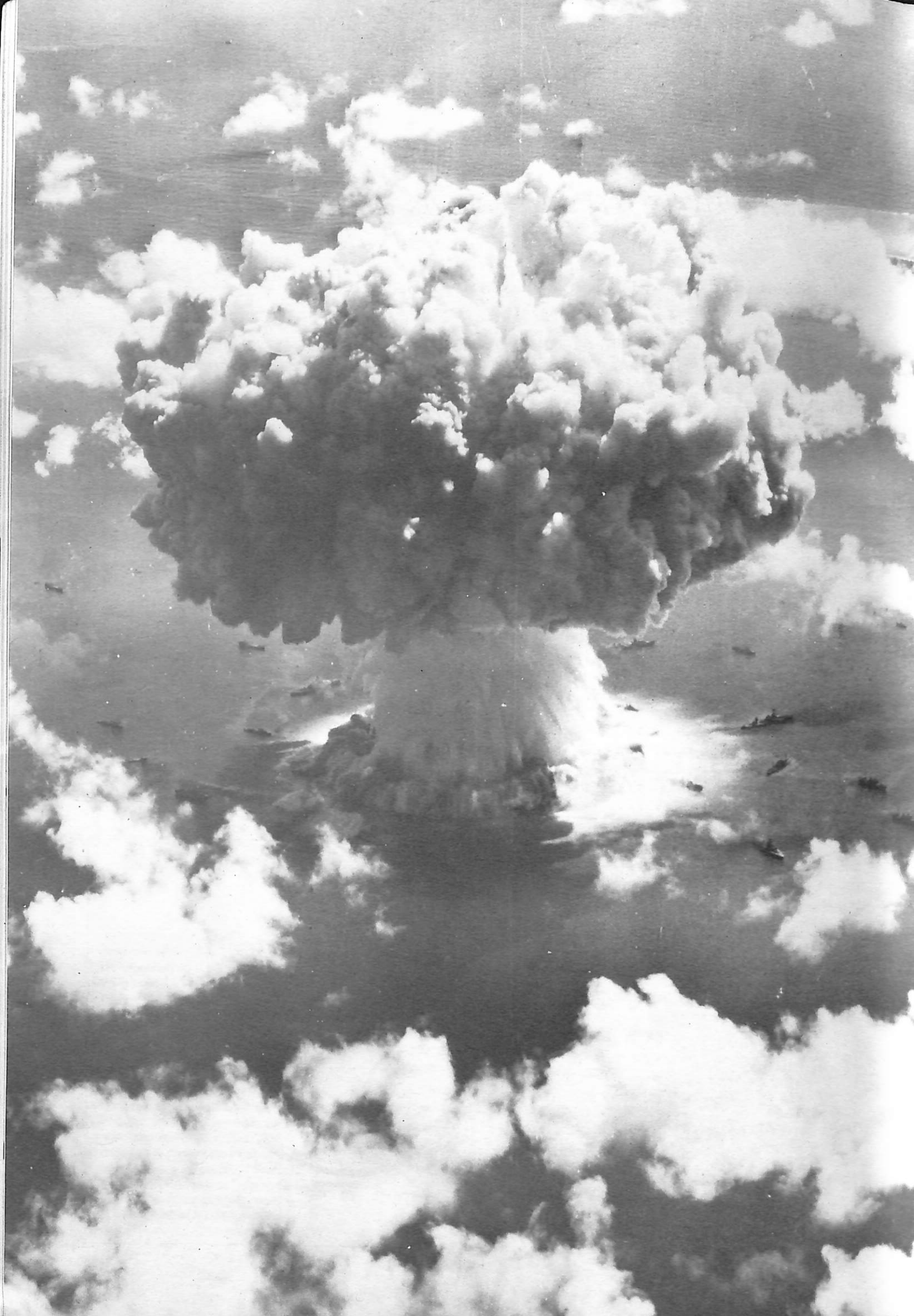
I'm glad that I left Moruroa... I hope that I haven't been exposed to too much radiation. I have five children and they are all healthy so I think I've been lucky.

French authorities claim the medical services of the armed forces and CEA monitor all personnel working on the firing ranges (Moruroa and Fangataufa). However, as late as October 1981, workers at Moruroa were expressing concern about the lack of systematic monitoring. On October 19, the CEA branch of the CFDT trade union distributed a leaflet which demanded systematic X-rays and better medical care for the personnel on Moruroa. (Chronology p32)

The symptoms described here could fit ciguatera poisoning.

Map of Moruroa Atoll, showing location of underground test-sites, contaminated zones, and faults caused by the tests.





'My skin peeled like a snake'

Tama began working at Moruroa in the 1960s as an office worker.

"Bombs were still being exploded in the atmosphere then, and workers were evacuated just before the tests. Even though we returned to the atoll only four to seven days later, no one wore protective clothing except in the prohibited zones.

After five years of office work, I was sent back to work at the LSR (Laboratoire de Surveillance Radiologique) in Papeete which monitors fish, coral, taro, sweet potato and so on for radioactive contamination. At that time there were a few Tahitians working there but now it's exclusively whites and there is barbed wire around it.

Two years later, I returned to Moruroa to do administrative work for about four months before working as a decontaminator. By that time the French had changed from atmospheric to underground testing. There was a lot of drilling work going on both before and after each test and a lot of the drilling equipment got contaminated and had to be cleaned after use. This was done in a huge pool filled with a special substance called Pascodine 120. The instruments were left submerged for several hours and then taken out, hosed down and rinsed with water. In the end all the cleaning products were washed into the lagoon.

We were issued with gloves to wear for this work but no other protective clothing was provided – although sometimes we wore masks. We all had to carry a batch of film and a special pencil to measure the dose of radiation we were exposed to. People were only allowed to work there for six months and then we were allocated other jobs. I volunteered for this work because I was an active union member and I wanted to find out what was going on there and whether things ought to be changed.

Ever since underground testing began, the atoll has been sinking. In some places, the land and the coral have completely disappeared into the sea. The road has to be raised about every three months and it is now about two metres above the original ground level. It is still possible to see the old roadway down under the water in some places. This subsidence of the atoll is the reason why huge amounts of cement have to be brought in from France and New Zealand. Because of the sinking at Moruroa, there were rumours in 1977 that the French might move the tests to the Kerguelen Islands.

It was also about 1977 that the biggest bomb blast I ever experienced took place. It was codenamed Astyanax and the test site was about 27 kilometres from the village in the Viviane test area. There was such an earthquake that no one could stay upright. At the same time, on the opposite side of the atoll beyond the airport a three kilometre-long fissure opened up. As a result of further tests, it gradually extended to seven kilometres. The deep end is submerged under water and cannot be seen. This fissure has not been shown to journalists – all they ever get to see is the airport and village.

I have also experienced fish poisoning. After the atmospheric testing finished people were allowed to eat fish caught from the ocean side of the atoll again but the lagoon fish were still considered unsafe. I got sick from eating fish several times. I was itchy all over and my skin peeled just like a snake. One of my friends was less fortunate – he died after eating fish and mussels from the sea.

I left my job at Moruroa even though I earned as much as a member of the Territorial Assembly and got free flights home every weekend because of a

This is likely to be the Mahina laboratory of the Service Mixte de Contrôle Biologique, which is responsible for radiological surveillance and safeguards for animals, foodstuffs and drinking water.

Pascodine 120 is likely to be a strong scouring agent or detergent which "fixes" radioactive particles in water.

The Atkinson report details subsidence in several parts of the atoll. The French have considered several other locations for nuclear tests, including Kerguelen Island in the southern Indian Ocean, mainland France and the US Nevada test site. However, the Kerguelens were ruled out by Defence Minister Charles Hernu in 1984 because of hostile climate and difficult access by air and sea. France currently maintains a scientific and meteorological station at Kerguelen, an archipelago comprised of some 300 islands. Australian scientists identified several sites in France suitable for testing, including areas of the Massif Central and Corsica, but they are unlikely to be taken up.

See map for location of Viviane area. A test codenamed NESTOR on 24 November 1977 with a yield of 55 kt, caused a submarine slide and resultant tidal wave. The code-name of most tests is unknown, so it is impossible to discover the yield of the ASTANYX test without knowing a precise date.

(Opposite) Event Baker: US test at Bikini Atoll 1946.

- 26 According to a report in *Le Matin*, 8 August 1979 (*Poisoned Reign* p264) this accident was the result of an explosion during a detonation experiment. These experiments are carried out in concrete bunkers on the surface of the atoll and result each time in the release of unknown quantities of plutonium. Their purpose is presumably to study the implosion of the chemical high explosive which surrounds the nuclear fissile material. The bunkers were normally sealed and abandoned after each test. However in July 1979 DIRCEN decided to re-use a chamber 'for economy reasons'. 'Decontaminators' working on the bunker caused a spark which ignited the acetone gas still filling the chamber.

terrible accident I saw. The first French neutron bomb test - codenamed Meknes - was supposed to take place on 7 July 1979. A big bunker had been built just for this test. Inside the bunker was a container in which the bomb lay. Above the bunker itself was a control room which was connected to it with a thick double-glazed window. Before entering the main room, you had to go into a room where you put on an "astronaut" suit. You had to go through a system of several automatic doors before entering the room containing the bomb. There were only two workers inside the bunker at a time and they only worked there for two hours at a time. All in all there was a team of 17 people.

7 July wasn't far off, but work had been delayed for several reasons. The superiors were angry and put a lot of pressure on us to speed things up so that the bomb would go off on schedule.

On 6 July the accident happened.

I had just finished tea. I had been replaced in the control room by one of my mates. While I was walking back up the steps to the control room - I was about halfway up - the explosion occurred. My colleague was flung out of the control room just in front of me - dead instantly. Another "astronaut" - my boss, Rene Villette - was killed inside the bunker. The other "astronaut" had just been on his way out and was severely burnt. He was evacuated to France and died soon afterwards.

Another man who had been in the changing room getting dressed was also seriously injured. He was also sent to France and died a little later. The three other people on the site, myself included, were taken to hospital although none of us were hurt in the accident. All the survivors were thoroughly examined. We had to go into a big machine which measured the degree of radioactive contamination. Every day my urine, saliva and stools were tested.

After the explosion, people with special protective gear had to enter the bunker and pour cement over the whole container. They were only allowed to stay in there for a short time as the whole place was full of plutonium and other radioactive substances. Rene Villette's remains - or what were thought to be his remains - were found three days later and sent to France in the form of a concrete block.

I asked for an immediate discharge but while my French workmates were sent home after two weeks, I had to stay on for another two months. I think it was because I was a union member and the military didn't want me to go back to Tahiti and tell people there what had happened - especially as anti-nuclear feeling was growing there.

When I was finally allowed to leave I got a compensation payment of 1,200,000 Pacific francs. Before leaving I had to check out at the Securité. I was warned not to talk to anyone about what had happened. There were no threats from the security people but other Frenchmen told me I should watch my step... they said there could easily be an accident...

I am still having six-monthly tests at the military hospital, where I am put into the big machine to measure radioactive contamination.

Olivier

Olivier is in his early 30s. He started working on Moruroa in 1981 as an office clerk and has since been doing computer work. Through his work he is well-informed about the activities on the testing sites.

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"Right now we are drilling on Moruroa and on Fangataufa. The holes in the lagoon are usually between 500 and 800 metres deep, very rarely deeper. There are usually two series of tests per year with four to six explosions each.¹

People live on Moruroa but nobody lives on Fangataufa, probably because it is too contaminated. On Moruroa we live in small units we call 'shelters' which accommodate two people. They're about the size of a station wagon. Every year living conditions improve a little because the number of workers decreases.

Eating fish is prohibited. I've had ciguatera three times and in 1977, when I was there with the navy, I got sick after eating a coconut. Now it is impossible to get them to eat as they are cut down by a special crew while they are still green. This is supposed to be for safety reasons, but it isn't done anywhere else.

I work there because I need the money to build a house. There is a lot of unemployment in Tahiti and I had to wait two years even for the job on Moruroa. The working conditions are not very good and I earn as much money for my 56 hour week as a friend earns for a 39 hour week doing the same job in Tahiti. I can only visit Tahiti every two months. It used to be every six weeks. It causes a lot of problems in personal relationships. My pregnant girlfriend left me and is now living with another man who works in Tahiti. I know of a lot of other people with similar problems. I'd say more than half the relationships of people working at Moruroa and Fangataufa break up like mine has done.

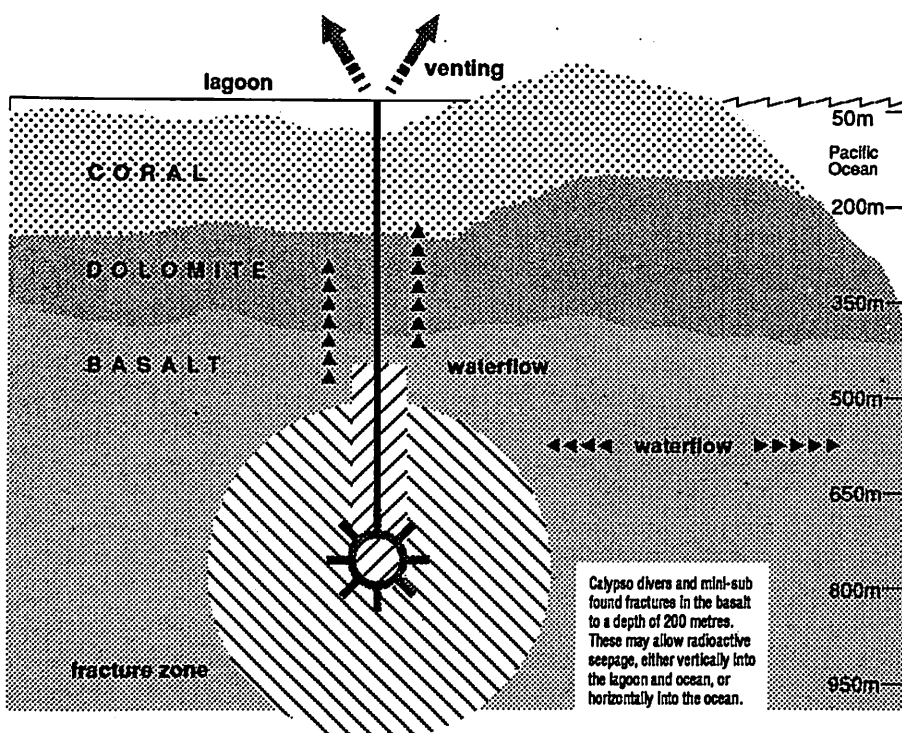
On top of that there are the health risks. The workers have annual medical checks which include a check-up by the spectro machine but my best friend who works on Moruroa has had a lot of health problems. He has one healthy child but his wife has had three miscarriages.

With the move to underground testing and a reduction in the number of tests and associated construction and drilling, numbers of workers at Moruroa have fallen from around 10,000 at the peak of activity to 2,000 in 1989.

The minimum monthly wage in Tahiti (February 1990) was set at 80,233 French Pacific Francs (US \$700), a rise of two percent reflecting a two percent per month rise in the cost of living index. The unemployment rate is 15 percent.

The Gardner Report, a recent investigation into the health risks posed by the British Nuclear Fuels plant at Sellafield in Cumbria, showed links between parental exposure to low-level radiation and an increased incidence of radiation-linked illness in children. Increased chromosome damage and gene mutations in an embryo are like to result in spontaneous abortion.

Cross section of Moruroa test shaft.



¹ The number of tests per year was reduced to six in 1990. Previously, there were 8-13 tests a year, with half taking place between May and July and half between October and December. In 1988, the year following this interview, the first underground test on Fangataufa since 1975 took place. Underground tests at Moruroa have been conducted at the bottom of shafts drilled through both the outer rim of the atoll, and the lagoon, down to the basalt core of the atoll to a depth of 500-1,200 metres, depending upon the yield of the device. Because tests since 1981 have taken place in the centre of the lagoon, further from the outside wall of the atoll and where the basalt core is nearer the surface, they are not quite as deep, ranging between 500 and 700 metres. It takes 4-6 weeks to drill a 700 metre deep, two metre diameter testing shaft. (FNT p10)

'A psychosis of fear'

28



Oscar Temaru is in his mid-40s and is a customs officer. He was sent to Moruroa several times a year from 1964 to 1975 to check planes and boats. He was taken to the atoll by military plane and stayed for as long as it took to do the work (generally a few days at a time). On average, he spent about a month a year on Moruroa. He is now mayor of Faa'a, French Polynesia's most populous and first declared nuclear-free commune, and is leader of the pro-independence and anti-nuclear party Tavini Huiraatira, the Polynesian Liberation Front.

"In 1964, everybody wanted to go to Moruroa because the place was known for its beauty and the many fish and shellfish there. In our spare time we would go fishing and put whatever we caught into the freezer of one of the boats. Later, when the boat called at Tahiti we could collect it to eat with our families and give away to friends.

But in 1966 the first atmospheric test took place and more or less overnight the whole atoll was covered in signs banning swimming at the beaches and fishing on both the lagoon side and the ocean side of the atoll. From then on, we were searched when we arrived and when we departed, and during our stay we all had to wear badges which measured the amount of radiation that we were being exposed to.

News travels fast on the atoll because people haven't got a lot to do in their spare time. So they spend a lot of time talking to one another. Soon everyone knew of a few people who had had to go to hospital for treatment after eating fish caught there. As more and more people had to go to hospital, people started to wonder about the effects of these nuclear bombs.

On one of my visits to Moruroa, soon after one of the very big atmospheric tests, I noticed that all the leaves of the coconut trees had turned yellow as if the trees had died. It looked incredible. And then suddenly, new signs were put up which prohibited eating coconuts. Slowly a sort of psychosis of fear spread over the atoll. Some people were so sick that they had to be taken off the atoll and later people heard that some of them had died. That was in about 1969 or 1970.

New workers were constantly arriving. None of them were briefed about the possible dangers of eating fish, shellfish or coconuts. Only the signs warned people of the dangers. But of course they didn't take much notice of signs. It's very difficult for Tahitians to stop eating fish when it has been our daily diet for centuries. Fish has always been good food – why should it suddenly be bad? So people kept eating them in spite of the gendarmes who kept watch over the lagoon.

Then the first underground tests took place. Soon afterwards the first fissures showed up on the atoll. They were everywhere; on the road, beside the road and in the reef. Some of them were between 20 and 30 metres wide and near the lagoon... some were even larger. Quite often you could see the military trying to fill them up with sand and concrete, as if they were trying to hide them.

Surveillance of people arriving and departing from Moruroa became much more stringent. Cameras were prohibited. But there was never any official explanation given for what was going on.

When I saw how the atoll was being destroyed and became aware of the dangers of nuclear weapons I started to become active. Being the representative of the customs officers' union, I wrote a letter to the military head of

There were no nuclear tests in 1969, as two large thermonuclear tests codenamed CANOPUS and PROCYON detonated at the end of 1968 reportedly contaminated Moruroa and Fangataufa badly. They were blasts of 2.6 megaton and 1.2 megaton yields. However, there were also some large tests in 1970 in the one megaton range.

The Atkinson report (p93) noted that some cracks were difficult to identify because of "...substantial modification of the atoll surface for constructional purposes".

operations at Moruroa saying that customs officers refused to be sent to Moruroa any longer. I based this refusal on the health risks and I immediately got a favourable response. A new arrangement was worked out and customs officials no longer go to Moruroa.

I have never had any health check-ups by French medical authorities. I feel well. I have six children aged from three to fifteen years. My first child was lost at seven months, stillborn for no apparent reason. Another of my sons probably contracted meningitis at six months of age and has been partially paralysed ever since. Was he simply unlucky or had his body's defences been weakened by my exposure to radiation? I don't know.

The relationship between radiation and the immune system is not clear. A healthy immune system undoubtedly serves to keep infections at bay. A June 1989 report by Dr Rosalie Bertell to the US Congress on the health of Rongelap people exposed to radiation during US atmospheric testing said "reproductive loss is a continuing and serious problem for the Rongelap people." A survey carried out by Dr Brenda Caloyannis in January-February 1988 found 66 percent of women living on Rongelap during US tests experienced reproductive loss, along with 41 percent of women from a US Department of Energy control group who had not been on Rongelap during the tests but moved back subsequently.

On Bikini atoll in the Marshall Islands a US navy doctor examines a child after an atmospheric test. (April 1954)



'Shooting sheep from helicopters'

30

Hotel ships were used to house some of the personnel on Moruroa. Others were based on Hao.

In the 1960s, Hao served as a rear base for assembling the nuclear devices to be tested. Following the construction of a runway on Moruroa, the nuclear device assembly facility (Centre Technique CEA/DAM) at Hao was deactivated and transferred to Moruroa. (FNT p54)

In September 1985 the Sydney Morning Herald reported that while French officials at Moruroa insisted the level of radioactivity was only one third of that in Paris, the 3,000 workers there refused to drink water from the desalination plant. Instead the army flew in 6,000 litres of mineral water every day.

This is called venting. Venting does not occur, according to the French authorities. However the Atkinson report noted that 'volatile and gaseous fission products migrate from the explosion cavity at the moment of the test, and that the quantities were larger than those that one would expect to find simply through a "not completely perfect" stuffing of the test shaft.

Patrick was 39 years old at the time of the interview. He worked on Moruroa as an electrician from 1965 to 1971.

"Before the tests started everything had to be constructed in both the living area and the explosion zone. At first, we lived on the atoll but three or four years after the testing began our living quarters were moved onto boats; only legionnaires kept living on the atoll. I don't know whether the move was due to contamination of the soil from atmospheric testing. After I left, people were moved back on land again.

It was easy to know when a test was going to happen. A few days before, a big truck and trailer would go to the airport. Everyone in it would wear protective clothing. A lot of instruments and machines would be loaded onto it while legionnaires with guns guarded the whole operation. Then the truck would drive back with alarm lights flashing and everyone would have to make way for it.

When a test took place, everyone was moved to some other island or stationed at sea a good distance from Moruroa. A few hours after the test, the boats would return. The area where the test had taken place was completely burnt up. Everything was burnt, the earth, the plants, the stones, everything. And even years after the explosion nothing would grow there.

When we first arrived there was lots of marine life in the lagoon and on the reef and we were allowed to eat anything from the lagoon and land. But after the first test we were forbidden to eat fish or shellfish although there wasn't much fish poisoning at the time. We had to eat imported food. But of course we still ate fish. You can't stop a Polynesian from eating fish. I was part of a team which built the desalination plant which turned seawater into drinking water. But I'm sure that if eating fish was prohibited because of the radioactivity, then the water must also have been contaminated.

A year or so later, a special team of workers was formed to cut down all the coconuts before they ripened. They started at one end of the island and worked their way to the other, then turned round and did it all over again. That was all they did. They didn't give us any reason for why this happened.

Swimming was forbidden and water sports were out. People watched TV and played soccer and tennis. We could only go home on leave and see our families now and again. So it's hardly surprising that quite a few people went mad and had to be sent back to Tahiti. Of course, that meant the sack and no further income for them or quite often their families as well.

During my time on Moruroa, I was never checked by the spectro. I think I'm lucky because even now, after 20 years, I don't have any health problems and my children are healthy. I left in 1971 because I was fed-up with the working conditions and wanted to start a family.

I wasn't there when the underground tests began but I have a friend who stayed on after me. His job was to drill the shafts for the new underground explosions. After a test, specialists with geiger counters would check the level of radioactive contamination in the test site area and then usually a week later the drillers would be sent back to drill the next hole. What he saw there eventually made him leave his job.

When they went back to the site of the latest test, he saw smoke coming out of the ground through fissures in the rock. They were told that it was of no significance, and not dangerous, but he was scared. He noticed that the atoll was starting to sink into the sea where the underground tests had been taking

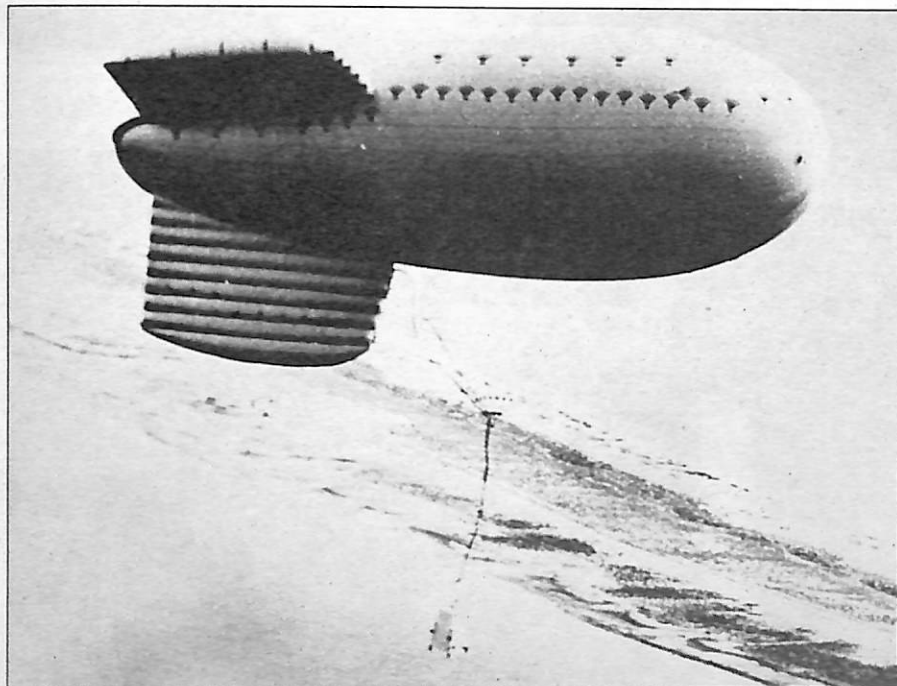
place. He decided it was time to quit. He now lives in the Marquesas islands which is about as far away from Moruroa as you can get in French Polynesia.

A few years ago the French started to search desperately for new testing sites. They were running out of room at Moruroa, and the Marquesas islands have always had a reputation for being pro-French, so the military did some test-drilling on Eiao. The island was uninhabited except for thousands of sheep. When the French arrived, they first had to get rid of the sheep. They did this by shooting them with machine guns from helicopters and publicising their bravery on Tahitian television. They started to build houses and drill holes. However, it seems that the rock which is volcanic, just like Moruroa, was unsuitable. So they left, leaving their houses – or what was left of them – and the drilling holes, and slowly the sheep have taken over the island again.

In 1976, the *Journal de Tahiti* described a test on 11 July resulting in radioactive gas which "did not escape along the predicted path, and the technicians are still trying to figure out what happened to it".

The Cousteau mission (p33) found traces of iodine-131 which could have leaked through the drilling shaft or through a fissure from a cavity to the surface. CEA officials said it had been released accidentally during post-test drilling. The Marquesas are north of Moruroa (see map of French Polynesia).

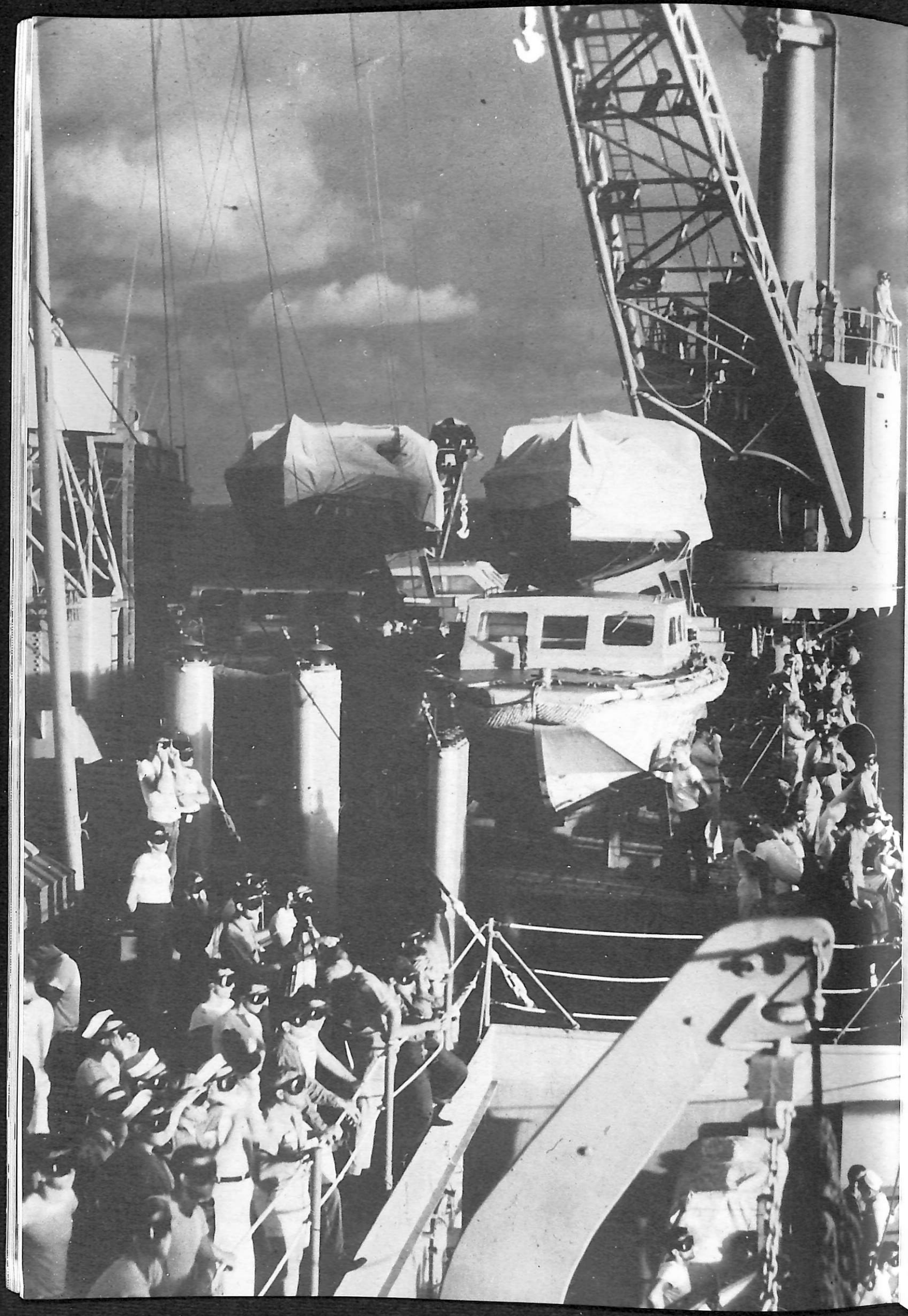
In 1972, President George Pompidou ordered the Army to find a suitable site for underground testing. Initially the army considered Eiao, a small uninhabited island in the Marquesas group. Holes were drilled through the basalt to a depth of 1,000 metres, but due to the fragility of the basalt, Eiao was found unsuitable. (*Poisoned Reign* p196)



(Left) The balloon bearing the bomb is towed by ship into the lagoon at Moruroa during an atmospheric test

(Below) The surface of the lagoon, disturbed by wave action and venting during an underground test. Note venting on ocean side of atoll (top of picture).





'Everyone is doomed'

Edwin Haoa has worked on both Moruroa and Fangataufa. He was on Moruroa when the first bomb was exploded in 1966 and he left in about 1972. He was the leader of one of the teams of about six people which had the task of monitoring the degree of contamination after the explosions.

"The whole atoll – about 9,000 people at its peak – had to be evacuated just before each test. Most people were sent to the main military base on Hao, or to Tahiti. But a lot of people were only evacuated on to boats which would wait for the explosion 25 miles off the atoll. At that distance, you couldn't see the atoll or the balloon suspending the bomb.

Sometimes the bomb couldn't be exploded because the weather was not good enough, the wind was blowing in the wrong direction, or for technical reasons. For instance, at the first test in 1966, the bomb was detonated only on the third attempt. Before the test took place, everyone on board the boats had to go below deck. We all received a pair of dark sunglasses and five or six minutes after the blast we were allowed to look at the fireball. Fifteen minutes later, we were allowed on deck to look at the mushroom cloud. After about an hour planes started to fly through the mushroom cloud firing special rockets to make it rain. Taking photos was strictly prohibited but I took some and had a little business going, selling them to my friends.

Once something went wrong. Instead of drifting away, the mushroom cloud drifted over the boats. It started to rain and everyone was ordered below deck. However, a group of Polynesians who were playing the guitar on deck and were a little bit drunk from the free drinks offered after every "successful" test, did not understand what was happening and remained on deck... After the rain stopped, the whole boat had to be washed and scrubbed down.

My team were the first people to go back to the atoll after the explosions. Sometimes half a day, sometimes three days later, we set foot on land. We wore full protective clothing with oxygen masks, and were equipped with geiger counters to measure the radioactivity. We would start with the living quarters and then move to check the rest of the island. When we first arrived on the atoll after an explosion, everything would be destroyed. There was no vegetation left. Everything had been burned, broken or blown away. But a few months later, quite miraculously, things started to grow again. There were melons and tomatoes, grass and new trees, and many more plants. Of course no one was allowed to eat the fruit and vegetables. If we did we were dismissed.

If the geiger counters started to ring in an area, we had to put a barbed wire fence around it with radiation warning signs. After doing this we would be decontaminated. We had to wash using special soap, and then we were showered and put into a special machine, called a "spectro", which I think checked the degree of contamination. We were put onto stretchers and pushed into the machine where we would stay for up to an hour or more. Two weeks later, we were flown to Tahiti for blood tests and further investigations.

As the contamination decreased with time, my team and I had to check the island every month to see whether the radiation in the prohibited zones had fallen below the official limits. If that was the case, people were sent out again to do the required work, but without protective clothing or oxygen masks.

If a concrete surface was contaminated, it was washed down and then coated with a very thick, white paint called "kukime". This could only be done to concrete – everything else had to be left as it was until the contamination level had decreased naturally and was considered to be "safe" again.

There are discrepancies in accounts of the distance ships went from the atoll during the tests. The official danger zone was a radius of 222 kilometres.

General de Gaulle attended the fourth test of 1966, and it is said that due to his impatience, the device was detonated in spite of adverse wind conditions, thus sending radioactive fallout to all islands west of Moruroa, including Western Samoa, Fiji and the Cook Islands. In 1971, following a large (450-500kt) atmospheric test, fallout fell over the atoll of Tureia on the night of 12-13 June. (*Le Monde*, 17 August, 1971)

(Opposite) US crew watch nuclear test at Eniwetok 1948.

Admiral Jean Lorrain is quoted as saying: "Our greatest problem during the next season will be how to decontaminate the site from one blast until the next. As a matter of fact Moruroa will not be inhabitable before November this year, and Fangataufa not before January 1967. The best solution would be to cover these two atolls with concrete, since it is easier to clean a concrete slab than the coral ground". (*Poisoned Reign* p111)

The first true thermonuclear device was detonated on Fangataufa in 1968. The second, codenamed PROCYON, was detonated on Moruroa. No tests were conducted on either atoll the following year, some say because of the serious radioactive contamination of the two sites. The two observation towers referred to were built with not less than 46,000 tonnes of concrete and 16,000 tonnes of iron and were 15 metres high with walls six metres thick. (*Poisoned Reign*, p 73)

There is a long delay between radiation exposure and cancer – among the survivors of Hiroshima and Nagasaki the number of additional cancers was barely detectable for the first few years.

A survey of the health of Rongelap people exposed to US nuclear tests showed a high rate of childhood deaths, reproductive loss, congenital defects and general ill-health. (Dr Brenda Caloyannis, 1988).

Because I was head of one of the teams which used to check the level of contamination, I knew that with every atmospheric test the overall contamination was getting progressively worse. By 1969 we knew it was dangerous to live on Moruroa.

In 1968, the first "H-bomb" was exploded. It was the biggest explosion so far, it destroyed all the surface structures on the atoll. Even the high metal observation tower completely disappeared. Whatever didn't get carried away by the shock wave was washed away shortly after by the tidal wave that followed.

As was usual after every "successful" test, there were free drinks to celebrate for everyone involved. So everybody was a bit drunk when Jean Veilla, who was the leader of a decontamination group like me, asked his boss, Jeudi, whether in fact there was any danger to us working there. Jeudi replied, "Tout le monde est condamné" ("Everyone is doomed"). He said we would all experience health problems in 15 to 20 years, either ourselves or our children.

Jeudi was a cheerful, healthy man from Marseille. He died a while ago at the age of about 50. I was told that he died of a coronary but I don't believe it. Lumina Cesar, another decontamination team leader, is also dead, also supposedly from a coronary. Jean Veilla is apparently still alive.

I have some health problems myself. I've been receiving medical treatment for the past six years. The doctors say that I've got a blood disorder but they have never given me a diagnosis. I used to weigh about 72 kilograms but I've lost almost 10 kilograms over the last few years. At first I used to go to the military hospital to have weekly injections in my hip and was supervised while I swallowed a few tablets. Now the treatment is the same but only every three months.

The three children from my first marriage are all healthy. My wife died while giving birth to a fourth child. These children were born before I started working at Moruroa.

I married again, and have had more children. But two of these children have died and my wife has had three miscarriages.

Mirelle was born on 1 October 1977 and lived only nine months. At first she appeared to be normal but at four months blisters came up all over her body. Her skin started to peel off. After five months of suffering, she finally died of fever.

Ken was born on 6 February 1981, and died nine months later. Like Mirelle, he seemed to be normal at birth. But he developed diarrhoea, turned black all over and died. My wife and I were not allowed to see his body. The doctors said that he had septicaemia.

I have two other children... Sarah was born on 30 September 1975. In the beginning she too appeared normal. But at the age of seven months she had to go to hospital. We were never told what was wrong with her and all we know about her treatment was that she was given some blood transfusions. She got better but even today she tires easily and is an extremely nervous child. However, she is at school and does not require any treatment at the moment. My son Edwin, who is now 14, was sent to France in 1983 for two months. He underwent several investigations and I think he has a heart murmur.

Work on the atoll was pretty easy as a rule. When I wasn't doing contamination checks, my job was to clean up and repair the mess from the tests, and to look after a few machines and installations. There were only three or four months of really intense work each year before the test series began. But whatever we did, whether we were working or just enjoying ourselves

playing soccer, we were constantly being exposed to radiation. If, for example, we were playing soccer and the ball fell into a contaminated zone, one of us would go in and fetch it. If something had to be brought from a contaminated zone while we were working, then a Polynesian would have to go and get it, without any protective clothing. White people did not enter these zones.

People knew that it was dangerous because we were told not to drink any of the water from the atoll, or to eat any of the vegetables or fruit. In 1965, all the fish around Moruroa could be eaten. But almost as soon as the nuclear tests started, eating fish was prohibited. But we've been eating fish for centuries – we weren't used to the food they gave us and we didn't like it.

At first it seemed to be alright to eat the fish but around 1968 this changed. I remember we were celebrating my 30th birthday. My friends and I got together and prepared a traditional meal with many types of fish, both raw and cooked. Soon after eating, a lot of the people there started to feel sick and their skin felt itchy all over. Fortunately nobody died.

But I know of cases where people have died from eating fish...

One of my friends, Viri Vairau from the Tuamotus, was working on Moruroa as a bricklayer. In 1972, when he had been on Moruroa a month, he ate a fish freshly caught in the ocean. The next day he started to vomit blood and had blood in his stools. He became seriously ill and was sent to Tahiti, where he died the same day.

As far as I know, a total of four people have died there. They were all young, 26 or 27 years old. I don't know why they died. I didn't know everyone working on Moruroa so there are probably others who died that I never heard about.

I know one of the boat drivers at Moruroa who also died. They had to drive small launches about the lagoon, transporting people and material wherever requested. They often had to enter contaminated zones. In about 1967, Boniface, one of the three boat drivers, started to lose his hair. He was sent to France soon afterwards, where he died. After this, all the boat drivers left and returned to their home islands.

About the same time another man died. Pierre Farahia, from Raiatea, was about 25 years old. He was in my work team and was one of the best players in our soccer team. There was an important game one weekend and the winning team was going to get a week's holiday at Bora Bora, one of the most beautiful islands in all of Polynesia. I asked my superiors not to let Pierre fly back to Tahiti for the weekend.

Pierre was so furious that he had to stay on Fangataufa, that he got drunk and then set off to walk from the work-area to the area where the living-quarters were located, a distance of about five or six kilometres. Normally, people on their way to the work area were transported in a special van, called the "car chaud" or "hot bus". It had no windows, a special air-conditioning system and was absolutely air tight.

It took Pierre about two hours to reach the living-quarters. In the evening he felt ill and came to see me. I noticed blisters at the corners of his lips and suggested that he go and see the doctor. That was the last I ever saw of him. He was sent to the military hospital in Tahiti and then to France where he died. A few days later, I was summoned to Tahiti to see the head of the CEA, who wanted to know what had happened. Apparently Pierre had been contaminated but that was to stay a secret.

In about 1972 or 1973, I left my job, in spite of the high wages that everyone earned out there. I was too scared to stay. I had seen too much.

Moruroa has experienced an outbreak of ciguatera in the last two decades, as a result of damage to coral caused by testing and associated activities.

The effects of high radiation doses include severe headaches, diarrhoea, reddening and blistering of the skin, followed by hair falling out, unconsciousness and death.

'Treated like a dog'

Distances between ground zero and the spectator boats vary considerably between eye-witnesses.

Other tests were detonated from barges or by air-drops from planes.

The Atkinson report confirmed that considerable subsidence has occurred on various parts of the atoll.

Full medical statistics for workers at Moruroa have not been released for the years 1966-1990. Critics of the health statistics which the French authorities have released, such as the Cancer Register, point out that many Tahitians use traditional medicine rather than going to Western doctors, and so are not included in official health statistics.

In June 1990, the US House of Representatives approved legislation setting up a US \$100 million fund to compensate victims of radiation-induced illnesses caused by US nuclear testing. The measure applies to thousands of people exposed to airborne radiation downwind of the Nevada test site between 1945 and 1963. The British Ministry of Defence is considering the introduction of compensation, paid without admission of legal liability, to naval dockyard workers and nuclear submariners, even if their cancers cannot be proven to be linked to radiation exposure at work.

Tetuahau worked on Moruroa from 1967 to 1985. He worked first as a painter and later as a storeman. His last job was driving bulldozers, trucks and tractors and on his discharge he was assessed as having an 80 percent disability.

"During the atmospheric tests we were usually evacuated onto boats which travelled about five kilometres away from Moruroa. From this distance, we could see the rising fireballs quite clearly. The tests usually took place in the morning and the boat would return to the island in the evening. There would be a lot of damage to repair when we returned.

Although the bomb was exploded between five and ten kilometres from the village (flying ten metres above a two metre high platform), houses sometimes had their roofs blown off and quite often tidal waves swept through the living areas on the atoll. There were always a lot of dead fish lying around afterwards, decaying and stinking terribly.

In 1968, I worked on Fangataufa for the year preparing for the first French hydrogen bomb test. When we first arrived Fangataufa was a lovely place, quiet and undisturbed, with a lot of vegetation. After the explosion, nothing was left. No houses, no manmade installations, no trees, nothing. The whole place had to be evacuated because of the radioactive contamination.

On Moruroa there are many contaminated zones and people often had to work very close to the prohibited areas. If people spoke up and refused to work so close to the radioactive zones they were dismissed and sent back to Tahiti.

The old underground test sites formed 20 metre wide craters filled with water. The land in some of the test site areas had sunk by up to two metres, and in others it has disappeared into the sea. I cannot remember any tidal waves since underground testing began but the fish in the lagoon still die after every test, maybe as a result of the earthquake which follows the explosion. They can be quite frightening. With a big bomb, the whole island shakes. Usually, everyone stops talking several minutes before the test goes off.

In 1985 I was dismissed. A medical certificate says that I have an 80 percent disability but no one has ever told me what is actually wrong with me. It must be some sort of heart disease because I get short of breath easily. I have been given electric shock treatment twice to heal my heart but it hasn't worked. I wasn't told I was going to receive that treatment; I was just put to sleep. While I worked on Moruroa I had an annual medical check-up and the degree of radioactive contamination that I had received was measured, but I was never informed of the results of these examinations.

Now, I feel so fed up that I have left Tahiti and the doctors there and returned to the island on which I was born. I am treating myself with local medicine and I seem to be doing all right. But because I'm not using professional medical care I am not eligible for compensation for not being able to work. The "Caisse de Prevoyance Sociale" has blocked all my payments, so I receive nothing.

After working for 18 years on Moruroa and Fangataufa and having my health destroyed by working on those sites, I am being treated like a dog. And I am not the only one. There are more and more people who have worked on the test sites for 18 to 20 years or more and are now not able to continue working because of health problems. Some who are not so sick get less demanding jobs in Tahiti but the others are in my position or worse. A friend of mine who had worked on Moruroa for about seven years, started to lose his hair and got very sick. He had to be evacuated and was sent first to Jean Prince in Tahiti and then to France where he died.

'There are fissures all over the place'

Philippe worked on Moruroa from 1971 to 1985.

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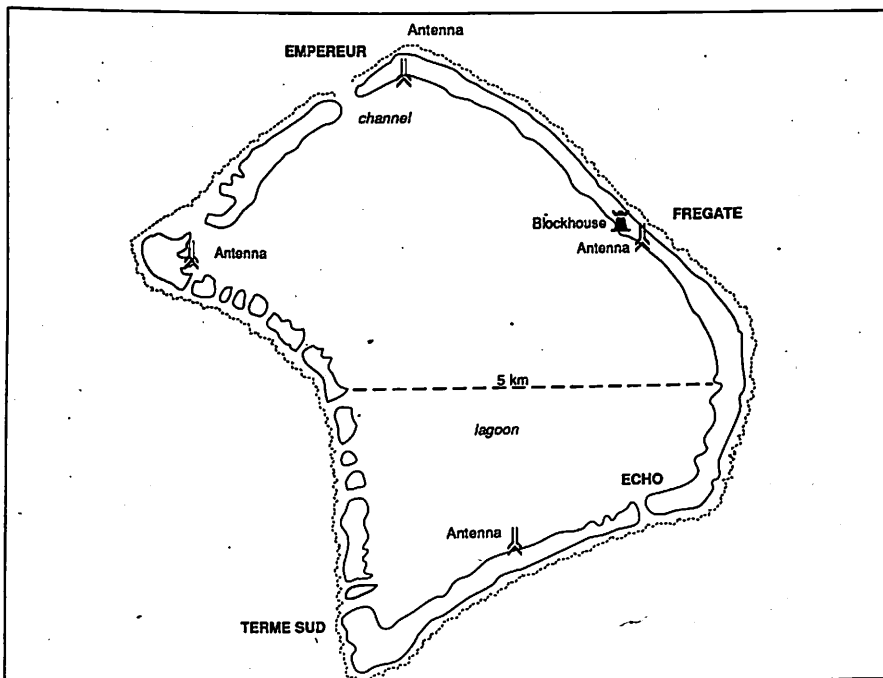
"For the first year I was in the navy doing my military service. During atmospheric tests our ship would sail out a few miles from Moruroa and watch the explosions at a distance. The crew were issued with special glasses and breathing masks which I think were to keep out radioactive dust. As soon as the tests were over and the specialists wearing protective clothing had gone round the atoll with geiger counters and fenced off all the areas they considered too heavily contaminated for humans, the ship would sail back into Moruroa. I found it surprising that the boats were not routinely cleaned after the explosions.

After that first year I got a job as a carpenter on Moruroa and worked all over the atoll, often near the blockhouse where the tests took place. I also worked on Fangataufa. We often had to work near the prohibited zones there when they were preparing for the underground tests. Some parts of the atoll were still totally burnt out from the atmospheric testing ten years before. Now mikimiki, a small, bushy plant, is growing in some places and the French have planted a lot of pine trees, but no coconut trees seem to grow there anymore.

Since the tests went underground there are fissures all over the place. I'm sure these fissures prove that the tests are dangerous, but no one warns the workers of this when they first arrive. In some areas we had to wear badges to measure the degree of radiation we were exposed to and we had annual medical check-ups but we never got any feedback.

About three years after I began work on Moruroa, I started to feel ill. My stomach hurt most of the time and I lost ten kilos. After a while I went to a doctor who examined me and told me that I had an ulcer. I was given treatment which relieved the symptoms but as soon as I stopped taking the drug the pain recurred. I quit my job two years ago mainly because my wife insisted. She found me a new job in Tahiti. But even now I often cannot go to work because I feel too weak and miserable to get up.

Other sources report warships would go to the lagoons of Hao, Fakarava or Mangareva to be washed down with sea water.
(Ruff p13)



Map of Fangataufa, the atoll used as an alternative weapons test site.

'Thousands of stinking fish'

Tupou lived and worked on Fangataufa for four years during the first underground tests there. His job was 'chef d'équipe' with a group of workers looking after the drilling gear.

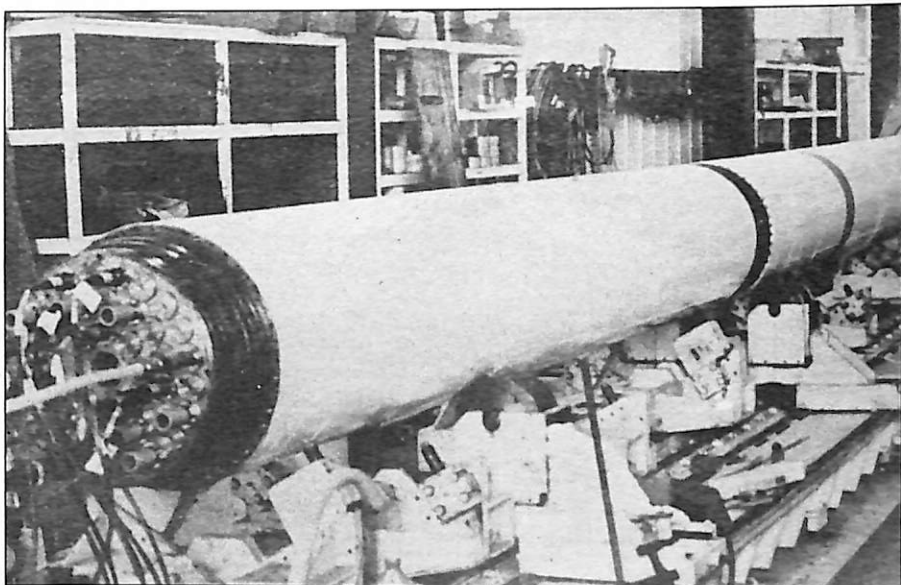
"The first one was at 'Terme Sud'; the other two were at 'Echo'.¹ When we finished drilling the shaft, the bomb was lowered into the hole and instruments were put in as well. Then the hole was sealed with concrete.

After the tests, specialists in protective clothing retrieved the instruments and then the place was fenced off and became a prohibited area. Fissures appeared after each of the tests I observed. One was 50 metres long and a few centimetres wide. Another was 100 metres long. Between the explosion sites, which were about one kilometre apart, there was a road which disappeared into the sea in places after one of the tests. The atoll sank and shallow craters, 100 to 200 metres in diameter, formed in the area of the explosion. There were a lot of prohibited areas on the atoll where atmospheric or underground tests had taken place. If people had to go into these areas to do some work they would erect little huts on the edge of the contaminated area where you could change into protective gear and shower when you came out.

The living quarters were in a small area called Fregate. We lived in a sort of container, completely sealed off with air-conditioning. The containers were two sizes: small ones which were for two white workers and larger ones which accommodated five Polynesians. Air-conditioning was a necessity as Fangataufa was very hot. There were no trees as they had all been destroyed by the explosions. There were rumours that the air-conditioning was to keep the workers inside because the air outside was too contaminated. Of course, this was not the official explanation.

Journalists visiting Fangataufa described sea washing over the reef in many places, and cracks in the concrete covering a previous test pit.

Preparation for an underground test: The nuclear device is placed in a test canister, a white steel tube over 20 m long and 1 m in diameter. The canister contains diagnostic instruments capable of recording what happens during the explosion. When the shafts were located on dry land, the test canister was transported in a horizontal position on a 28 wheel trailer from the assembly plant to the shaft, usually only a few kilometres away. It was then raised into a vertical position and lowered into the water-filled shaft with the help of cables. When the tube reached the bottom, the shaft was filled with a cement plug which encased the cables, and covered with a concrete lid. (FNT p10)



¹ Only two underground tests at Fangataufa were recorded by seismologists during the first underground tests. These two, codenamed ACHILLE and HECTOR, were "exploratory" tests undertaken during 1975, one on the southern, and one on the northern part of the atoll rim. However, further tests may have been planned, or of such low yield that they were undetectable by seismological monitoring. The French newspaper *Le Point* reported in June 1975 that "the first test will be followed in quick succession by four others". (*Poisoned Reign* p212). According to a French Ministry of Defence dossier released in 1985, 14 underground tests took place between 1970-1977, two more than previously thought. These two extra tests could have been conducted in 1975-1977. Another source claims that France conducted two underground tests in 1974, a year before France officially moved its testing underground. (FNT p44)

Now, except for a small area used as a recreation area which has some normal, fully-grown coconut trees in it, no trees on Fangataufa grow higher than a metre. Even in Fregate, where the living-quarters were, none of the coconut trees we planted have grown higher than a metre and none bear coconuts. When we first arrived at Fangataufa, we were allowed to go swimming and do all sorts of water sports. Even fishing was okay. But after the first underground explosion at Terme Sud, that area was out of bounds and after the two following explosions at Echo, swimming and fishing were prohibited in the whole lagoon.

After each underground explosion there was a sort of tidal wave that washed over part of Fangataufa and a few days later thousands of stinking dead fish washed up on the shore. Initially there was no ciguatera, but then we were told not to fish anymore. We couldn't eat coconuts or anything else that grew there. I know people who got sick and were evacuated but nobody told us what the problem was. Nobody told us whether there were any dangers or what effect the dangers would have. Most of the island was fenced off but we were only told to respect the signs. If we didn't on the first occasion we got a warning, on the second we were sent back to Tahiti immediately. But of course we went fishing all the same.

I left Fangataufa because of the working conditions. We were only allowed to go back to Tahiti every six months for a holiday and consequently there were a lot of divorces. There were also health problems.

We did have some medical check-ups. When I first started working there and again when I left, they took blood and urine samples, blood pressure, X-rays and I was monitored in 'spectro'. But there was nothing while I was there and no follow-up after I left the job. I am married and we have one boy. He has heart problems but we don't know exactly what it is. We have been trying to have another child but we haven't had any luck so far.

Shortly after I left Fangataufa, I heard from friends there that the atoll had been temporarily abandoned again, probably because of radioactive contamination.

The problem is the amount of unemployment in Tahiti. People see all the luxury goods, the fancy cars and the beautiful homes and they want to get them too. Just to earn some money to feed their families, they have no choice but to go out there to Moruroa and Fangataufa and work under those dangerous conditions, even though they may not want to at all.



A diver from the Cousteau mission (1987) examines a fissure in Moruroa's coral crown.

The Fangataufa test site was officially closed down in February 1976, purportedly to save money.



'All the handicapped children'

Robert has been living in the Gambier Islands for the last seven years. He did his military service working as a crew member on a hotel ship which was stationed for a month in the lagoon at Moruroa.

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"There were two or three hotel ships moored there all the time to provide accommodation for civilians, mainly high-ranking French people, and some Tahitians such as customs officers. They were very clean, with air conditioning and so on. French military personnel were the only people living on the atoll itself. During the tests the boats went out to sea, sometimes going to Hao or the Gambiers.

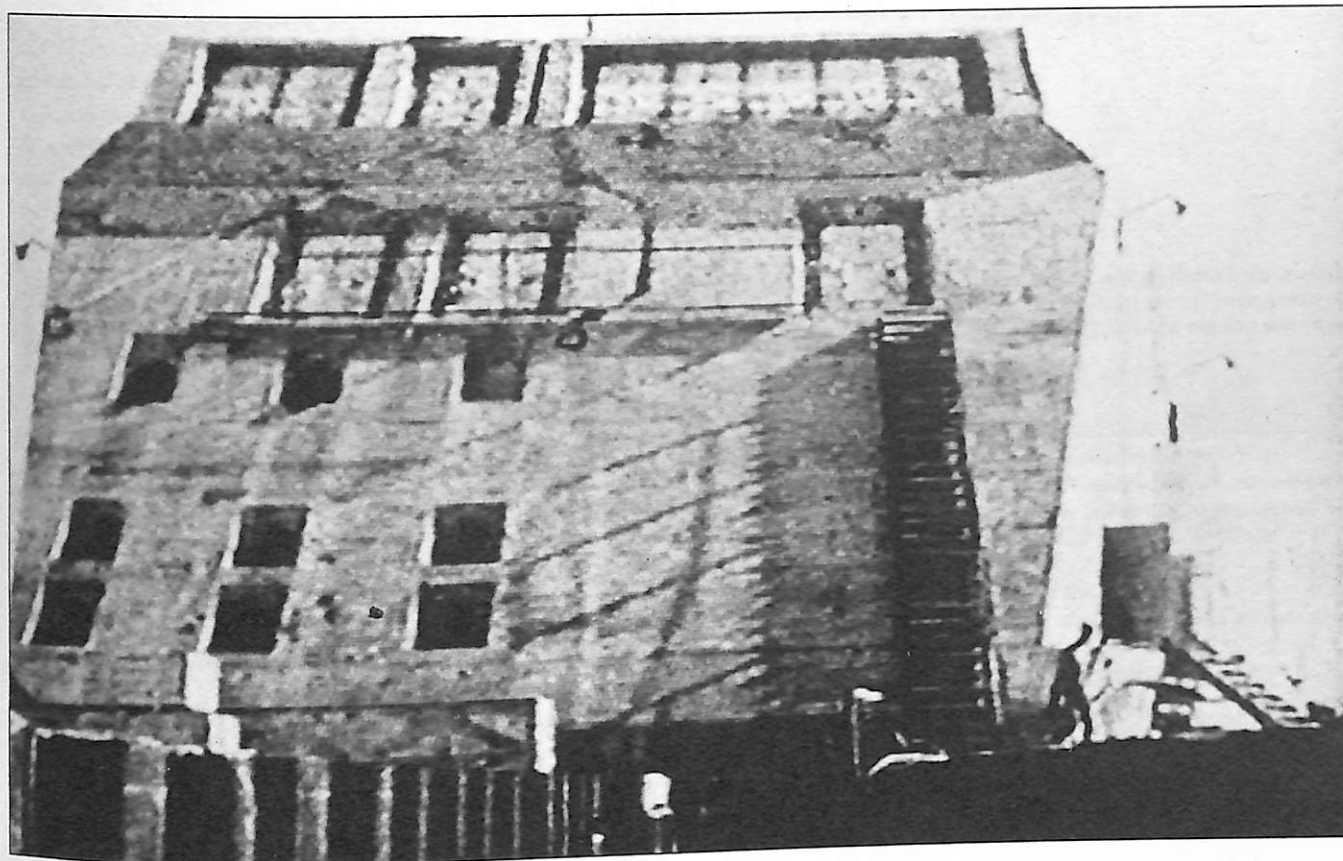
On Moruroa, people were free to go anywhere they wanted except into the blockhouse and certain areas fenced off with barbed wire and showing the radiation sign. The radioactive areas which were off limits were around the blockhouse and beyond the airstrip. But movement on the roads was unrestricted and I went out there on the bus which went to pick up the workers who had been doing the shift in the blockhouse.

The airstrip was on one side of the road and the lagoon was on the other with radiation signs all over the place. At the blockhouse, there was a big parking area which you were free to enter and I even walked round the back of the blockhouse. Again there were the signs and barbed wire. But the close surroundings of the blockhouse were supposedly uncontaminated. The blockhouse itself was off limits for military reasons. Behind it, in the northwest corner, there were four large concrete pads about three or four metres square and about a metre high that at one time had supported a large radio mast or antenna, made of eye beams. The cross sections of the eye beams were about

Most of the 3,000 personnel on Moruroa were evacuated during the 41 atmospheric tests detonated between 1966 and 1974. After watching the explosion they were taken to one of three atolls with large lagoons and wide passes - Hao, Mangareva or Fakarava. Hao has one of the longest runways in the South Pacific, together with a number of storehouses and workshops. Before the construction of a runway at Moruroa, Hao served as a rear base for assembling the nuclear devices to be tested, which were flown from France via Martinique, thus avoiding the densely populated and highly critical Tahiti.

(Opposite) The Rainbow Warrior lies crippled in Auckland Harbour in 1985. French secret service agents planted two bombs on her hull, killing Greenpeace photographer Fernando Pereira.

The blockhouse ("P.C. de tir") is where the nuclear device is detonated, using cables which run from the blockhouse to the shaft.



six inches. The tower was immense – over 30 metres high. The remains of the rest of the tower were lying on the coral 30 to 40 metres away. It had been sheered off fairly cleanly with only the stubs left, all bent to one side. There was no vegetation around.

A bit further on, there was a cement mock-up of a house and a couple of tanks or armoured personnel carriers. The house was fairly much intact and the tank was upright. It was scorched and you could tell it had been subjected to extreme heat. The front of the blockhouse faced the lagoon with a deep channel about a metre wide in front of it. That is apparently where they laid the cables so that they ran out of the blockhouse into the lagoon and up to the balloon. The bomb must have been just out there in front of it.

They used the blockhouse over and over again. It was a very sturdy structure with a sloping front so that the shock would slide right over it. I think there were slits for windows but I'm not sure. It looked about 20 to 30 metres high. On the carpark side was a big steel door which was set about a metre back into the cement. I never saw it open but the walls were at least a metre thick, probably more. It was so massive, it looked as though it must have been much bigger and thicker.

As far as I know, there were two blockhouses. One on the south-western edge of the lagoon and the one I just described. The blockhouse was between five and ten kilometres from the village, about two kilometres beyond the airstrip. This means that the bombs were exploded about five to ten kilometres from the village.

The village began at the edge of the airstrip and consisted mainly of tin shacks and a tin hanger at the village side of the airstrip. None of these 'buildings' were at all blast-damaged which was surprising.

Fishing was forbidden but we were allowed to swim in the lagoon. In the residential area of the village there was a nautical centre with beach facilities and so on. There were no medical checks and no badges for me or civilians.

I returned in 1979 after being in the Gambier Islands. I was travelling to Tahiti on a military ship which stopped at Moruroa for 36 hours. I noticed that parts of the island that had been above water when I was there last were now submerged and had causeways built over them. This was in the northern part of

The blockhouses are known as "Denise" and "Dindon".

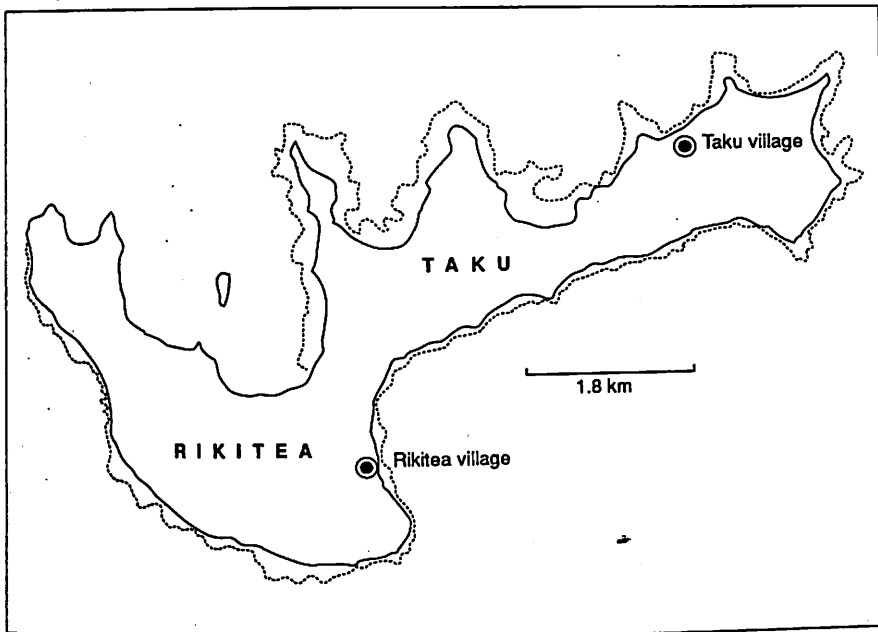
Postcards extolling the beauties of Moruroa and its recreational facilities are on sale in Papeete.



the atoll where they were drilling at the time. By now the tests were underground, and I could see the workers drilling on the reef. We weren't allowed off the ship so I couldn't see any fissures. They still had hotel ships and there was still a large village on shore.

I first went to Mangareva in 1959 and then again in 1963. Everything was fine and there weren't any military there. All the major islands in the Gambiers were inhabited. Roughly 2000 people were living there, with about five villages on Mangareva alone.

There was not much ciguatera then, except for the usual amount normally found in tropical waters. Everybody knew which fish were ciguatoxic and in which areas of the lagoon they were found. It was not a problem. And if, by accident, someone did eat a toxic fish the symptoms were mild enough to be treated with some local medicine such as sugar, milk and ginger root. This did not stop the disease but it helped to relieve the symptoms a little.



My next visit was in 1972 and by then all the fish were poisoned, though apparently it wasn't as bad then as it had been. Even the maoa were ciguatoxic which was unheard of previously. The consumption of most species of fish was prohibited except for fish caught in the open ocean.

The population had declined considerably by then. I gather that in the years after the nuclear testing programme began, people had started to leave. A lot of people left to join the civilian labour force needed by the military for construction work on Hao, Moruroa and Tahiti. Others left because the fish was ciguatoxic and couldn't be eaten. So men left and their families followed, going to Tahiti because of the conveniences there and the poisoned fish at home. The people remaining were mostly the old people, young children and a handful of middle-aged.

In the beginning the only military presence on Mangareva was at the meteorological station. There were six to ten permanent weathermen at the station and about 30 support people. First they were on Taku but after the airstrip was built at Totogegie they all moved there. Later, they had a rest and recreation centre at Totogegie. When I was on Moruroa the legionnaires would

The Gambier Islands consist of four high islands and a few atolls. They were once an independent entity within French Polynesia with their own flag. This status no longer exists, and none of the Gambier Islands are inhabited except for Mangareva which now has a population of 500.

There is no proven treatment for ciguatera. Mannitol, a type of alcohol generally used to increase urine production, and amitriptyline, an anti-depressant drug used in a variety of pain syndromes and nerve diseases have had some effect. Ciguatera has occurred throughout the Pacific, but there was a massive outbreak in the Gambiers in 1968, probably connected with French military activity which damaged reefs in the lagoon. Overall, rates more than three times the regional average were recorded in French Polynesia in 1973-1987, with 24,000 reported cases. The South Pacific Commission estimates that the official statistics reflect only 10-20 percent of cases. (Ruff p4, 16-17)

Map of Mangareva

Maoa is a sea-snail.

Recruiting by the CEA virtually emptied many outer islands in the 1960-70s. Attracted by relatively high wages and the bright lights of Papeete, one source estimates that the population of the Gambiers, once numbering 5,000, fell to 500. Rapid urbanisation led to the emergence of slums in Papeete, disruption of traditional social structures and values, dependency, corruption and prostitution.

See map for location of Totogegie airport. Meteorological buildings were erected on Totogegie in 1967.

Two of the long-term effects of radiation exposure include increased incidence of spontaneous abortions and lack of eye development.

The transfer of pregnant women from Mangareva to Papeete is confirmed by other testimonies.

The monitoring is undertaken by the "Service Mixte de Contrôle Biologique" (SMCB), an agency set up by the Commissariat à l'Energie Atomique (CEA).

occasionally go there, 10 to 15 at a time on leave. (They had one week off every four months). There is a bunker-like blockhouse at Taku and a shelter at Totegegie similar to the type at Rikitea but half the size.

I've heard of stillborn and premature births on the island and I know of three families with retarded children. The youngest of these children is about five or six and the oldest is about 12 or 14 years old and has epileptic fits. All the handicapped children on the island were born after the testing started. There are also a lot of cross-eyed people. For example, my friend Ton and his wife have a five-year-old retarded child. Ton's wife had several premature births too. The old postman's wife has had several stillborn babies. This has all been in the seven years since I have lived on Mangareva. The Tahitians do not seem surprised about the handicapped children. They are a fatalistic people and take what comes.

When I first went to Mangareva in 1963, I did not notice any handicapped or cross-eyed people. The only case of cancer that I know about was an old man called Io who died of a cancer on the side of his face. I don't know of any leukaemia.

Soon after the tests began, the women were sent to Tahiti to give birth. The reason given for this was that supposedly the facilities on Mangareva were not set up to handle births. This is nonsense because in 1959 and 1963 there was no infirmary at all and everybody gave birth at home as they had always done. There were a few older midwives who knew how to handle the situation. I even helped a guy get some hot water ready once. It was totally normal. You just did it. The fact that there were no facilities was just an excuse used so that if anything went wrong they could just hush it up in the hospital in Tahiti. I can't pin people down on the exact date that the evacuations of women started. It was probably one or two years after the tests started.

Every year or so, they send a team of doctors to Mangareva and everyone is supposed to see them. They are given a complete examination down at the infirmary and urine, faeces and blood samples are taken. It isn't very regular. Since I've been there, they have come three or four times. It is part of the free medicine that they get. I have never gone myself. I don't know exactly who is behind it.

'Some fish species became extinct'

Robert's description of the environmental, social and economic impacts of testing is echoed by many of the people living on Mangareva and other atolls near Moruroa. The following thirteen interviews describe the dramatic changes which the testing programme brought about; the severe outbreaks of ciguatera fish poisoning which affected large numbers of people; and the precautions – or lack of them – which the authorities took to protect the people of neighbouring atolls from radioactive fallout.

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Tafai is from Mangareva, an island 450 kilometres south east of Moruroa in the Gambier group. About 700 people lived on Mangareva in 1966. Because of its proximity to the nuclear testing site, permission to travel to Mangareva must be secured from the French authorities.

"The tests usually took place at about eight o'clock in the morning, sometimes a little later. You would see lightning and hear an almighty booming noise. There would be a huge gust of wind and all the windows would shake as if the explosion was close by. If you went up to the top of the hill, you could see the fireball rising out of the sea and into the sky.

I remember on one occasion, I was standing at my front door when I saw the lightning and then a strong gust of wind threw me backwards. I heard the windows rattling. It was a Sunday and everyone was ordered to go to the shelter. When we went in the generators were turned on. Filtered air was pumped inside and the roof on the shelter was constantly washed down with sea water by a sprinkler system.

Before the French built the first shelter on Mangareva, there was an inflatable tent, like a giant turtle, that was set up in the village and used once. Then a permanent shelter was built which I remember having to go to twice.

The first time we went there, it was just for a day. The next was the time of the Canopus test in 1968. We were supposed to be there just for the day again, but in the evening a message arrived to say that the wind had shifted. Something had gone wrong, and we should stay in the shelter until eight

In 1963, the French Governor in Tahiti, M. Grimald told the people of French Polynesia that "not a single particle of radioactive fallout will ever reach an inhabited island". Therefore, no shelters were built initially for people living in the nearby islands. However, after the first tests in 1966, radioactivity was detected in islands as far away as Samoa, Fiji and the Gilbert Islands by the New Zealand Radiation Laboratory. Shortly after, shelters were built in several of the inhabited islands, including Mangareva.

The purpose of the CANOPUS test was to test France's first thermo-nuclear device, or "H-bomb". It used a highly enriched uranium-235 primary and lithium-6 deuteride secondary. The device weighed an estimated three tonnes, and was exploded at Fangataufa on 24 August 1968.

Printed instructions were issued to the people of Mangareva

INSTRUCTIONS IN THE EVENT OF ATOMIC TEST:

"When you are asked to go to the protective shelter ("abri de prevoyance") these instructions will help you to remember the precautions you must take:

1. Before leaving your home:

- (a) Remember the animals. Attach them so as to prevent them from doing any harm. Leave enough food and water within their easy reach to last for three days.
- (b) Likewise protect some of the things that you leave behind. Carefully close all windows and doors. Wrap up in vinyl tissue (which will be distributed when needed) your boats, household utensils, crops and food products. Extinguish all lamps as well as the burners of your kerosene refrigerators. Stop all motors.
- (c) Prepare one or more parcels containing your valuables and important documents such as identity cards and land deeds, linen, and particularly for your babies, silver ware and such things as rubber teats, thermos bottles and the formulae to which they are used. Whatever happens, you will be allowed to keep these parcels provided that their weight does not exceed 20 kilograms. You can also take along games, guitars, plaited mats and blankets. But no animals.

2. When the time to leave comes:

You must proceed to the shelter within two hours after the church bells have rung.

Keep all family members together so as to facilitate checking in.

A motor vehicle will assure a shuttle service for the sick and the aged and for pregnant women." (*Poisoned Reign*, p169)

Radiological surveillance and safeguards for animals, foodstuffs and drinking water is the responsibility of the Service Mixte de Controle Biologique (SMCB), which is based at Montlhery, France, and has an annex at Mahina, near Papeete. French authorities of the SMCB claimed in 1970 that 200 individuals had been selected and were being examined regularly. However, details of only 22 men and 10 women were published, leaving the other 168 people unaccounted for. (*Poisoned Reign* p186)

The effects of exposure to radiation include an increased incidence of sterility, cancer, cataracts, miscarriage and still births, along with defects in children such as abnormal body parts, lack of eye development, tumours of the thyroid, leukaemia, slow mental development and small head size. Loss of appetite, nausea, vomiting and bleeding are symptoms of short term exposure to radiation. The epidemic of vomiting and diarrhoea described here could have been the result of other sources, such as contaminated food or water, or alternatively, ciguatera fish poisoning.

French foreign legion troops began arriving in French Polynesia in June 1963. Within a year, accommodation for 7,000 troops had been built on Tahiti. The number of single men created social tensions and local newspapers reported numerous brawls and attacks, often over women. To solve this problem, the military authorities decided to organise legalised brothels, but there was such a public outcry that the plan was abandoned. (*Poisoned Reign* p81-2)

See other testimonies which confirm that the military stopped using local food. This may have been the result of an accident in July 1967, when a test codenamed ARCTURUS exploded at sea level due to a technical mishap, causing severe fallout downwind.

o'clock the next morning. There was enough food and you could sleep, but it was a long wait. Some people played cards and some of the older people prayed.

After that test, there were other problems. Usually, after a test, some military people would go around the island with a geiger counter checking for radioactive fallout. Two Mangarevans would go with them to give them a hand. One of them later told me that after Canopus, they had found contamination in the northern part of the island. They even had to throw away rainwater from the catchment drum. Apparently, this man got sacked because he had talked but he has got another job now with the military on Hao.

In spite of the fact that there had obviously been contamination in at least one part of the island, we weren't officially told. We weren't told to do any special clean up jobs. The only precautionary measure had been the order to store all the food, dishes and cutlery into plastic bags and to close doors and windows tightly before each test. Although the shelter was washed down constantly by the sprinkler system, people's houses were never washed and nor were the gardens or roads.

There hasn't been much medical follow-up either. Twice, a boat came to the island with a special machine on board which I now know was to measure the level of radioactive contamination in people's bodies. But at the time, no one knew what was going on. The military simply put the entire population of Mangareva through the machine. We were put on a stretcher and pushed into the machine where we stayed for a few minutes with background music playing. Then we were pulled out again and sent home. We didn't know what it was all about or what the results were. There was no blood or urine testing or physical examinations. I think that they came for the first time before the tests started and then again three or four years later.

I don't know whether the bomb has had any affect on the health of the people. I have ten children who were all born at home and are healthy. They were all born before the tests began.

Today women are often sent to Tahiti to have their babies. It seems that there are a lot of premature babies and handicapped children.

I also remember an epidemic of vomiting and diarrhoea in about 1969 or 1970 shortly after a nuclear test. Several children died of it and others were evacuated. I wonder whether this epidemic was a result of the radiation. I also know of one person who has died of cancer. I think it was cancer of the ear. And there was a young woman of about 30 years who had a cancer somewhere of the head. She was treated in France and is still alive but her face is a bit deformed.

The French military arrived in 1963 or 1964. At first they kept to the north of the main island at Taku. Things changed with their arrival. For one thing, a lot of fatherless children appeared all around the island. Generally speaking, they were quite welcome however. Some legionnaires even lived with local families but later there were a lot of fights between legionnaires and local youths, mostly over girls and under the influence of alcohol. People drank a lot more alcohol once the military arrived.

In the beginning the military bought all the fish and vegetables they could from the locals. I even had a garden myself where I grew vegetables for them. But after the third nuclear test they stopped buying fish and then suddenly in 1970, without giving any explanation, they also stopped buying vegetables. Weren't they good enough? Were they too expensive? Or were they

contaminated? I don't know why they stopped buying the fish either. Was it because of radioactive contamination or was it because of the new phenomenon, ciguatera?

This wasn't a totally new disease but it had always been mild before. We could treat it with local medicine which relieved the symptoms. There were only a few species of fish that carried the disease and we knew where in the lagoon they were. But in about 1968 or 1969, virtually all the fish in the lagoon were contaminated with a substance that made people who ate them get sick and even die. All the elders of the village agreed that there had never been such a phenomenon before and it was of course linked to the French activities in and around Mangareva and the nuclear testing.

Around that time there was another disaster. Thousands of dead fish were washed ashore. It lasted for quite a long time and the beaches stank. There were all kinds of fish, not just one or two species. Some species became extinct. Nothing like this had ever happened before.

Today the situation has improved slightly. There are two or three species that can be eaten if they are caught in certain areas but people still mainly eat fish caught outside the lagoon. I have been sick myself from eating contaminated fish. I had diarrhoea and vomiting so badly that I couldn't leave the toilet. It took about three months before the symptoms disappeared and they reappear if I eat meat, particularly tinned meat like corned beef. I get itchy all over. Sometimes the symptoms come back even when the fish I'm eating isn't contaminated.

I was fortunate but another guy I know, Salamon, got very sick on two occasions. Once he was found lying unconscious outside his house. We took him to the infirmary where he was given injections and infusions and he remained comatose for two days.

In 1968 or 1969, three people were evacuated to Tahiti with fish poisoning. When one had recovered a little, he went to Reao, where he ate another poisoned fish and died. Another returned to Mangareva but he also ate another poisoned fish and got very sick again. He was partially paralysed and never got over it. He died a few months later.

Ciguatera fish poisoning is caused when fish eat a particular organism which grows on damaged or dead coral. The dinoflagellate organism, *Gambeirdiscus toxicus*, which causes ciguatera is named after the Gambier Islands, where there was a serious outbreak of ciguatera in 1968. (See page 13, interview with Ruta for more details) Ciguatera is occasionally fatal (around 0.2 percent in the largest documented series of 12,890 cases in French Polynesia). The highest density of *Gambeirdiscus toxicus* ever recorded in scientific literature was recorded in 1978 at the main island of Mangareva – over 5 x 1,000,000 cells per gram of algal sample. The 1968 outbreak provides the best documented example of the association between extensive death of corals and ciguatera. Construction activities began in 1967 on the island of Totegegie, including extensive land clearing, installation of four generators, construction of a desalination plant and water reservoir, eight radio and meteorological buildings, four workshop and storage hangers, a launch tower for meteorological balloons, nine buildings for living quarters, three large platforms, including a helipad, a radiation monitoring station and an airfield. In the lagoon a large concrete jetty was built, channels were dredged and 48 support blocks for antennae were put in. (*Le Journal de Tahiti*, March 8 1969). Visits of warships to Mangareva were frequent, either to load fresh fruit and vegetables, or to be washed down with sea water in the lagoon after watching an atmospheric test. Between 1971 and 1980, the incidence of ciguatera in the Gambiers did not go below 30 percent, peaking at 56 percent in 1975. Between 1960 and 1984, each of the 5-600 inhabitants has, on average, had documented ciguatera more than four times. (*Ruff* p12-13).



'A fabulous pearl'

Hiro was born at Tauere near Hao. From 1928 to 1986 he lived on Tureia, 78 nautical miles north of Moruroa. During this time he regularly went to Tematangi to work in the copra industry there.

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"Today there are about 100 people living on Tureia, a lot of them children. The last military people left the island about one and a half years ago. In the sixties there were a few more civilians living there but they were outnumbered by the military. There were also a lot of legionnaires who were involved with construction work, the meteorological station, observation stations for the atmospheric tests and other activities.

In some ways it was good to have the military there as they created jobs which meant we could earn cash. Another good thing was that people who worked for the military could go shopping in the military shop which was cheaper and better stocked. The alcohol was cheaper there too. All the men here drink at least one litre of whiskey a day and if it runs out they make their own coconut brandy. One of the bad things about the military presence was they tried to get hold of local girls. Several of the legionnaires got beaten up because of their affairs. There are quite a number of half castes on Tureia with no father to look after them. The problem was that the military had gifts of jewellery for the women and alcohol for the men to please everyone.

When the military first arrived and explained what was going to happen, lots of very important people came to the atoll to talk to us. The admiral came and told us that there was no danger and that nuclear bombs were good. He came with a man who was said to be a professor and was introduced to us as one of the greatest scientists in the world. This man's knowledge could not be argued with. The admiral compared him to a fabulous pearl. This man also said that there were no dangers for us. After having done the tests they would take the bomb back to France and it was only there that it would become dangerous. There was also a white Catholic priest who told us that as the Americans had the bomb to protect themselves from a nuclear war and it was about time that they, the French, also had it and that it was absolutely normal and right that the French should do this. A few years later, after the tests had begun, a military doctor told us that the tests weren't good but he didn't want us to tell anybody because he would risk life imprisonment.

The military built two bunkers which people had to go to whenever there was an atmospheric test. The military told us that it was because of cyclone warnings. I liked it inside. It was massive. The walls and the roof were concrete and at least one metre thick. Inside was everything we needed, including a fridge that contained free food and alcohol. It was like a good party. We had to stay there overnight and the military checked that everyone was inside and everything was alright. Then they closed the doors and went to their own

(Opposite) Equipment dumped by the French military into the Mangareva lagoon.

French officials constantly assured the people and politicians that no harm would come of the tests. The admiral in charge of the test programme in 1966 was Jean Lorrain. The head of the CEA was Professor Francis Perrin. (*Poisoned Reign* p111)

Before the first atmospheric test in 1966, the CEP sent out a warning to all ships and aircraft to keep out of a danger zone "extending in a 400 km radius around Moruroa with a wedge-shaped, 740 km prolongation in an easterly direction." When Tahitian politicians pointed out that this zone included seven inhabited islands, the danger zone was reduced to a radius of 222 km. However, Tureia was still within this area.

In 1969, testimony from a French military helicopter pilot was published about a visit to Tureia two days after the third atmospheric test: "I flew to Tureia to pick up two meteorologists who had been left there together with the population of about sixty people at the time of the explosion. I was forbidden to wear the protective orange overall, so as not to alarm the population. But I put on my special boots and gloves. I spent three minutes on the atoll, just the time needed to take off the two meteorologists. For my part I was given a special shampooing, after which I could join my mates; but the two meteorologists had to remain in the hospital on board. However, before being allowed leave in Papeete, I had to submit to a special examination which revealed the existence of radioactive iodine in my thyroid glands. The amount was slight but I had to remain under observation for three days. As for the meteorologists, they were kept for a week in the hospital at Hao. This was a thought-provoking experience. Since I had had to be decontaminated after having spent only three minutes on Tureia and the meteorologists who had been there for a month needed more extensive treatment, how much more radioactivity must not the islanders have absorbed? They had not been evacuated and had received no instructions as to how to protect themselves. They continue to eat the lagoon fish and coconuts, to handle palm leaves and stones." (*La bombe ou la vie*, Fayard, Paris 1969, pp55-6 cited in *Poisoned Reign* p171)

The evacuation of residents of Tureia to Mataiea took place in 1968, a fact that was discovered when electoral results for the 7th July general elections showed no returns from Tureia. The CEP initially denied they had evacuated the Tureians, but later said it had had nothing to do with the tests but was because the Tureians wanted to be in Papeete to celebrate the July 14th Bastille Day celebrations. (*Poisoned Reign* p128)

This account suggests that the French authorities were themselves unsure about the effect of nuclear testing on the marine environment, and whether fish poisoning was a result of radioactive contamination, or of ciguatera. The episode when many fish died has also been described by several other interviewees.

The boat with the spectro aboard may have been the Marara, a biological control ship run by the SMCB which collected marine samples. Protection of the population is the responsibility of the Service Mixte de Securite Radiologique (SMSR) which was based at Moruroa. Figures for 1988 from the SMCB state that levels of radiation found in coconut milk, copra and fish were around seven times higher in Tureia than in Papeete, but still negligible in terms of allowable population dose.

blockhouse. The next morning everyone was drunk and I can't really remember what happened. I think that some of the military went around with geiger counters to check for radiation. I think some people, mainly the mayor and the councillors, got quite a lot of money from the military after each test. I never received any money – the booze was enough.

I still think the tests are a good thing for Polynesia. If there was a war, France would protect us. Besides, if all the high up military people think that the tests are safe, it's not for me to think anything else.

Even the evacuation in 1970 didn't change my mind. Some military people came to tell us that there might have been an error and that it would be better to evacuate. There might have been some radioactive fallout. It was just a precaution of course. So the whole population was moved to Mataiea, a military camp on Tahiti. The military even told us that if there was really a problem on Tureia, they would buy us some land around Mataiea. That's further proof that the military were really good to us.

We stayed there for several months, inside the military compounds. There was heaps of free food and lots to drink. Some people got paid jobs. Others got paid even though they didn't have jobs. When we wanted to go into town we were taken by military transport and constantly looked after and accompanied by military men.

As soon as we returned to Tureia I went to catch some fish. I had prepared it and was about to eat it when the local gendarme came and told me that it was forbidden to eat fish from the lagoon for a year. But when the gendarme saw what a delicious fish I had caught we both ate it. Instead of fish we were supposed to eat the free imported food which was distributed by the military that year. But you can't sit there and look at the lagoon and the fish in it and ignore them...

I suppose that the reason we weren't supposed to eat the fish must have been because of radioactive contamination. There had only been a small amount of fish poisoning before. Even before the evacuation there had been regular checks on the fish. I'm not sure what they were being checked for, but I had to go and catch certain quantities of particular species every two months for the military who then had them analysed. It was only for that year that we were forbidden to eat fish but the doctors told us that one species of fish caused diarrhoea and that we should never eat it again. If someone got seriously ill after eating fish they would be flown to Moruroa and checked in the spectro machine. One time millions and millions of fish died for no apparent reason.

Every three months a military doctor would come and examine the whole population to see if there were any medical problems. A sample was taken of everyone's blood, urine and faeces. In the beginning they came with a spectro machine on a boat but later we were taken to Moruroa to be checked in the spectro there. To me this is proof that the military were really concerned about our health and were looking after us.

'The turtle shelter'

Hinano lives on Mangareva.

"The military first arrived in the Gambier islands in 1963. About 20 of them, including some legionnaires, settled in Taku, at the north end of the main island, and built houses, roads and a bunker. Later, they moved to Totegegie, where the airport was built. More and more people were brought here until, at one stage, there were about 1,000 foreigners (mainly legionnaires and French military people) working there, as well as Polynesians who were brought from other islands to work for them. Of course this changed our quiet lifestyle on Mangareva quite considerably. Big boats arrived all the time and once the airstrip was built, big airplanes brought more people and more goods.

In the beginning, when the first military people arrived, we were happy to welcome them. We had never seen so many white people and their arrival meant work, money and cheaper goods because suddenly transport was free. It also meant a lot more alcohol too which sometimes led to problems. With legionnaires and locals getting drunk, there were a lot of fights which meant a lot more work for the gendarme.

Before the testing started, a lot of VIPs came to the islands; scientists, admirals, generals and the professor who constructed the bomb. They had meetings where they talked to the people, telling us not to worry, that there were no problems and that everything would go well. They said in case there was a problem they would certainly send a navy ship out there to evacuate us if necessary. Most people were so impressed by these important visitors that they believed everything they said and didn't ask any questions.

The bunker that had been built in Taku was very impressive, with walls and the roof a metre thick. It was designed to accommodate all the military and the local people but they soon discovered that it was much too small. When they moved to Totegegie, they built another shelter but it was quite different from the first one. It was built from tin and a sort of plastic. It was very spacious, though much less solid.

In Rikitea, a large inflatable tent was set to use as a fallout shelter. It looked rather like a turtle and was kept inflated by generators which ran day and night. After a few months, the military decided that it was not good enough as it was too expensive to keep running for decades to come so they started to build a shelter like the one on Totegegie. The turtle shelter was never used except as a venue for showing movies in the evenings.

We had to stay in this new shelter at least twice. We were told it was just a precaution. Before leaving our houses we had to pack away all our food, cutlery and dishes into plastic bags issued to us by the military. All the windows and doors had to be left completely shut. Nobody was allowed to stay behind. If someone wouldn't go, the gendarme would come and take them to the shelter. Inside the shelter, it was quite comfortable, with free food and drink. If there was food left over, we were allowed to take it home with us afterwards. After some of the tests we were even given mineral water for the babies. There was so much that it lasted for several months.

Fresh air was pumped into the shelter continuously through big filters and a sprinkler system was constantly washing down the roof. We all wore our every day clothes but the military people who accompanied us had to wear protective clothing and masks and gloves whenever they left the shelter to do any work outside.

As soon as the alarm was over we were allowed to return home. Although

Army personnel moved to Mangareva early in the 1960s, as the Gambiers had been chosen as the site of a third major military base after Moruroa and Hao. Construction activities begun in 1967 on Totegegie included a desalination plant, water reservoir, eight radio and meteorological buildings, four workshop and storage hangers, living quarters, a radiation monitoring station, airfield and large concrete jetty. (*Journal de Tahiti*, 8.3.69)



The Taku bunker

- 52 In 1971, British and American observers were stationed on Pitcairn island, 1,000 km southeast of both Mangareva and Moruroa. A schoolteacher was told by the authorities that if the level of radiation on the monitor reached 25, something would have to be done. The level reached 120, and everything on the island was ordered to be washed down. (*Chronology*, p18)

Between 1971 and 1980 the incidence of ciguatera in the Gambiers did not go below 30 percent, peaking at 56 percent in 1975. Between 1960 and 1984, each of the 500-600 inhabitants has, on average, had documented ciguatera more than four times. Fishing had previously been the major source of livelihood, and the high risk of poisoning from local fish has had considerable social impact. (*Ruff*, p13-14)

the roof of the shelter had been washed down constantly, no one told us to wash down the roofs of our own houses. No other clean-ups were considered necessary.

The first time we had to go to the shelter, we went in the morning and were allowed to return home in the evening but on the second occasion we had to stay the night. The test was called Canopus and it must have been a big one. Something must have gone wrong because it wasn't normal for us to have to spend the night in the shelter. Later, we found out that there had been some radioactive contamination. After each test the military would make a round of the island with a geiger counter. Normally, there was no contamination, but after Canopus there was contamination in Taku. They told us to throw away some barrels which contained drinking water. Contamination also showed up around the shelter. During the night it had rained and this had probably washed the radioactive dust from the sky on to the islands.

When the military first arrived, they had half the population working for them, either fishing or growing vegetables. They paid very well. However, soon after the tests began, they stopped buying the fish and shortly after that, they stopped buying the vegetables as well, although they continued to buy vegetables in Tahiti.

I think that the first signs of increased fish poisoning started about a year after the military finished the airstrip on Totegegigie. To build the airstrip, they needed a lot of cement which they made partly from dead coral from the lagoon. To do this they had to dredge the lagoon which meant that a lot of coral was destroyed. The first sign of fish poisoning appeared near the village of Rikitea and from there it seemed to spread to the rest of the lagoon. At first only a few species were affected but in the end all the fish in the lagoon were poisoned and none could be eaten. All the elders of the islands agreed that nothing like this had ever happened before in the history of the Gambiers.

We had known ciguatera before but it was very mild, and limited to a few species of fish. It didn't happen very often, and only in a few places in the lagoon. If someone did get sick from it, they would take some local medicine which usually relieved the symptoms. It was unheard of that anyone should die from it. Now it became much more severe. People were very cautious and scarcely ever ate any fish from the lagoon. However, I nearly died of it once. Luckily my kids were away at the time. Scarcely an hour after I had eaten some fish, I started to get ill with vomiting and diarrhoea. Then I began to feel itchy all over and had pains in my joints. I was unconscious for a while and my cat, who had also eaten some of the fish, died. People needed to be treated with injections and serum whereas before cucumber and coconut had been enough to cure them.

It was very difficult for us to adapt to the new situation. We were so used to eating fish that we just continued to eat them believing that we would be lucky. but after a while we had to accept that the fish was really bad for us.

Around 1970-71, another phenomenon occurred. It lasted only a few months but it was even more frightening than the fish poisoning. Dead fish were washed up on the shore. At first there were only big fish of a few species but later millions of fish of all sizes and species died. Everywhere you went there was a horrible stench. Some species were totally wiped out and even today there are none left. Millions of shellfish also died. We had to collect samples to send away to specialists for analysis. Some specialists also came to Mangareva but either they didn't discover the cause or they simply never let us know the

results of the analysis, because we never heard back from them. All we know is that such a massive quantity of fish had never died like that before.

Before the nuclear test programme began, a lot of scientists came to Mangareva to take samples of everything there; soil, plants, land animals, fish, water, everything. Others just came and observed. They watched birds and fish and made a lot of notes. Since the tests began, military people come at least twice a year to take samples. They usually come on a boat called Marara, which has a laboratory on board, but they take the samples back to the larger laboratory at Mahina too. They have never said why they are collecting these samples or what the results of the analysis are. Early on another boat came to the island with a machine on board called a 'spectro'. When the boat arrived, everyone had to get together and go on board the boat. We had to lie on a sort of stretcher, and they would play background music as you entered the machine. Then after a few minutes, you would be pulled out again. This was repeated two or three times. Some people got suspicious and upset about it, but again nobody told us anything.

Another group came, firstly military personnel and then civilians. They took blood samples, urine and faeces and gave us all physical examinations. If anyone refused to go and be examined the gendarme would come and get them.

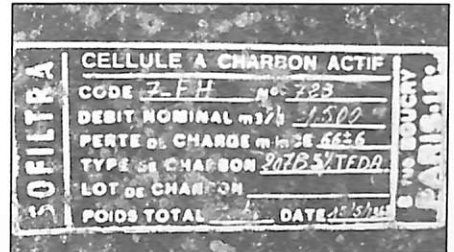
Looking back, I'm appalled at the way in which we were treated. For instance, I had a premature baby which was taken by military plane to hospital in Tahiti. The following day, I got a message to say that the baby had died. Her body was never returned to us and we never received a death certificate which means that officially the baby is still alive. I don't know how to find the military nurse who came to take the baby away – I don't know what I can do. Even now, years after it happened, I have nightmares about it.

My husband got to know quite a few of the French officers who were stationed on Mangareva to test for radioactivity. Some of them said that what was going on was very bad... that it was very dangerous and that we should be careful. Others said the whole thing was an enormous waste of money. And of course, there were some who simply enjoyed being able to spend a few months on Mangareva.

I could easily get into trouble if it becomes known that I've been talking about these things.

This incident is mentioned by most of the interviewees from Mangareva.

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(Top) Air filter from the shelter at Mangareva, dated 10 July 1968.

(above) Carbon filter from the shelter on Mangareva, dated 15 May 1968.



The SMSR biological control ship Marara

'Molestation of young girls'

Construction of a major military base at Totegegie began in 1967, but back-up facilities for Moruroa would have been erected earlier.

In *Poisoned Reign* (p75) increasing crime and alcoholism are described as a result of the influx of French soldiers. Soldiers were advised not to walk alone at night or wear uniform in Papeete because of the risk of being attacked by Tahitian men: "Owning cars and having plenty of money, they [the soldiers] could find girls without any difficulty. Each new conquest meant that a local man lost his wife or sweetheart..."

Roland, a gendarme, was sent to Mangareva in 1963 and stayed there until the beginning of 1968. His wife and their youngest child went with him but his two older children stayed in Tahiti to go to school.

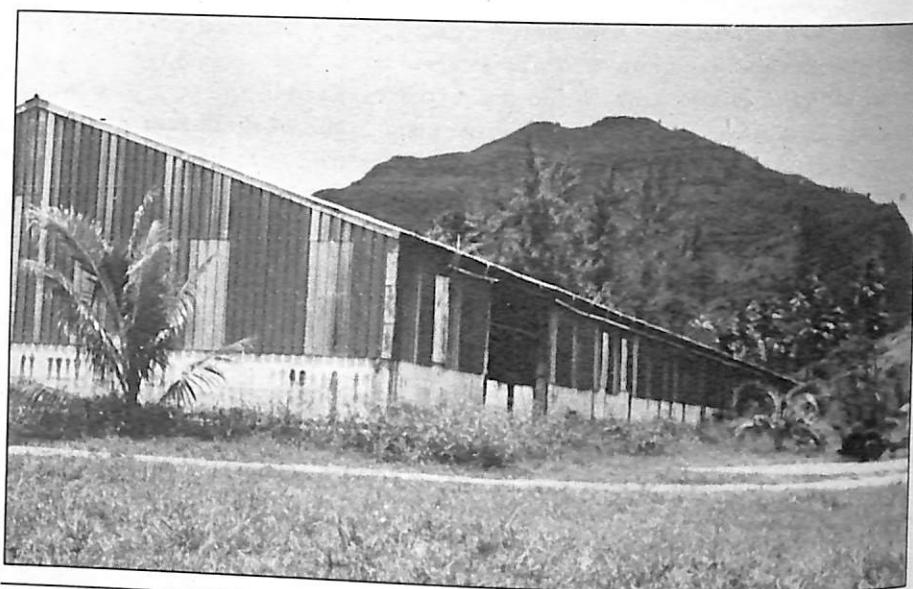
"When we arrived on Mangareva, there were 700 people living there. I was surprised to find that there were also about 20 legionnaires living on the island building a wharf and road.

The people of Mangareva lived mainly on what they grew and by fishing. Fish poisoning had never been heard of before.¹

When I was offered the posting to Mangareva, I was promised a beautiful island, nice people and no problems. However, the situation had changed with the arrival of the legionnaires. They had become the "kings" of the island because they had money and alcohol. They got women by getting husbands or fathers drunk, or by buying them off. Some of the local men had gone to work on Moruroa, which made it "easier" for the legionnaires.

Fighting and the molestation of young girls were major problems. But no legal action was ever taken, either because people struck private deals or were too afraid to speak out. Maybe it was also because of the peaceful nature of the Mangarevans. In a single year, alcohol consumption increased by five times on Mangareva.

In 1966 the first nuclear bomb was exploded at Moruroa. On Mangareva we saw the flash and a little later, felt the shockwaves. There was an earthquake. There were no shelters for this first explosion. Although they were constructed later, people didn't use them. Nobody told us about fallout.



Shelter built at Rikitea.

¹ The fish poisoning referred to, ciguatera, has had dramatic effects on the life-style of Polynesians for whom fish may be sometimes the only animal protein source. The need to avoid fish after an outbreak may exacerbate undernutrition, especially among children; fear of poisoning increases dependence on imported food which can lead to a diet with more salt, fat and complex carbohydrates and subsequent increases in chronic diseases such as diabetes, hypertension and heart disease. R. Bagnis has estimated that the annual cost of paid work-time lost as a result of ciguatera poisoning in French Polynesia was around US \$4 million per year. (Ruff p21)

'Scarcely anyone eats fish any more'

Teua lives on Mangareva.

The French first came here in 1963. In 1965, they started building the airstrip on Totegegie and needed a lot of cement for it. Some of it was brought from overseas on big boats and the rest was made here from coral sand dredged from the lagoon. They also dredged it to make channels for the large ships which brought the imported cement.

Suddenly in 1968 there was ciguatera everywhere. Every species of fish had it and even shellfish were contaminated. There had been ciguatera before but it had never been all over the lagoon and it had been limited to a few species. A lot of people got really ill... At one stage most of the dogs, cats and even pigs on the island had died from eating the leftovers of contaminated fish. We had to change our whole eating habits... suddenly everything had to come from outside, as seafood had been the basis of our food before. It is only in the last four or five years that we have started to catch and eat some species of fish again.

Another mysterious thing happened in about 1969. Over several months, thousands and thousands of fish and some species of shellfish died. Specialists came to investigate but we were never heard any results from them. This phenomenon came to an end but the contamination of fish continues.

Only three months ago, a man on the island almost died after eating a fish that was poisoned. Two hours after eating the fish he got diarrhoea and had pains all over his body. He had to be treated with injections and serums.

What the scientists claim is true. There are far fewer people getting fish poisoning nowadays. However, the reason for that is not the decrease in poisoned fish but because scarcely anyone eats fish anymore.

Other sources give the date for construction beginning at Totegegie as 1967 (*Le Journal de Tahiti*, 8 March, 1969). Both during construction and warship visits, a wide variety of materials were dumped in the Mangareva lagoon. Local officials repeatedly expressed concern that some of this material was radioactively contaminated. To date, no clean up has been undertaken there by the CEP.

The description of ciguatera outbreaks here is familiar. Along with intimate knowledge of the local marine environment, domestic animals were fed fish viscera prior to human consumption of the fish to protect people from ciguatera poisoning.

French military band in Papeete



Hans

Hans is a legionnaire who settled on Mangareva after having worked for the French military for many years. He travelled widely before settling in French Polynesia. He is married and has five daughters.

"A few months ago I ate a poisoned fish which almost killed me. Two hours after eating it, I got cramps in my stomach and then diarrhoea. It was so bad that I was taken to the infirmary where they took my blood pressure. It was 50 and my pulse was 30. They gave me a lot of serum and injections. Eventually I recovered.

I've had ciguatera at least seven times before. The first time was on Hao in 1972. I got diarrhoea, then started to itch, and later whenever I touched water it hurt. Your whole body gets very tired when you get this disease.

I've worked on many different atolls in French Polynesia. The places where they blasted away the coral during construction work would become contaminated and cause ciguatera after about two months, covering an area with a radius of 500 metres. This happened at Reao, Tematangi, Maria and Makemo.

However, at Moruroa there is a difference between ciguatera fish poisoning and contaminated fish due to radiation. People who became ill as a result of eating either had to be evacuated. In 1972 I caught a fish at Moruroa that looked very strange so I showed it to the laboratory personnel. They put it under the geiger counter and then they put my hand under the geiger counter and it showed that I was contaminated from touching the fish. I had to go and take three showers to get rid of the contamination. Besides radioactive contamination and ciguatera, the fish are also poisoned by heavy metals which have been dumped in the lagoon. The military throw a lot of waste into the lagoon.¹

On another occasion on Hao I was also contaminated. We had to wash down the planes that flew through the mushroom clouds during the atmospheric tests to measure the effects of the bomb blasts. We all wore full protective clothing. Only non-smokers and men with no beards were selected for the job to make sure that the masks would fit tightly and that people wouldn't take them off to smoke during work. But some of us did take off our masks and I contaminated my face by doing this. I had to wash it many times to get the radioactive particles off.

Hans describes classic symptoms of ciguatera poisoning, and the association between extensive death of corals and ciguatera outbreaks. Ciguatera outbreaks have been documented at Reao, Pukarua and Fakarava, where military activities may be implicated as a cause. (Ruff p15)

Several of the atmospheric tests were conducted by airdrops from Mirage IVA, Mirage IIIE and Jaguar A aircraft. Warships which had been in the vicinity of the testing areas were also washed down with seawater in the Hao, Mangareva or Fakarava lagoons. (Ruff, p13)

¹ Only one study looking at the correlation between radioactivity and ciguatoxicity has been done. No correlation was found. According to evidence from a military doctor in an interview in La Depeche de Tahiti in 1971, however, nuclear testing did have a major impact on fish life: "A few days after the first explosion (ALDEBARAN) of the 1966 testing series, it actually became necessary to prohibit the eating of all lagoon fish because they had become so contaminated that they were no longer fit for consumption. This explosion took place at sea level on board a barge. In spite of its feeble strength, it seems to have been quite poisonous for the submarine fauna. It caused massive destruction at point zero and various fission products led to secondary contaminations. Three explosions of this type occurred in 1966 and 1967". (Poisoned Reign p181)

Mahinui

Mahinui's father was born on Hao which is now the main French military base in French Polynesia.

"My father worked for the military on Moruroa and on Hao. In 1972, soon after eating a poisoned fish on Hao, he came down with vomiting and diarrhoea and his skin started to itch badly. He was sent to Mamao, but he died soon after getting there.

There was no fish poisoning on Hao when I was a child. It started at the time the French military arrived and began their activities in and around the lagoon.

The first case of ciguatera ever reported from Hao involved fish caught in August 1966 at the site where French landing craft originally landed. The first fish to become toxic were herbivores but by April 1968 sufficient toxins had moved up the food chain for carnivores to cause poisoning. In mid-1968, R. Bagnis complete a survey of medical records and a house-to-house survey and found an incidence of ciguatera of 43 percent of the population of 650, on an atoll previously free of the disease. (Ruff p11)

The geophysics laboratory at Rikitea, Mangareva, responsible for measuring seismic activity, including that caused by testing at Moruroa.



Tautu

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The sixth test was in October 1966; the eighth was in 1967. A severe outbreak of ciguatera began in Mangareva in 1968.

Tautu lives on Mangareva.

"When the military first arrived they bought all their fish and vegetables from us but after the sixth test they stopped. They gave the excuse that they had too much fish. This was even before the big ciguatera epidemic started after about the eighth test.

That's about when the huge fish poisoning episode took place too. They died in enormous numbers and the place stunk terribly. At first it was mainly the big fish that died but later there were smaller ones as well. At the same time there was some other strange phenomena. Floating rock was washed onto the shores all around the island. I'm an old diver and I'm sure the rock did not come from the island and must have come from outside the lagoon. This continued over a period of several months. I certainly didn't know what it was.

At first the military were welcome but when they stopped buying vegetables and fish we weren't so happy about them being here.

I remember one test in particular called Canopus. I was taking schoolchildren to Tahiti where they were going for further studies. In the afternoon we had all embarked on the military ship and were ready to leave the lagoon. There were no moves to leave so I asked a crew member what was going on. I was told that they had received a message to wait for a cloud to pass by up north, the direction that we were going in. I was told it was confidential and not to tell anyone else. Later, when we got to Tahiti we read in the paper that there had been a test called Canopus and that a child had been born in the shelter that night and was named after the test.

The first military doctors arrived at the time the testing began and from that time all pregnant women were evacuated to Tahiti for childbirth. This continued for some time with no explanations. I know about the ship with the spectro. I think that they came three or four times to check the inhabitants of Mangareva but I never went to have myself checked. The last time they came was at the end of the atmospheric testing.

I also got sick from eating fish on several occasions. The first time I was very ill so I became more cautious and was never that ill again. People in general became more cautious about eating fish, particularly if they didn't live on the main island where the infirmary is. Because with this new form of disease some people died - before people had only been mildly sick, and could be treated with local remedies.

Ciguatera fish poisoning is occasionally fatal (around 0.2 percent in the largest series of 12,890 cases in French Polynesia). More commonly it runs a long course over weeks, months or years. Subsequent attacks tend to be more severe, generally, than first attacks. (Ruff, p3)

'Nobody can talk freely'

Jean lives on Mangareva.

"Before the atmospheric tests started the French military asked all of us on Mangareva to plant fruit and vegetables for them, but once the tests had begun no one came to collect them. In 1979, for the first time at Mangareva we had fish poisoning on a large scale.

I've also heard of several cases of cancer, some of which have been fatal. I think they were because of the nuclear testing. On Mangareva we have a big problem, because we all depend directly on the French government and the French military for jobs and food.

Marcel is in his fifties. He was born on Mangareva and has always lived there.

"A few years after the testing began, I noticed that I was losing the sensation of touch. Now I never feel it when I get hurt on the coral. I think this is due to the nuclear testing. Since the testing began a lot of the children have started to have epileptic fits. I want to help my people fight against the nuclear testing in any way I can.

Teva lives on Mangareva.

"Before the tests started the French military used Mangareva as a holiday resort but since they began they have stayed away. We were told unofficially by some military people that in the future we would have problems with our food because of the testing. Now all our food is poisoned. The SMCB used to come regularly to take samples of fish, vegetables and other stuff to analyse but they stopped coming quite a while ago. We never received the results of any of the tests. All we were ever told was that the fish were not poisoned. A few years ago there was an extremely high number of dead fish which the authorities kept quiet.

Although the politicians say that there is no problem from the tests I know of several cases. In the past four years both my mother and grandmother have died of cancer, and I know that there are other cases of cancer on the island. I can't remember any cancer in the past. I've also noticed more handicapped children on Mangareva. The oldest of these children is six or seven years old.

There are two nuclear fallout shelters on the island built out of corrugated iron. One is for the military and the other, which can accommodate 600 people, is for civilians. It has water and toilets inside and even a basketball court! Before a test the CEP people would arrive with tinned food and ask everyone to move into the shelter. I went there twice; the first time it was for half a day. After the test the shelters were decontaminated.

After each test everyone on Mangareva was paid a certain sum of money. Nobody on Mangareva can talk freely about the issue because we depend so much on the government and the military.

In fact, a major outbreak of ciguatera poisoning was first documented on Mangareva in 1968. An error in transcription of the interviews might explain this discrepancy.

Figures released in 1990 by the SMCB noted that the weakest radiation dose of the outer islands was on Hao, and explained that this was because fewer local products were eaten there as most food was imported by the military base.

Radiation is linked to specific cancers such as leukemia and tumours of the thyroid. Genetic damage in humans is estimated to double at exposure to 60 rems or more of radiation.

Hiro also talks of money being paid to people on Mangareva. Teva's house was destroyed by a fire a month after giving this interview. Two of his sons lost their jobs with the government for no apparent reason.

'The jewel of my life'

60 On 3 July 1970 the Tahitian press reported that: "Since France began testing nuclear bombs here, more than 35,000 samples of fish, crustaceans, fruits and vegetables have been taken in the territory of French Polynesia and analysed in the radiobiological laboratory at Mahina. Every week the laboratory receives two hundred samples of fish, spiny lobsters, pawpaws, mangoes, bananas etc. To start with they are dried and calcined. The ashes are crushed, pulverised and pressed into pellets which are put into a lead chamber where their radioactive contents, if any, are determined." However, the UN Scientific Committee on the Effects of Radiation (UNSCEAR) regularly deplored the paucity of data from the SMCB. The New Zealand representative in 1973 said "his delegation could not accept a resolution which sought to base complacent conclusions on a partial picture of incomplete data". (*Poisoned Reign*, p179-180).

Tamatoa was interviewed in an aeroplane en route from Mangareva to Papeete, where his son was going for a medical checkup.

"I don't want to give my name because I'm scared there might be repercussions. My son is eight. He is the jewel of my life.

He is handicapped, I think because of the testing. Before the testing started there were no handicapped children on Mangareva.

In the beginning the nuclear tests brought money but now all they bring is illness. I am a farmer, I've seen how the animals also seem to be sick now, and the banana trees no longer bear their usual crop. The bananas fall off before they ripen.

I'm against the tests... I think they should stop them now.



Women at the Papeete market. Samples of produce from the market are monitored by the authorities.

'They drink until they can't drink anymore'

Therese married a man from Tureia a few years ago, and has lived on Tureia for the past four or five years.

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There are about 100 people living on Tureia, if you include the children and those who are on Tematangi cutting copra.

In the past there were quite a few military living on the island. But they have all left now, except for two people who look after the meteorological station. While the military was here there was always a doctor on the atoll but since they left there has only been a nurse. The airstrip has just been finished so that people can be evacuated if need be. Today, from the fifth month on, every pregnant woman is evacuated.

Luckily there was a doctor around when I got ciguatera after eating a fish. I got very sick and had to have a lot of injections. I think I would have died otherwise. It was silly of me to eat the fish, I guess, as it is known that almost all the fish from the lagoon and even the reef fish on the ocean side are contaminated.

There are two bunkers on the atoll. One was for the military and the other one was for the civilians. We haven't used them recently as the bomb explosions have all been underground. But in 1983 we had a cyclone, so we all used the bunker. Once we had got inside and closed the door we couldn't hear a thing of what was going on outside. The walls and doors were very thick. When the cyclone was over we came out and saw that the whole village had been totally destroyed.

The houses have all been rebuilt now. They are very luxurious with sliding doors and windows and smart inside. Most people have videos and there are quite a lot of motorbikes and one or two cars even though there are scarcely any roads. We manage to get these goods with the money we earn from selling copra. Copra is subsidised so we get good prices for it. With the money people here also buy a lot of alcohol. It's a real problem on Tureia. It was freely available in the past especially when the military were there. The CEP sold alcohol. And people tend to drink until they can't drink any more. Mainly on Fridays and Saturdays but other days as well.

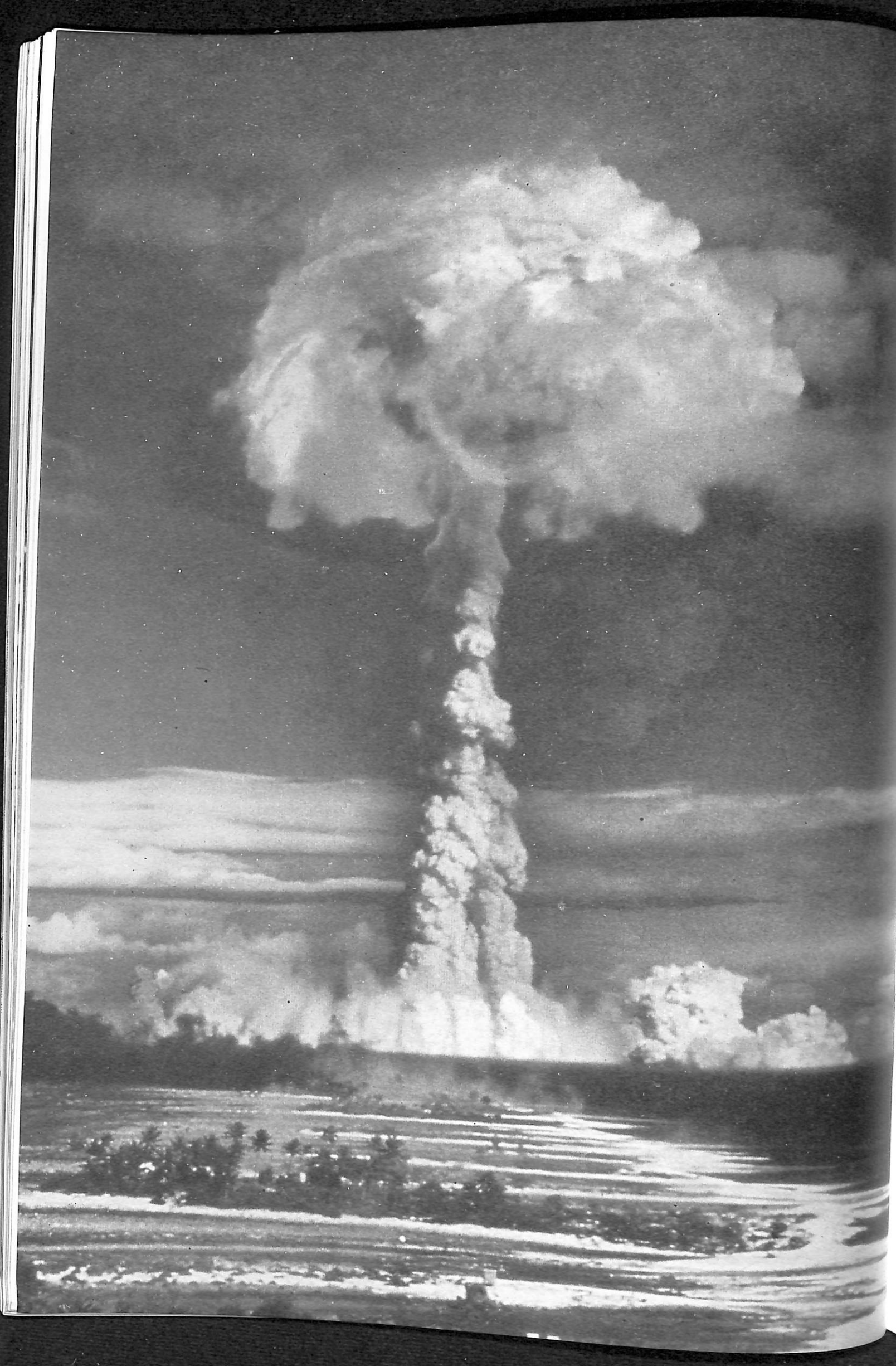
A lot of the coconut trees are damaged. They don't give as much copra as they used to. Something has made them weaker and there are also insects now which make the crop even smaller.

I think there have been more skin diseases on the island since the atmospheric tests started. Quite a lot of kids have skin eruptions a bit like burns which itch and then get infected and start to suppurate. There is one child who was okay at birth, but when she was five she started to have eye problems and she's now partially paralysed and cannot walk. In the last four years since I have been on Tureia there have been two deaths which could have been cancer. My mother-in-law, who had always lived on Tureia died, at 61 years of age, of cancer of the intestines, I was told. She had lost blood through her anus. The mother-in-law of a friend of mine who had also lived on Tureia all her life died of a problem with her throat. She started to have difficulty swallowing and then found it difficult to breathe. She had an operation at Mamao – they put a tube down her throat so that she would be able to breathe again. She came back to Tureia to die.

The economy of the Tuamotus is based on cultured pearls and copra. Harvesting copra is tedious, back-breaking work that involves splitting ripe coconuts with a machete, drying them in the sun, plucking the meat out and drying the meat once more. Generous subsidies from the government keep the price of copra artificially high to ensure it provides a worthwhile income. However, production of copra fell dramatically with the arrival of the CEP, and production fell 40 percent between 1962 and 1967.

Ciguatera incidence between 1960 and 1984 in the Tuamotu Archipelago averaged 1,700 cases per 100,000 every year. (*Ruff*, p17)

There were several cyclones in 1983. On 25 January, Cyclone Nano, with winds of 150km an hour, swept through the Tuamotu Islands, leaving hundreds homeless. Military installations on Hao were devastated. On 23 February, Cyclone Orama struck the Tuamotus, flattening coconut plantations and increasing the number of homeless. French authorities provided detailed information of all damage incurred in the Tuamotus, with the exception of Moruroa atoll. In April, the French newspaper *Le Canard Enchaîné* published a document from the Civil Protection and Prevention Commission of the Superior Council of Meteorology in France dated 23 March, stating that all atolls in the Moruroa area suffered extensive damage as a result of the cyclones. The report also indicated that the Gambier Island group had been moved on the Superior Council's map several degrees north east, so that cyclone Reva, which passed over Moruroa in March, would appear to have missed the Gambiers. (*Chronology* p36)



Maeva

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Ionizing radiation can induce structural changes in chromosomes. Chromosomal mutations are responsible for a small percentage of congenital abnormalities in live births.

Maeva lives on Mangareva.

"I've got two children. Just a few months ago I had a healthy baby girl. But my oldest, Pierre, has an abnormality. He was born without an anus and had to be operated on immediately. They discovered that he had something wrong with his kidneys too, and he has been operated on twice for this in Paris. Recently they gave him an ultrasound scan which showed his waterworks are also damaged. He often gets urinary infections which have to be treated with antibiotics. In a few weeks we have to go back to France for yet another operation to close the artificial anus that was formed in the first operation and to try to get his original one working. Pierre is 19 months old now, but he still doesn't walk. But at least he is crawling now and can say a few words.

Women protest against nuclear testing in Papeete



'The water looked like wax'

The final interview with Hopu illustrates how the secrecy surrounding the nuclear programme breeds paranoia and self-censorship, affecting both those working at the test site and those outside of it. The blanket of silence about the effects of nuclear testing, resulting from fear and official repression, means the nuclear programme goes largely unchallenged. These testimonies aim to break that silence by, as Hopu says, "letting people hear the truth about what is going on out there".

Hopu worked for the CEA from 1973 to 1977 as chief engineer on the M/V Marara. During tests, the Marara was on standby near Moruroa to collect scientific data on the consequences of the tests.

"We were close enough to hear, see and even feel the explosion. Usually we weren't allowed to look at the explosion, but once I was given special dark glasses and allowed to look out of a port hole. I saw the fireball rising and the mushroom cloud forming. We were so close I damaged my eyes in spite of the special glasses, and they were very painful for some time afterwards.

Apart from the pilots who flew the Mirages through the mushroom cloud, we were the first people to move in after the explosion.

Half an hour after the explosion, we would approach Moruroa to take samples of sea water. The water didn't look like water any more. It was thicker, and looked like wax. This must have been because of the bomb, but I don't know exactly what changed the water.

We stayed there about 24 to 48 hours taking samples and measuring them in the laboratory on board. All that time we had to wear special suits and masks to protect us from the radioactive dust. It's really tough to have to wear the suits for 24 hours. On top of that we all had to wear a badge which measured the amount of radiation. Of course, they never told us what the result was. Still, you could tell from the precautions that were taken that the sea and the air had been very heavily contaminated. Besides wearing suits, we weren't allowed to flush the toilets because seawater would be taken in. And the engineers were told to keep well clear of the cooling system in the engine room which ran on seawater in case a pipe burst.

As soon as the whole thing was over, the whole boat was thoroughly washed down. However, I was never given a health check – no blood tests, no checks with the "spectro". That seems really strange – I've been married since 1974 but even though we've tried hard we've never had a child together. This might be because of my exposure to radiation.

In quiet periods in between tests, we had to go to other atolls and islands to take fish and other samples to check for contamination. I know that after the big atmospheric tests, fish that we caught hundreds of miles away and analysed on board showed radioactive contamination.

Things got a little better when the tests went underground. Again we had to heave-to a few miles off Moruroa until the explosion had taken place. There was nothing to see now, but you could still feel the shockwave. A few seconds later we would get the command to approach the atoll again and take water samples. As the explosions were underground we didn't have to wear masks or protective clothing.

But in 1977 there was this one test called Dindon. Although we were at least three miles off the coast, we saw an explosion on the atoll with dirt and water flying into the air, many metres high. It didn't last long and then when we came

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The first airdrop was the TAMOURE test, on 19 July 1966. During France's first nuclear weapons test in Algeria, primarily to test the effects of nuclear weapons, military equipment including aircraft were exposed to assess their survivability in a nuclear environment. Following this test, codenamed GERBOISE BLEUE (13 February 1966), a pilotless aircraft measured the radioactivity in the interior of the atomic cloud, while measurements close to the ground were aided by helicopters. (FNT p25)

French official documents claim that 'coastal fishing regions and international waters were practically free of any contamination apart from that attributed to global fallout... A network of samples covering the whole of Polynesia was set up and systematic analyses have made it possible to monitor the influence of fallout on the foodchains... the levels of radioactivity remain extremely low... and are to a large extent attributable to global fallout.' (White Paper on French Nuclear Testing, Ministry of Foreign Affairs 1973)

- 66 This test may have been confused with one named NESTOR on 24 November 1977 which resulted in a submarine slide and tidal wave. NESTOR had a yield of 55 kilotons. This test was noted in Tazieff's report.

in closer we saw that part of the atoll had completely vanished into the sea. Then we were told to put our protective clothing and masks on and get badges to stick on our suits.

We started to ask questions and wanted to know what was going on. So the head of operations, Monsieur Joli, told us to assemble in the laboratory. There he told us that there had been "venting" – leaks – and that people should not go on deck. We could look out of the portholes but had to stay inside. As I was a representative of the unions and had to translate what he said from French into Tahitian so that everybody would understand, I took a few notes. When the military saw what I was doing they immediately thought I was a spy. Three days later when I got back to the quay at Moruroa, the gendarmes were waiting for me. They told me that I had to go back to Tahiti, but I told them that my boss was the captain, not them, so I went to see my captain. The captain pretended not to know anything and told me that maybe someone in my family was sick. So I had to leave and go back to Tahiti. But before leaving, I asked him to write me a discharge paper, but he wouldn't do it. The captain said it wasn't necessary and that everything would be sorted out in Tahiti.

When I arrived in Tahiti, there were four guys from the military security service. They started to question me on the notes I had taken. I told them over and over that I wasn't taking notes on the bomb, that I didn't know anything about bombs. But nobody wanted to believe me. They insisted that I was spying, and I repeated that wasn't the case. So they started to threaten me. They told me that they would put me into prison, but I said that even if they put me into prison I still hadn't done anything wrong. So at the end they forced me to give up my job.

After that they asked me for permission to search my house. I gave it, and they searched from top to bottom without finding anything. After all that, of course I couldn't get another job. I was sitting around for over a month doing nothing, and I decided I would have to do something about it. I went to see the President of the Territorial Assembly, but he was too scared to get involved in anything concerning "affaires d'etat".

So finally I went to see my brother who had a good friend in the CEA. When this friend heard the whole story he intervened, and talked to a few people, so that I got my job back again, but on a different boat.

This was possible because a judgement was made on my case, and the admirals who were my judges said that I was right and the guy on the Marara who started the whole thing was wrong. So they let me have the job on the condition that I would never ever talk to anybody about this. But I think it's important that people start to hear about what is going on out there. I want the nuclear tests to stop, so I have to speak out.

Epilogue

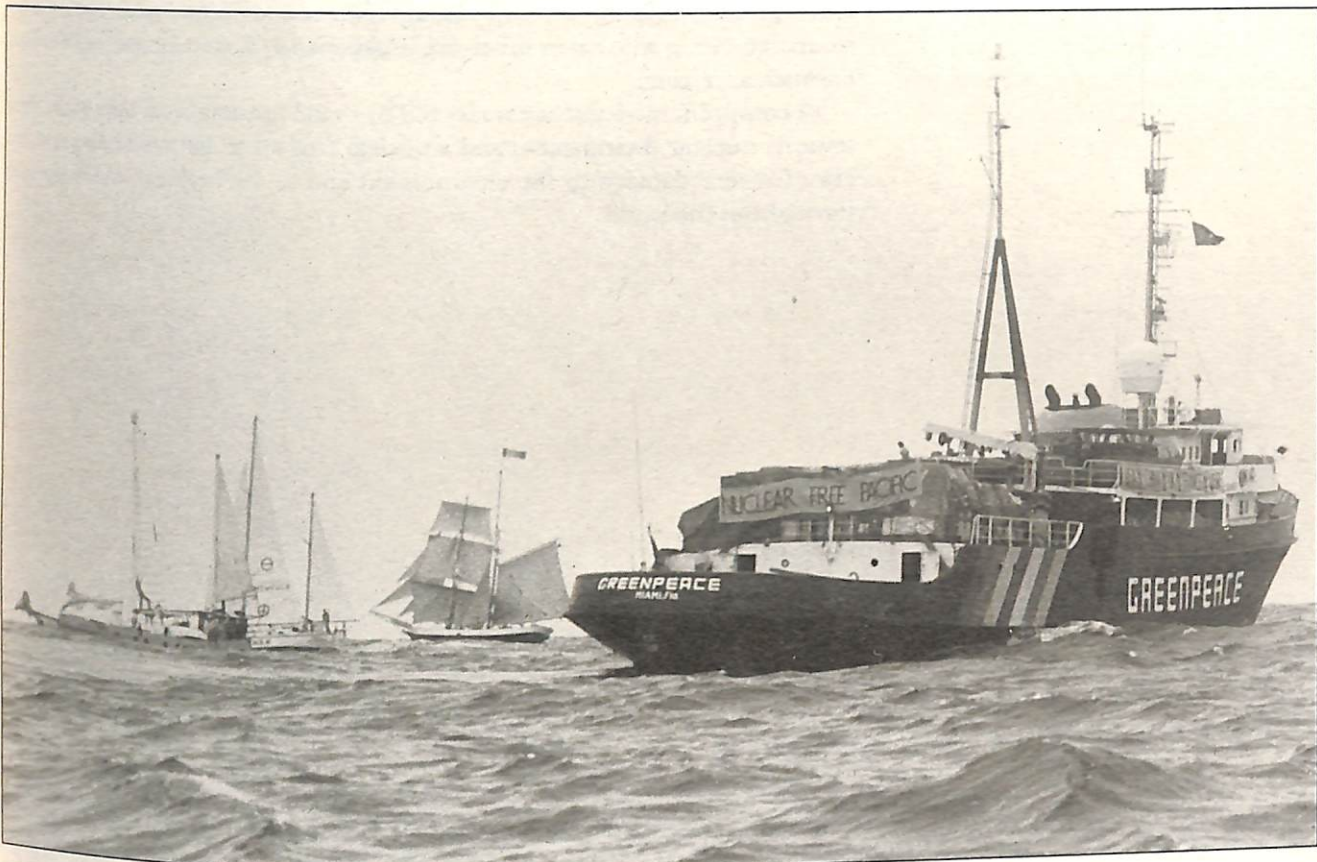
While this book deals with the test programme in French Polynesia, similar stories can be told from several other countries in the Pacific region. The people of the Pacific have suffered the effects of foreign nuclear weapons testing for over 40 years. The United States conducted tests at Bikini and Enewetak in the Marshall Islands, and at Johnston and Christmas Islands (Kiribati); the United Kingdom at Monte Bello Island, Christmas Island and in Australia. In each of these test sites the indigenous people have experienced long-lasting health and environmental damage, as well as the devastating impact on their culture of the presence and activities of thousands of foreign military personnel.

The people of Bikini and Enewetak in the Marshalls were evacuated from their birthplace so that the US tests could take place there. They were told there would be no danger to their health, and that the tests were being done for "the good of mankind". However, radioactive fallout from the tests, particularly from the blast codenamed Bravo on 1 March 1954, contaminated a wide area. Today the inhabitants of at least seven atolls in the northern Marshalls suffer from radiation-induced illnesses such as leukaemia, thyroid cancer, and miscarriages. Rates of still births and children born with disabilities have increased. Many people will never be able to return to their home atolls, which remain too contaminated for habitation.

During the British nuclear tests at Emu Field and Maralinga in the Australian desert, soldiers put up signs to warn people to keep out of the test area. The Aborigine people whose land was being used for the tests could not read the signs and were not informed of the danger. The effects of radiation on

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The vessel *Greenpeace*, flanked by a flotilla of peace yachts, approaches Moruroa to protest French nuclear testing in 1985.



the Aborigine people has not been well documented, but in 1985, an Australian Government commission revealed that 20 kilograms of plutonium still remain spread over the Maralinga desert as a result of the British tests there 30 years ago. (Plutonium is one of the most dangerous substances known to the human body, and has a half-life of 24,000 years.)

By the beginning of the 1980s, higher than average rates of cancer, sterility and other radiation-related illnesses had been observed among the thousands of British, New Zealand, Australian and American servicemen who had been involved in the nuclear tests in the Pacific in the 1950s and 1960s. While compensation had in some cases been awarded to test veterans, France's agreement with the Territorial Assembly in French Polynesia exempts them from any liability to clean up or compensate for the effects of the nuclear testing programme.

Ever since the first nuclear bomb was dropped on the people of Hiroshima in 1945, we have learned that radiation is far more dangerous than scientists initially claimed, and that the authorities have consistently underestimated, and sometimes lied, about its effects on health and the environment. For example, it was only in 1987 that re-assessments of the radiation dose received by the survivors of the Hiroshima and Nagasaki atomic bombs forced the International Commission on Radiological Protection to dramatically change its cancer risk estimates from one extra cancer death for every 100 sieverts of radiation to at least twice this number.

Greenpeace was born in 1971, when a group of people sailed a boat to Amchitka in the Aleutian Islands to protest against US nuclear tests there. Since then, Greenpeace has protested against all the nuclear testing countries - the United States, Britain, the Soviet Union, France and China - and continues to campaign along with many other organisations world wide for a complete ban on nuclear testing.

A comprehensive test ban treaty (CTB) would not only be an important step towards nuclear disarmament and a nuclear free world, but would also end an era of severe damage to the environment and to the health of many people throughout the world.

Acronyms

- CEA (Commissariat à l'Energie Atomique)
The French Atomic Energy Commission, responsible for all aspects of the French nuclear warhead programme, including warhead design, manufacture and nuclear materials production.
- CEP (Centre d'Experimentations du Pacifique)
The Pacific Test Site.
- CFDT (Confédération Française Démocratique du Travail)
French trade union representing technicians employed at Moruroa.
- DIRCEN (Direction des Centres d'Expérimentations Nucleaires)
Charged with preparing and supporting the tests, and directly subordinate to the French Ministère de la Defense.
- DSIR (Department of Scientific and Industrial Research)
The New Zealand government department which monitors French nuclear tests through its seismological laboratory in the Cook Islands.
- SMCB (Service Mixte de Contrôle Biologique)
The branch of DIRCEN charged with radiological surveillance and safeguarding food, animals and drinking water.
- SMSR (Service Mixte de Sécurité Radiologique)
The branch of DIRCEN, composed of personnel from the army and the CEA, responsible for radiological safety and protection of the population from radioactivity.



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(Opposite) High-ranking US personnel watch an atomic detonation during Operation Greenhouse at Enewetak in 1951, 12.5 miles from ground zero.

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