

## **Mururoa: Environmental Risks and Climate Change**

If the effects of 46 aerial explosions carried out by France at Mururoa and Fangataufa are measured today by the repercussions on the health of personnel involved on test sites and the general population of the Polynesian islands, the ecological consequences of underground tests are just as much a Sword of Damocles hanging over future generations.

One of the greatest errors made by those responsible for France's nuclear tests is to have chosen atolls in the middle of the ocean to carry out underground testing. The Americans, who began their aerial testing in the Pacific and carried out several underground experiments in the substratum of low lying islands off Alaska, quickly understood the environmental danger of such underground explosions for the islands and chose Nevada test sites instead.

### **Errors gravely prejudicial to the environment**

After 137 underground tests at Mururoa and 10 at Fangataufa, all carried out at a depth of between 400 and 1000 metres, these two atolls remain – in the middle of the ocean – seats of risk for contamination of the environment due to the remaining radioactive materials, having a life expectancy of more than tens of thousands of years.

With the indiscriminate dumping at sea between 1972 and 1982, off Mururoa Pass and the Denise zone, of more than 2700 tonnes of radioactive waste, the risks of contamination of the living oceanic environment increased and have never been verified by independent experts.

Furthermore, Fangataufa's radiological state and geological stability give rise to legitimate doubts, given that no control or permanent follow-up processes have been installed on this atoll since the end of testing.

The altitude – height above sea level – of these two atolls is never more than three metres. Fangataufa's north east and Mururoa's south west zones are regularly covered by the Pacific's largest swells. Global warming, together with the probable rise of ocean levels, will thus crash headlong into these two nuclear atolls. Radiological and geological monitoring will be impossible and the risks of contamination of the oceanic living environment will be abandoned to the whims of climatic vagaries.

### **Short term danger**

Military authorities at Mururoa violated elementary legal rules regarding management of radioactive waste. Thousands of barrels of radioactive waste, loose contaminated material, were used to plug the top of 25 underground firing shafts. Whereas the rule concerning management of radioactive waste is the absolute prevention of any contact with water, the Mururoa shafts used for this purpose are today in water or situated in zones at risk of sinking.

By way of comparison, radioactive waste of a similar nature (very weak or weak activity) is stored in France – for 300 years – in sites at La Hague and Soulaines, which are highly protected from the surrounds and from rain and underground water.

What is the exact situation at Mururoa ?

**Contents of 27 radioactive storage shafts at Mururoa**  
(Ministry of Defence document 2006)

**LOCATION OF EXPERIMENTAL SHAFTS USED FOR WASTE STORAGE**

NAME	Years Buried	Number of Collars & Barrels	Volume of Aggregates & Scrap Metal in m3	Total Activity $\alpha$ At time of Burial	Total Activity $\beta \gamma$ At time of Burial
ARA 5	1981-1982	878	0	2,2.10 <sup>9</sup> Bq	Nil
ARA 6	1982	159	0	NS	Nil
ARA 7	1984	161	0	5,9.10 <sup>7</sup> Bq	Nil
DAHLIA 7	1982	27	0	NS	Nil
DAHLIA 8	1984-1985	883	0	3,4.10 <sup>10</sup> Bq	1.10 <sup>12</sup> Bq
DORA 5	1996-1197	163	0	2,6.10 <sup>9</sup> Bq	8,9.10 <sup>8</sup> Bq
DORA 7	1996	141	0	4,4.10 <sup>8</sup> Bq	2,75.10 <sup>10</sup> Bq
EDITH 8	1983	55	0	4,5.10 <sup>8</sup> Bq	Nil
FRANCOISE 1	1980	398	23	NS	2.10 <sup>11</sup> Bq
FRANCOISE 8	1982	137	0	NS	Nil
FUSCHIA 2	1981-1982	59	3	NS	Nil
FUSCHIA 3	1982	264	550	NS	Nil
FUSCHIA 4	1987	52	480	7,4.10 <sup>9</sup> Bq	3,5.10 <sup>11</sup> Bq
FUSCHIA 5	1986-1987	532	20	5,8.10 <sup>8</sup> Bq	3,4.10 <sup>11</sup> Bq
FUSCHIA 6	1987	61	662	1,0.10 <sup>10</sup> Bq	3,5.10 <sup>8</sup> Bq
QUEEN 5	1982	205	0	NS	Nil
THERESE 2	1982	354	0	NS	Nil
THERESE 3	1983	577	0	3,5.10 <sup>9</sup> Bq	3,0.10 <sup>9</sup> Bq
URSULA 1	1988-1995	604	0	1,9.10 <sup>9</sup> Bq	1,8.10 <sup>13</sup> Bq
VIVIANE 3	1982	832	0	1,0.10 <sup>8</sup> Bq	4,0.10 <sup>10</sup> Bq
YVONNE 2	1984	325	0	1,2.10 <sup>9</sup> Bq	9,3.10 <sup>9</sup> Bq
YVONNE 3	1986-1987	99	725	9,1.10 <sup>9</sup> Bq	4,2.10 <sup>10</sup> Bq
YVONNE 4	1987-1988	266	522	1,4.10 <sup>10</sup> Bq	7,3.10 <sup>11</sup> Bq
ZOE 3	1983	420	0	7,4.10 <sup>8</sup> Bq	Nil
ZOE 4	1984	117	0	4,4.10 <sup>7</sup> Bq	Nil
PS 1	1979-1996	3332	628	2,1.10 <sup>13</sup> Bq	7,0.10 <sup>11</sup> Bq
PS 3	1983-1997	425	1110	2,3.10 <sup>12</sup> Bq	2,2.10 <sup>7</sup> Bq
TOTALS		11 526 Collars & Barrels	4 723 m3 Aggregates & Scrap Metal	2,3.10 <sup>13</sup> Bq	2,1.10 <sup>13</sup> Bq

NB : NS = not a significant measured result

**Location of storage shafts on Mururoa map**

The Ministry of Defence document (distributed to COSCEN members in 2006 by the Delegate for Nuclear Safety Defence) comprises, together with the above table, a basic map, indicating the position of storage shafts around Mururoa, with a letter followed by a number.

This cartographic presentation is quite insufficient. In reality, there is no indication as to the state of the different zones of the atoll, where shafts exist. And yet, this information is vital in order to understand the environmental risks.

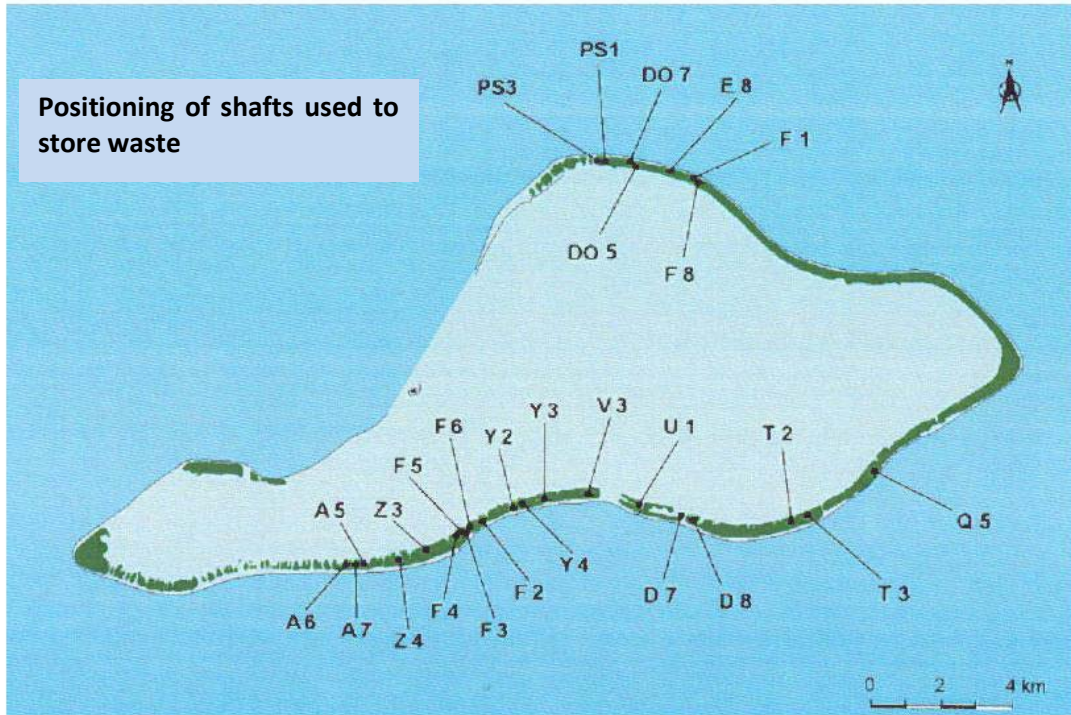


Figure 1 - Map of Mururoa showing position of radioactive waste shafts

All positions of waste shafts in Figure 1 correspond to firings of underground explosions, for which it is important to know the energy level. Thus it will be possible to measure the risks of ground destabilisation and of cracking.

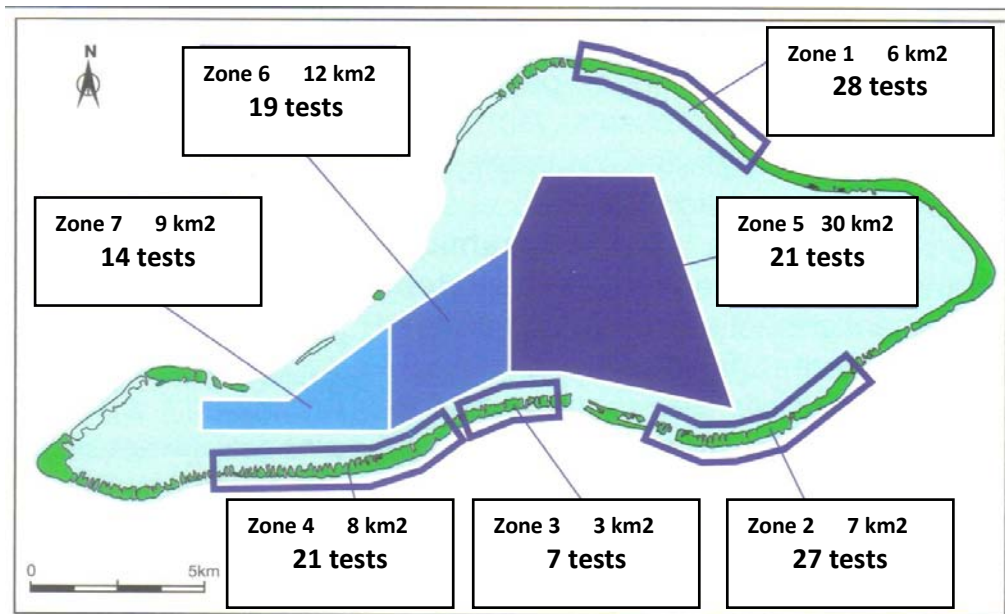


Figure 2 : Mururoa underground tests by zones (Ministry of Defence document)

Underground explosions, especially on Mururoa's outer reef, resulted in serious problems of geological stability. This is the main reason for moving to test under the lagoon from 1981, following serious collapsing in the south east zone in 1978 and 1979

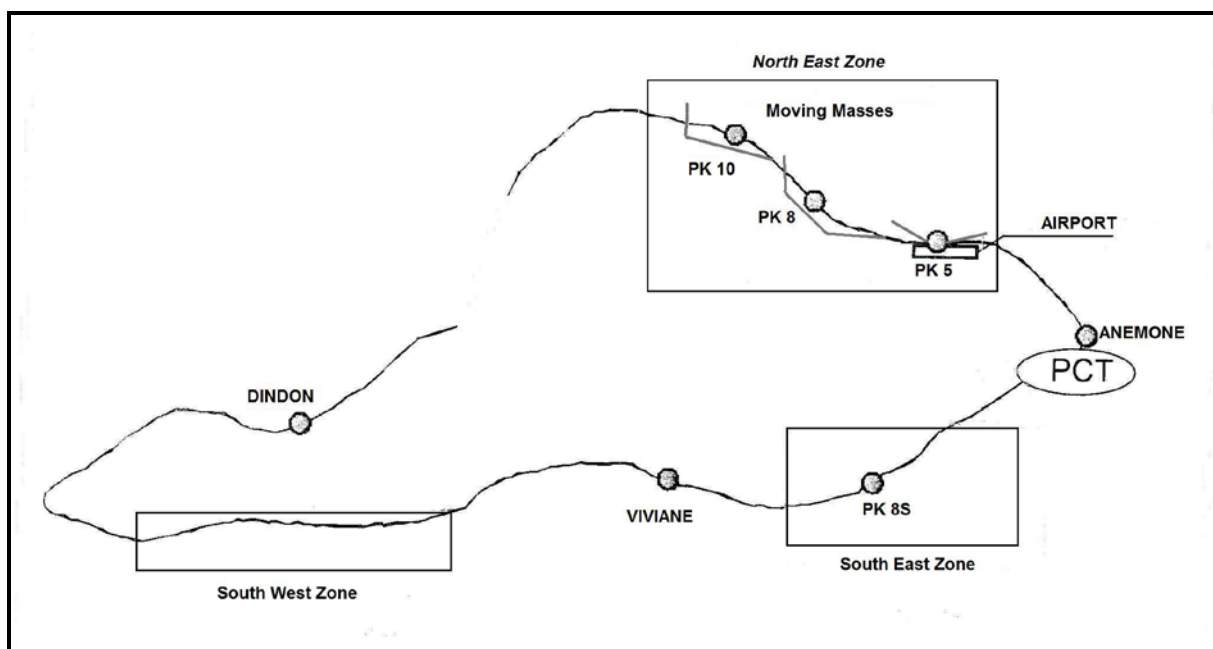


Figure 3 : Areas of Mururoa weakened by underground explosions (Ministry of Defence document)

It can be seen that shafts having been used to store radioactive waste are situated in the zones which have been weakened and fractured by underground testing. In the case of destabilisation or collapse of part of an ocean cliff, not only radioactive material remaining from the underground firing, but also contaminated material from the tops of the shafts will be found in the ocean.

#### Mururoa: South West Zone

- The surrounds of storage shafts are not concreted
- Radioactive waste stored in shafts in Ara, Zoé, Fuchsia, Yvonne zones – see fig. 1
- Heads of these SW zone storage shafts (Ara, Zoé, Fuchsia, Yvonne) are under water – see fig 4 & 5
- All these shafts are in an area at danger of ocean cliff collapse on the ocean side (see fig. 3). Collapses already happened:
  - o 30 November 1978, collapse of cliff following Priam firing at Coucou (west of Ara).
  - o 25 July 1979, collapse of cliff after Tvdée firing at Ara.

#### Mururoa: North Zone

- Edges of storage shafts not concreted
- Radioactive waste stored in shafts in Dora, Edith, Françoise zones (see fig. 2)
- The two shafts with very high activity (VHA) radioactive waste in Denise zone.
- Plutonium remains in Colette zone, on the outer reef and edge of the lagoon 10 metres down.
- Dora, Edith and Françoise shafts are situated in the Mururoa zone where the collapse of the ocean cliff is considered at the moment as a great danger (see fig. 3 & 6).

**Mururoa: South East Zone**

- Edges of storage shafts not concreted.
- Radioactive waste stored in shafts in Ursula, Dahlia and Thérèse zones (see fig. 1)
- All these shafts are in a zone in danger of collapse (see fig. 3)

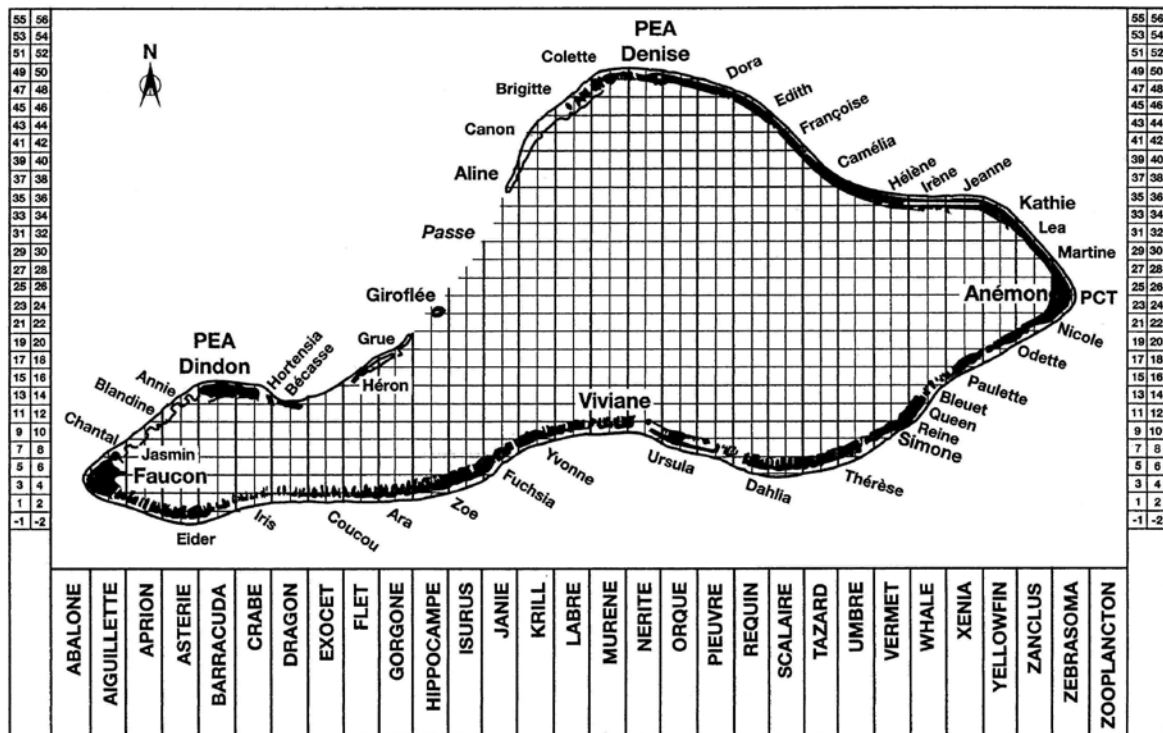


Figure 4 : Mururoa site names and grid (Ministry of Defence document)

The most urgent environmental problem is that of the south west Mururoa zone where the tops are under water (fig. 4). In reality, the altitude compared with sea level is very low, but underground explosions caused, as well as the collapse of ocean cliffs in 1978 and 1979, a general weakening of the land. Is radioactive waste from shafts in Ara, Zoé, Fuchsia and Yvonne zones lying in the waters of the lagoon ?

**Rise in ocean level: a serious danger**

Annual reports from the Ministry of Defence on “the surveillance of Mururoa and Fangataufa atolls” never mention climate change risks, nor earthquake or tsunami repercussions on these weakened atolls.

Even if the rise in ocean level is progressive, there is no doubt that the cracks on Mururoa's north zone risk becoming wider, thus causing collapses sooner than forecast by geologists.

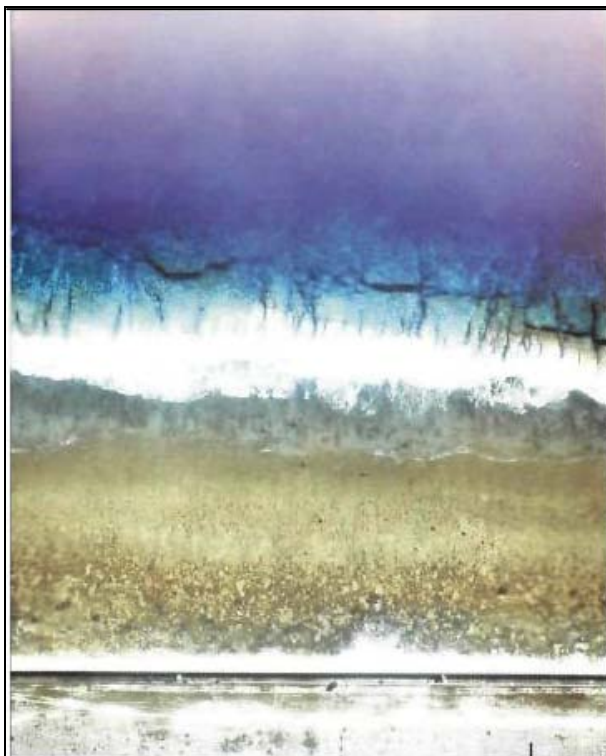


Figure 5 : The tops of the submerged south west zone firing shafts(1999 Fairhurst Report document)

The latest report of the Mururoa geo-mechanical audit (2007) carried out by the CEA (Atomic Commission) insists on the necessity to continue surveillance and concludes in these not very reassuring terms:

*“Concerning understanding of geo-mechanical behaviour, the measurements confirm that movements at depth continue to appear in all three zones. Their respective movement, although slow, evolves at different speeds, bringing about concentrations of constraints at their edges, regularly released and provoking small seismic activity. In Camélia zone the slide is slower, but affects a larger volume of rocks, including part of the submerged outer reef, where a network of fractures is visible from the surface, making the zone probably likely at risk of cliff falls. The most rapid movement at depth are taking place in Françoise zone.”*

In fact, it is this that is the most disturbing: CEA geologists do not have the technical means at their disposal to oversee the evolution and land movements “*deep down*”, which, according to their interpretation, could be “*still active*”. Now, at depth, at the level of cavities caused by underground explosions, the place where there is most danger of spillages of nuclear materials and contamination of the oceanic environment is to be found.



*Figure 6 : Cracks, 2 metres wide, visible under surface waters of Mururoa's north zone. (Fairhurst International Geo-mechanical Commission report document 199)*

### **The environmental consequences of nuclear testing must be studied**

This information sheet gives a few ideas for deeper and more concrete consideration of the environmental consequences of nuclear testing. France is very behind in matters of conscious, compared with large scale environmental restoration undertaken by the United States in the Marshall Islands and by the United Kingdom in Australia and on Christmas Island.

During a parliamentary debate on the Morin Law, the minister rejected amendments, including the environmental consequences on nuclear testing. Following the Minister of Defence's line, the Economic Affairs Committee also rejected the Minister of the Information Mission's proposal on environmental aspects, presented by the Polynesian Senator Richard Tuheiava.

This "resistance" towards inescapable evidence as to environmental damage caused by nuclear testing, happens to be contrary to the Central Government's aim of making the environment a "hard core" of its action, both domestically and internationally.

In order to follow up the consequences of these tests, Polynesia is ahead of mainland France with COCEN and the Delegation. These "institutions" are today reinforced by the support of organisations for the defence of the environment, which have added the nuclear fact to their concerns.

We are wagering that these Polynesian thoughts on the environmental consequences of nuclear testing will enable the "resistance" and official overcaution of our Metropolitan partners to be overcome.

*English translation : Barbara M. Dutton*