

Prepared for the South Pacific Forum

A Report on the International Conference on the Radiological Situation at the Atolls of Mururoa & Fangataufa

SOPAC

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FOREWORD

This report was prepared following a request from the Forum Secretariat for SOPAC to represent the region at the International Scientific Conference held at the IAEA Headquarters in Vienna, 30th June-3rd July to discuss the results of the IAEA study on the radiological situation at the atolls of Mururoa and Fangataufa.

The report was subsequently sent in final draft form to the Forum Secretariat, who tabled it at the 1998 Pre-Forum, Forum Officials Committee Meeting in Pohnpei, 21-22 August. [Document SPFS(98)OCP.16].

The Officials Committee reported to the Forum and as a result the Forum Communique states in paras 50, 51 , 52, 53:

50. The Forum noted that the finding of the International Atomic Energy Agency (IAEA) Study indicates negligible residual contamination as a result of nuclear testing. Leaders recalled that the Forum had called for such a study to be carried out and expressed appreciation that the results of the study had been presented to the region prior to publication and subsequent international scientific scrutiny.
51. Leaders commended Dr Vili Fuavao for his participation as the Forum representative on the International Advisory Committee which undertook the study as well as Dr Shorten of the South Pacific Applied Geoscience Commission who represented the region at the International Scientific Conference in Vienna to review the results of the study.
52. Leaders agreed that the concerns by the Forum representative at the International Scientific Conference about the lack of geological detail in the International Atomic Energy Agency (IAEA) Study on the Radiological Situation at the Atolls of Mururoa and Fangataufa should be fully assessed and responded to.
53. The Forum called on France to carry out ongoing radiological monitoring of the environment on Mururoa and Fangataufa, and strongly urged France to address fully, concerns of the people of French Polynesia especially regarding the possible health effects of the nuclear testing programme.

The release of this report as a SOPAC Publication, now completes the reporting on this activity.

CONTENTS

1. OVERVIEW OF EVENTS LEADING TO THE STUDY AND CONFERENCE....	4
2. HIGHLIGHTS OF SPF INVOLVEMENT.....	5
3. ATTITUDES OF PARTICIPANTS.....	7
4. ISSUES OF CONCERN AND QUESTIONS POSED	9
5. SUMMARY	5
6. OTHER REPORTS	20
7. APPENDICES	21
• Conference Program	
• Participants List	
• Text of Questions by SPF Representative	
• Closing remarks and Summary of Conference Chairman	
• Report Volumes	

1. OVERVIEW OF EVENTS LEADING TO THE STUDY AND CONFERENCE

The study of the present and predicted radiological situation at Mururoa and Fangataufa atolls, requested of the International Atomic Energy Agency (IAEA) by the French Government in 1996, has taken some 100 people over two years to finalise.

During French testing at the atolls a total of 193 tests were conducted of which 178 were nuclear tests and 15 were safety trials. Of the 178 nuclear tests, there were a total of 41 atmospheric tests (37 at Mururoa, 4 at Fangataufa), and 137 underground tests (127 at Mururoa, 10 at Fangataufa). Of the 15 safety trials, 5 were conducted in the atmosphere and 10 underground.

The objectives of the Study were to assess the conditions after the end of the French nuclear testing, review the present radiological situation, and look at the potential long term radiological situation.

These objectives were stated formally in the Main Report:

- 1) To assess the situation at the two atolls and in involved areas from the point of view of radiological safety.
- 2) To ascertain whether there are any radiological hazards to people.
- 3) To make recommendations on the form, scale and duration of any remedial action that might be required.

The study involved some 55 experts from 21 countries and 18 laboratories in 12 countries as well as the two laboratories of the IAEA, and was conducted by the International Advisory Committee (IAC) chaired by G. de Planque.

The Study takes the form of a Main Report, Technical Report in six volumes, Summary Report all marked as Interim, and an abbreviated report for public consumption.

Chairperson of the Conference was E. Bobadilla Lopez, a medical doctor of the Chilean Nuclear Energy Commission, particularly concerned with the potential effects of radionuclide release on Pacific Fisheries, particularly with respect to his own country, Chile, which possesses the closest territories to the test site.

2. HIGHLIGHTS OF SPF INVOLVEMENT

- In his opening remarks, Z. Domaratski, Director-General of Nuclear Safety, IAEA, acknowledged and welcomed the presence of the SPF and made reference to me as the SPF representative. He also made reference to the visits of senior members of the IAC earlier that month to Nadi, Suva and Tahiti to present the findings of the Main Report.
- H. Garnett (ANSTO) and J. Mosely (NZODA) both communicated to me privately that a great deal of effort had been put into obtaining funds for up to four participants from Forum countries, and that these efforts had gone wanting.
- In the event, I was the only representative from the South Pacific present except for a Tahitian representative from the World Council of Churches, John Taroanui Doom, whose agenda was to look at the radiological effects on workers during the testing - a subject specifically excluded from the terms of reference of the Conference. An interesting side note here is that he points out that the name of his island isn't even spelled properly - it should be *Moruroa*.
- G. de Planque (Chairperson, IAC), in her opening statement and again in response to my statement during the final Discussion regretted that more representatives from the Pacific could not be present.
- She repeated this theme in her final address, but singled out firstly myself and secondly S. Carroll (GreenPeace) in order to congratulate us for our contribution to the discussion and insight into the problems, noting that the Conference would not have been the success it was without this vital contribution.
- The Chairperson of the Conference, E. Bobadilla Lopez (Chile), congratulated me on my breadth of knowledge of the Main Report and my insightful questions as to its content.
- Gonzalez, Director, Division of Radiation and Waste Safety, IAEA, also congratulated me on my knowledge of the Main Report and my searching assessment of it.

- H. Garnett (ANSTO) stated on several occasions how pleasing it was that SPF had selected a technical person (particularly a geologist) to represent their interests at this Conference.
- **Reference was again made by G. de Planque of her visit as part of the high level team from IAC to Nadi and Suva to put forward the Committee's views to the SPF and other Pacific Island Nation representatives, indicating that it was disappointing SOPAC had not been fully involved in these earlier discussions.**

3. ATTITUDES OF PARTICIPANTS

In general, for what should have been a group of dispassionate scientists, there was high degree of emphasis placed over and over again in their presentations on the credibility of the report and the conservative nature of assumptions made throughout so that the worst case was always presented.

On the first day, I was approached, one at a time, by a number of the Committee members in what appeared to me to be a concerted exercise, insisting that their conclusions were fair and right, that the French had been more than co-operative.

I found this overall attitude disturbingly political and seemingly concerted, and it placed me in a defensive position immediately. I was reluctant to discuss my particular concerns out of session for fear of showing my hand and losing any advantage I might have had.

The French position was to hang back and maintain a low profile throughout the Conference, with most of the lobbying seemingly being done on their behalf by the members of the IAC which, I felt, showed not enough disinterest in the political ramifications of the report.

On the basis of this, I was at first deeply suspicious that I was witnessing a white-washing episode, trying to sell the results of the Study at all costs.

It may have been, however, that the IAC members were too near to their subject. From the beginning the Australian delegation took a very close interest in my views and comments and reacted strongly to all of my questions. They appeared overly sensitive to my comments and would question me closely on each proposition I put forward.

Although I had amicable discussions over lunch on about day two with some members of the Committee, this resentment at being questioned particularly showed by the last day in the case of one member who apparently saw my questions as sniping at his area of the report.

When I questioned C. Fairhurst (USA) on why the material presented by him on the slope failure was not made available to the SPF in the Main Report or the Technical Report, another IAC member butted in to claim that the information was contained in the Technical Report volumes (which it patently was *not*), and

rudely suggested that I probably found it hard to tell the difference between the written word and the presentation.

Fairhurst was later to give me the proper answer that the information was pending in the coming geomechanics report.

In balance, it has to be said that my reading of the report at no stage found any sinister cover-up, but only a number of primarily geological models that were internally inconsistent throughout the Study, or inconsistent with current geological thinking, which, when it was all said and done, did not have a large influence on the outcome of the radiological assessment in any of the cases.

J. Mosely (NZODA, Vienna) kept in contact with me continually to assess my attitude to the Study, but made no attempt to influence me, nor gave any indication of the NZ position except that it was to await the reaction of the SPF.

4. ISSUES OF CONCERN AND QUESTIONS POSED

From my reading of the Study, I eventually developed a set of about 20 questions on major points for which I required some form of answer. I tried to ask as many of these in the public forum as possible for the sake of the record.

In the event, 10 questions were registered and recorded officially in the Conference Proceedings (Q.1, 5, 7, 14, 20, 21, 24, 34, 45 and 72) and a couple more failed to be registered. This represented about 15% of all questions asked at the Conference (both minor and major) and, I estimate, about 50% of questions which seriously challenged the assumptions and outcomes of the report, see table below:

<i>Category</i>	<i>Number of Questions</i>
Challenging	25
Point of Clarification	30
Dear Dorothy	10
Inconsequential	15
<i>TOTAL</i>	<i>80</i>

Of the original 20 questions, a further 5 were resolved by private discussions with IAC members, several were presented in the form of statements requiring a response, and several more were made redundant by the presentations as the Conference proceeded.

Copies of the 10 registered questions are attached as an appendix.

The number of challenging questions in the Conference was disappointingly small, leading to the Chair pointing out the contribution by me. Many present at the Conference were Committee members or representatives of those organisations which worked with the project, or representatives of countries interested only from the point of view of their own national interests.

Discussions of a serious nature were held with perhaps 20 of the participants in the tea/lunch/cocktail breaks.

Serious concerns that I had fell mainly in the categories of:

Category 1: Failure to supply enough information to allow proper assessment by SPF (Q.1, 24, 72)

Category 2: Models and assumptions that did not necessarily meet with current scientific thinking (Q. McEwan)

Category 3: Models and assumptions that were patently incorrect (Q.7)

Category 4: Models and assumptions that were demonstrably self-contradictory within the body of the Study (Q.45, Levins)

Category 5: Failure to take into account effective geological processes when developing models of Earth behaviour (Q.5, 34)

Category 6: Models and assumptions which could be called into question (Q.14, 20, 21)

These categories are to be seen in the light that the whole assessment of the Study is based on a combination of both actual monitoring and conclusions founded solely on certain conceptual or mathematical models.

Category 1

Failure to supply enough information to allow proper assessment by SPF (Q.1, 24, 72)

The procedure of comparing different types of radiation from different sources and particularly the method of comparison with background radiation was not made clear in the body of the report or in the presentations. It was however made clear to me by several nuclear physicists who approached me with information after my question, and who pointed out that the information is available in an Annex to the Main Report.

This aspect became an issue because of the constant promotion of the findings that radiation from radionuclide release as a result of the tests was in most cases comparable with background levels (including natural solar and cosmic radiation and radiation from polonium contained in seafoods).

In regard to the monitoring and evaluation of the potential slide of the northeastern flank of Mururoa, I felt that too little information was provided to justify the conclusions presented in the Main Report.

A clarification was provided by C. Fairhurst (USA) who is leading a separate geomechanics committee (IGC, not under UN auspices) looking into this issue. He showed me a near-finalised report in preparation and undertook to provide this report to the SPF before the end of the year.

A separate investigation has also been undertaken by the French Government, and this report is also in preparation, due for release in English to the public before the end of the year.

In response to my question directed to J.-F. Sornein (CEA, France), the French delegation willingly provided a copy of their presentation and, via R. Fry (IAEA), a copy of their present and proposed geomechanical and environmental monitoring programs at the atolls.

Category 2

Models and assumptions that did not necessarily meet with current scientific thinking (McEwan)

An assumption was made in the Study that a major (120 m) glacial sea-level fall was unlikely to occur for another 50,000 y based on research that shows glaciations to be linked to Earth-wobble periodicities. I am under the impression that more recent theories would have a major meteorite strike tipping the scales to bring on a glaciation within a very short period of time. Based on the graphs of sea level change actually portrayed in the Study, I pointed out that at no point on the graphs is the interglacial period shown to be longer than the present one, and that minor glaciation events are shown to occur every several thousand years. This also places the issue in Category 4 (self-contradictory within the Study).

In the context of the issues that glaciation raises, I pointed out that even a minor glaciation (say a 10 m sea-level fall) would result in a disproportionately large area of lagoon floor being exposed, and a deepening of the groundwater lense, both having the effect of increasing the supply of radionuclides to the human environment by: (a) making the atolls more attractive for settlement, (b) increasing the aerial exposure of contaminated lagoon-floor sediments, and (c) increasing the risk of drawing off groundwater from radionuclide-contaminated sources.

While the Study claims that 50,000 y is a conservative value, I hold it is non-conservative and that there might be changes within several thousand years. I hasten to point out however that the big picture has to be viewed with an eye to (i) whether this is going to be the Pacific's biggest concern in such an event, and (ii) evidence showing that the level of radiation predicted to be released in this scenario poses a minimal to negligible health risk.

Category 3

Models and assumptions that were patently incorrect (Q.7)

One statement is patently in error. The calculation of a sedimentation rate of 0.07 mm/y for future lagoon sedimentation is the most glaring, being calculated on the basis of the total thickness of limestone divided by the time elapsed since start of deposition, which violates fundamental geological principles. The issue was cleared up in private with D. Levin (ANSTO) in order to spare the Committee embarrassment. This issue also fell into Category 4 - (self-contradictory within the Study) - because of a clash with another section where a sedimentation rate of 2 mm/y is assumed. The rate in question assumes an importance as the rate at which radionuclides on the lagoon floor are removed from the environment, now and in the future, as a result of burial processes. The Committee's mistake in this case worked by chance in their favour by providing a more conservative estimate.

Category 4

Models and assumptions that were demonstrably self-contradictory within the body of the Study (Q.45, Levins)

The Study is self-contradictory and internally inconsistent in the matter of sedimentation rate versus erosion rate for the lagoon, and also falls into Category 2 - not current scientific thinking.

The result of proposing an erosion rate equal to the sedimentation rate is to have no net sedimentation and hence no chance to blanket the plutonium contaminating the lagoon floor (as is also claimed in the same chapter). The argument as presented also sees most of the sediment, together with plutonium, being lost from the lagoon beaches over the rim, but ignores the geological processes that would necessarily concentrate the plutonium in areas removed from the effects of erosion, and hence not become lost to the lagoon system as the argument would have it.

There is also a contradiction as mentioned earlier over whether a sedimentation rate of 0.07 mm/y or 2 mm/y should apply depending on the scenario being discussed.

The contradiction between graphs presented on sea-level change over time and the predicted future timing of glaciation was mentioned earlier.

Category 5

Failure to take into account effective geological processes when developing models of Earth behaviour (Q.5, 34)

An apparently increasing concentration of strontium radionuclides in certain parts of the lagoon cannot as yet be explained because of the absence of evidence for increased concentrations of radionuclides that would be expected to accompany strontium. I questioned whether a potential means of concentrating strontium might not be through biological pathways, given the chemical affinities between strontium and calcium. In view of the fact that 100% of the lagoon sediment has a biological origin, this concept should at least be considered in resolving the outstanding question as to why caesium and

plutonium have shown a decreasing concentration in the lagoon over time, whereas strontium is on the increase in the sampled areas, and tritium results cannot corroborate strontium leakage from an underground chamber.

I also suggested that normal sedimentary processes of redistribution and concentration might explain in part why plutonium concentration appeared to be dropping rapidly in the lagoon. It is proposed that concentration of plutonium might be occurring in lag deposits in and around the motus in a similar way to which resilient foram tests are concentrated, particularly at the Colette motu where particulate plutonium is present in relatively high concentrations.

Category 6

Models and assumptions which could be called into question (Q.14, 20, 21)

Several models were seen to be questionable depending on the effects of scale in the models.

Observations in drillholes in the volcanics below Mururoa suggest a high degree of horizontal anisotropy in the permeability, whereas groundwater modelling in and around test chambers assumed an isotropic, homogeneous medium. Given the scale of the model, it was pointed out by members of the Committee that, in their opinion, vertical fracturing would balance out primary geological layering to produce a rock mass with an even and isotropic distribution of permeability. In the absence of evidence to the contrary (eg, indications of excessive leakage to a particular point on the offshore edge of the atoll), the model has to be accepted as the best for the interim.

Another question was posed on the parallels between test chambers and nuclear waste repositories as proposed in certain research proposals by CSIRO. This question pertained to the amount of interaction that might be expected between normal groundwater flow through the atoll and the more intense circulation cell that would be set up in the test chambers, my suggestion being that there may not be nearly as much leakage as might be expected. Answers provided to me by several experts in the field have convinced me that, although the parallel is valid in part, the groundwater field in the atoll is sufficiently different so that leakage will in fact occur upwards from the chambers to the lagoon floor over time.

I pointed out that hydraulic fracturing through and around the test chambers might provide pathways to the surface for radionuclides that are otherwise excluded by the theoretical intact, densified shells expected to form around test chambers under the special conditions of a nuclear explosion. The speaker C. Fairhurst (USA) admitted there exists a theoretical consideration whereby hydraulic fracturing might take place in a test chamber, but that little was known of the process.

The other issue considering hydraulic fractures concerns the likelihood of formation and direction of propagation depending on the in-situ stresses within the rock mass. The model assumes a balance between lithostatic and hydrostatic stresses which is the most obvious assumption, but in view of surprisingly high horizontal stresses found in other parts of Australia and the Pacific where they were least expected, I proposed that it would be helpful if the theory was backed by actual borehole measurements of in-situ stresses at the atolls.

5. SUMMARY

Overall, the shortcomings and potential shortcomings of the Study should be viewed in light of the fact that the monitoring and modelling work carried out gives rise to such low predicted values of radionuclide exposure to man and the environment that even large errors produce little change in the outcome.

In the cases recognised, the errors contained in the Study have usually acted in favour of the stated outcome by accidentally adding a further degree of conservatism. The contradictions that have developed have apparently come about through a genuine intention on the part of different researchers to present the worst case scenario for their own particular area of input. It is only unfortunate that not enough geological expertise was drawn on to recognise and adjust these inconsistencies through what is a large body of work with contributions from many and varied sources.

It would have been preferable for the IAC to present a holistic report which is consistent in its assumptions throughout, in order to remove any doubts that the situation of robbing Peter to pay Paul is not occurring - a mechanism for conveniently transferring parameters around the report to achieve the answer required.

In this case, no such intention to defraud is present.

Whatever objections that may be raised to the Study, it cannot be disputed that:

- a) The study was carried out by a senior, international body of researchers whose credibility cannot be questioned.
- b) The Committee's conclusions and recommendations come from a strongly held conviction in their own competence and honesty, and in the intensity and accuracy of the work and thought put into the process.
- c) The study was carried out assiduously, within the constraints (particularly time constraints) imposed. It seems that much of the work was carried out by members of the Committee in their own time and at their own cost. The terms of reference of the Study also limit the debate somewhat.

- d) The Committee has closely assessed the investigation that was carried out by France and have independently come to very similar conclusions, sometimes in surprising detail.
- e) The weakness of the Study lies in its lack of attention to detail insofar as the development of consistent geological and geomechanical models is concerned. Apart from where they have obviously erred, the models, by necessity, assume a geological simplicity which will almost invariably be put to the lie by further investigation, more because of the possibilities for infinite variation in the geological environment, than of the failure of the Committee to cover all the bases.
- f) To my mind, a further vulnerable point is the lack of a dispassionate approach which showed through time and again. Technically the work stands on its own - there was no need to constantly push the point that the atoll has a clean bill of health in regard to the current and future radiological effects on mankind.
- g) Plutonium remains in amounts at some areas of the Colette motu that, while low on the scale of predicted radiological effects, still fall above the limits imposed by the French Government itself during its own cleanup campaign. There is also a possibility that natural geological processes are tending to concentrate this material further in certain areas with time.
- h) Two other similar studies carried out by the IAEA, by comparison, have placed the annual doses from Bikini atoll at 15 mSv/y, Khazakstan at 140 mSv/y whereas Mururoa and Fangataufa on average lie at 0.01mSv/y, with the highest dose being 0.25 mSv/y – a telling comparison!

The official line that was repeatedly stated was that it was good to have a representative of SPF present at the Conference, and particularly one with a scientific geological background. Despite this, the underlying feeling that came through to me was one of an undercurrent of coolness and resentment that the study should be questioned. There appeared to be little intention at the outset to revise the Study in the light of the outcomes of the Conference, despite the fact that it was marked as interim. This may now change at my insistence.

To be fair, the IAC thought that they had covered this aspect of unexpected amendments by arranging special briefings in Nadi and Suva with interested bodies, including the Forum Secretariat, at which the points I'd brought up later in Vienna might reasonably have been expected to be dealt with earlier by somebody from SPF.

It was noted with sincere disappointment that a SOPAC representative was invited to only one of these briefings, and then only at the very last moment, and that the Draft Interim Main Report was only made available after this time for SOPAC's perusal. This action did more to undermine my position at the Conference than any other, and had the effect of weakening the SPF argument by making SPF seem uninterested in adopting a positive approach to the problem.

It is also disappointing to note that a French mission to the Forum Secretariat in December, 1996 presented scientific results on the atolls which were not brought to the attention of the Forum's technical arm, SOPAC.

Chairperson of the IAC, G. de Planque gave an undertaking during the final Discussion session that the Committee would deal with all the issues I had raised through amendment to the final report.

Her guarantee was in response to a statement which I presented in the final Discussion session in response to an implicit request from the Chairperson of the Conference, E. Bobadilla Lopez. This statement can be taken as a conclusive summary of my response to the Conference:

"I'd like to pay tribute to the IAC Committee on presenting two years of very intense work by a great number of dedicated people in a thorough and professional, and I must say, in a very open way. Given the adjustments to the Study that I have suggested, and which were discussed throughout the preceding Conference, this Study of the IAC is something I can present to the South Pacific Forum, and hold my head up and say that these people (the IAC) have covered all the bases. However, when faced with irrefutable facts, I have to resort to telling a short story: Like many of you here, I am a child of the Cold War era. During those Cold War days, one imagined way to escape the horrors of nuclear war and radioactive fallout might have been to seek refuge on a far-flung island in the Pacific - let us say an atoll; about 25 km long by 10 km wide for choice. If someone had come to

my island and told me 'We're going to blow a few kilograms of plutonium to pieces at one end of your atoll, let off around 40 atmospheric nuclear explosions, and 4 or 5 more in very leaky underground areas, not to mention another 100 or so in underground areas that you won't even need to think about again.' And then, to boot, they had guaranteed that after all this was over I'd be able to eat handfuls of sand on the beach with no ill-effects then, frankly, I wouldn't have believed them. But now, here it is in front of me in black and white! It's true! However, Mr Chairman, there is a large leap of faith required for me, and no less for the people of the Pacific whom I represent today. My appeal to you is to help me get that message across. I hope my efforts this week have not been seen as nit-picking, but more as an attempt to verify in all our minds that your Study is of the highest standard so that no one can find it wanting in any way."

In her closing remarks, the Chairperson of the IAC reiterated the guarantee that the changes I suggested would be made, and alluded to the Committee's support of the ongoing investigations proposed by the French Government.

My final response was to note that, in this regard, I felt sure that the people of the South Pacific Forum countries would be pleased to see France's plans for further environmental and geomechanical monitoring in the area.

6. OTHER REPORTS

The geomechanics report by the special IGC headed by C. Fairhurst due for publication in the next few months will report on the potential slope failure on the outer northeastern flank of Mururoa. Discussions with Fairhurst indicated that such a failure, if catastrophic, could result in a 2 m high wave at nearby inhabited islands which he considered not critical.

Even under the most overly pessimistic of assumptions (i.e. all of the plutonium present in the slide mass going directly into solution), then the plume of radionuclides which would move westward through Samoa, Tonga and Fiji after 5 years and impinge on Australia after 10 years, is only of a magnitude comparable to the background radiation.

The geomechanics report and report on environmental monitoring by the CEA on behalf of the French Government is also due for publication later this year. As the information contained in all of the above reports was utilised by the IAC in the production of their Study, there is expected to be no surprises contained in these later reports, but more a clarification of the issues.

7. APPENDICES

[Not Attached but available for viewing at the SOPAC Secretariat Library]

De Vries, P., Seur, H. 1997. Moruroa and us: Polynesian's experiences during thirty years of nuclear testing in the French Pacific. 222 p.

Forum Secretariat. 1998. Twenty-ninth South Pacific Forum, Pohnpei, Federated States of Micronesia, 24-25 August 1998. SPFS (98) 14.

International Atomic Energy Agency. 1998. The radiological situation at the atolls of Mururoa and Fangataufa. 16p.

Note: Includes:

- a) Summary Report. Interim (unedited) version;
- b) Main Report (interim version).

International Atomic Energy Agency. 1998. The radiological situation at the atolls of Mururoa and Fangataufa

Note: Includes

- A. Radionuclide concentrations measure in the terrestrial environment of the atolls (Interim Version) Vol. 1, 2;
- B. Inventory of radionuclides underground at the atolls (Interim version) Vol. 3;
- C. Releases to the biosphere of radionuclides from underground nuclear weapon tests at the atolls (interim version) Vol. 4;
- D. Transport of radioactive material within the marine environment (interim version) Vol. 5;
- E. Doses due to radioactive materials present in the environment or released from the atolls (interim version) Vol. 6

1997. Guide to radiological monitoring of the Mururoa and Fangataufa sites (version E). Vol. 1 and 2.

1997. Geomechanical monitoring guide for Mururoa and Fangataufa atolls. Vol. 1 and 2.

International conference on the radiological situation at the atolls of Mururoa and Fangataufa : closing conclusions and remarks.

List of Participants

Technical Sessions C: other issues

Participants contributions to discussions