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REPORT AND RECOMMENDATIONS MADE BY THE PANEL OF COMMISSIONERS
CONCERNING THE FIRST INSTALMENT OF "F4" CLAIMS

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Introduction

1. At its thirtieth session held from 14 to 16 December 1998, the Governing Council of the United Nations Compensation Commission (the "Commission") appointed the "F4" Panel of Commissioners (the "Panel"), composed of Messrs. Thomas A. Mensah (Chairman), José R. Allen and Peter H. Sand, to review claims for losses resulting from environmental damage and the depletion of natural resources submitted by Governments under category "F" and by public sector enterprises under category "E" (the "'F4' claims").

2. This is the first report of the Panel to the Governing Council submitted pursuant to article 38(e) of the Provisional Rules For Claims Procedure (the "Rules") (S/AC.26/1992/10).

3. The report addresses the first instalment of "F4" claims, which includes 107 claims for monitoring and assessment of environmental damage, depletion of natural resources, monitoring of public health, and performing medical screenings for the purposes of investigation and combating increased health risks (the "monitoring and assessment claims") submitted by the Governments of the Islamic Republic of Iran ("Iran"), the Hashemite Kingdom of Jordan ("Jordan"), the State of Kuwait ("Kuwait"), the Kingdom of Saudi Arabia ("Saudi Arabia"), the Syrian Arab Republic ("Syria") and the Republic of Turkey ("Turkey") (collectively "the Claimants").

4. A summary of the monitoring and assessment claims submitted by each claimant country appears in table 1. The "amount claimed" column in table 1 shows the amount of compensation requested by the Claimants (including amendments) expressed in United States dollars ("USD") and, where necessary, corrected for arithmetic errors.

Table 1. Summary of first instalment monitoring and assessment claims

<u>Country</u>	<u>Total number of claims</u>	<u>Amount claimed (USD)</u>
Iran	40	42,951,383
Jordan	10	12,488,949
Kuwait	22	460,421,114
Saudi Arabia	24	482,156,943
Syria	10	5,623,885
Turkey	1	3,770,300
<u>Total</u>	107	1,007,412,574

I. BACKGROUND

A. Mandate of the Panel

5. The mandate of the Panel is to review the "F4" claims and recommend compensation, where appropriate.

6. Article 31 of the Rules sets out the law to be applied by the Panel in considering claims for compensation. It reads:

"In considering the claims, Commissioners will apply Security Council resolution 687 (1991) and other relevant Security Council resolutions, the criteria established by the Governing Council for particular categories of claims, and any pertinent decisions of the Governing Council. In addition, where necessary, Commissioners shall apply other relevant rules of international law."

7. Paragraph 16 of Security Council resolution 687 (1991) affirms that the Republic of Iraq ("Iraq") is "liable under international law for any direct loss, damage, including environmental damage and the depletion of natural resources, or injury to foreign Governments, nationals and corporations, as a result of Iraq's unlawful invasion and occupation of Kuwait".

8. In discharging its mandate, the Panel has borne in mind the statement of the Secretary-General of the United Nations, in his report of 2 May 1991 to the Security Council, that:

"The Commission is not a court or an arbitral tribunal before which the parties appear; it is a political organ that performs an essentially fact-finding function of examining claims, verifying their validity, evaluating losses, assessing payments and resolving disputed claims. It is only in this last respect that a quasi-judicial function may be involved. Given the nature of the Commission, it is all the more important that some element of due process be built into the procedure. It will be the function of the commissioners to provide this element." ((S/22559), para. 20).

B. Compensable losses or expenses

9. Governing Council decision 7 (S/AC.26/1991/7/Rev.1) provides guidance regarding the losses or expenses that may be considered as "direct loss, damage, or injury" resulting from Iraq's invasion and occupation of Kuwait. Paragraph 34 of the decision states that "direct loss, damage, or injury" includes any loss suffered as a result of:

(a) Military operations or threat of military action by either side during the period 2 August 1990 to 2 March 1991;

(b) Departure of persons from or their inability to leave Iraq or Kuwait (or a decision not to return) during that period;

(c) Actions by officials, employees or agents of the Government of Iraq or its controlled entities during that period in connection with the invasion or occupation;

(d) The breakdown of civil order in Kuwait or Iraq during that period; or

(e) Hostage-taking or other illegal detention.

10. Paragraph 35 of Governing Council decision 7 provides that "direct environmental damage and depletion of natural resources" includes losses or expenses resulting from:

(a) Abatement and prevention of environmental damage, including expenses directly relating to fighting oil fires and stemming the flow of oil in coastal and international waters;

(b) Reasonable measures already taken to clean and restore the environment or future measures which can be documented as reasonably necessary to clean and restore the environment;

(c) Reasonable monitoring and assessment of the environmental damage for the purposes of evaluating and abating the harm and restoring the environment;

(d) Reasonable monitoring of public health and performing medical screenings for the purposes of investigation and combating increased health risks as a result of the environmental damage; and

(e) Depletion of or damage to natural resources.

11. Thus, monitoring and assessment expenses that qualify for compensation are those resulting from:

(a) Monitoring and assessment of environmental damage that is reasonable for any of the purposes specified in sub-paragraph (c) of paragraph 35 of Governing Council decision 7; and

(b) Monitoring of public health and performing medical screenings that is reasonable for any of the purposes set out in sub-paragraph (d) of paragraph 35 of the same decision.

II. OVERVIEW OF THE FIRST INSTALMENT OF "F4" CLAIMS

A. The claims

12. The first instalment of "F4" claims consists of monitoring and assessment claims submitted pursuant to paragraph 35 of Governing Council decision 7. A summary of the claims is given in table 1. The total compensation claimed is USD 1,007,412,574.

13. The Claimants seek compensation for expenses resulting from monitoring and assessment activities undertaken or to be undertaken to identify and evaluate damage or loss suffered by them as a result of Iraq's invasion and occupation of Kuwait. These activities relate to, inter alia, damage from air pollution; depletion of water resources; damage to groundwater; damage to cultural heritage resources; oil pollution in the Persian Gulf; damage to coastlines; damage to fisheries; damage to wetlands and rangelands; damage to forestry, agriculture and livestock; and damage or risk of damage to public health.

14. The Claimants allege that environmental damage, depletion of natural resources and increased health risks resulted from, inter alia:

(a) The release and transport, into the Claimants' territories, of airborne pollutants caused by oil fires resulting from the ignition of hundreds of oil wells in Kuwait by Iraqi forces during Iraq's invasion and occupation of Kuwait;

(b) Numerous oil rivers and lakes formed by oil from the destroyed oil wells that did not ignite;

(c) The release, by Iraqi forces, of millions of barrels of oil into the sea from oil pipelines, off-shore terminals and oil tankers;

(d) Disruption of fragile desert and coastal terrain caused by the movement of military vehicles and personnel, coupled with the construction of thousands of kilometres of military trenches and the emplacement of mines, weapons caches and other fortifications; and

(e) Adverse impacts on the environment resulting from the transit and settlement of the thousands of persons who departed from Iraq and Kuwait as a result of Iraq's invasion and occupation of Kuwait.

B. Priority given to monitoring and assessment claims

15. Prior to the expiration of the deadline established by the Governing Council, a number of governments submitted claims for environmental damage and the depletion of natural resources, including claims for compensation for expenses resulting from monitoring and assessment of such damage.

16. At the twenty-eighth session of the Governing Council, held on 29 June to 1 July 1998, Saudi Arabia, on behalf of itself, Iran, Jordan, Kuwait, and Syria, presented a proposal requesting the Governing Council to agree to a procedure under which awards for the monitoring and assessment claims would be made in advance of the review of the related substantive claims. Such advance awards would be made by the Governing Council on the basis of recommendations of the Panel.

17. The Governing Council, at its twenty-ninth session held on 28 to 30 September 1998, requested the Executive Secretary of the Commission (the "Executive Secretary") to invite the Claimants as well as other similarly situated claimant Governments, if any, to identify and file separately, within the period to be specified by the Executive Secretary, those portions of their claims already filed with the Commission that pertained to the monitoring and assessment of environmental damage. The Governing Council also decided that appropriate priority should be given to the processing of such claims, so that the claims could be resolved quickly and separately from the resolution of the related claims for environmental damage.

18. This report deals with the claims filed by six Governments, as listed in paragraph 3 above.

III. PROCEDURAL HISTORY

A. Article 16 reports

19. Pursuant to article 16 of the Rules, the Executive Secretary reported the claims to the Governing Council in the twenty-ninth report, dated 28 October 1999, and the thirty-first report, dated 28 April 2000, setting forth a number of factual and legal issues raised by the first instalment of "F4" claims and providing statistical information on these claims. These reports were circulated to all Governments and international organizations that had filed claims before the Commission and to Iraq. In accordance with paragraph 3 of article 16 of the Rules, a number of Governments, including Iraq, submitted views and additional information in relation to the reports.

B. Article 34 notifications

20. Following a preliminary review of the monitoring and assessment claims, the secretariat sent notifications pursuant to article 34 of the Rules to the Claimants in January 2000. The notifications requested Claimants to provide the following information relating to the status of the projects comprising the monitoring and assessment claims:

(a) Whether the studies had been completed;

(b) If a study had been completed, the date on which the results would be submitted to the Commission; and

(c) If a study had not been completed, the date on which it began, or was scheduled to begin, the date on which it would be completed, and the date on which the results would be submitted to the Commission.

C. Procedural Order No. 1

21. On 1 March 2000, the Executive Secretary submitted the first instalment of the "F4" claims to the Panel. On the same day, the Panel issued Procedural Order No. 1, in which it, inter alia, classified all the claims in the first instalment as "unusually large or complex", pursuant to article 38(d) of the Rules.

22. The Panel requested the secretariat to send Iraq a copy of the procedural order, together with one copy of the claim form, statement of claim and associated exhibits for each of the claims. The Panel further requested the secretariat to send a copy of Procedural Order No. 1 to the Claimants.

23. The secretariat transmitted a copy of Procedural Order No. 1 and copies of the other documents referred to in paragraph 22 to Iraq on 3 March 2000. The Government of Iraq submitted a response on 4 October 2000.

D. Oral proceedings

24. On 4 October 2000, the Commission received a request from Iraq for oral proceedings to be held on issues relating to the first instalment of "F4" claims.

25. In response to this request, the Panel issued Procedural Order No. 5, dated 18 October 2000, by which it informed Iraq and the Claimants of its decision to hold oral proceedings. The procedural order stated that the oral proceedings would be limited to the following two issues:

(a) Can the costs of research programmes, studies and procedures for the monitoring and assessment of environmental damage and depletion of natural resources qualify as "environmental damage and depletion of natural resources" in accordance with paragraph 16 of resolution 687 (1991)?

(b) If so, can any such costs qualify as direct damage or loss resulting from Iraq's invasion and occupation of Kuwait?

26. Oral proceedings were held at the Palais des Nations in Geneva, on 16 January 2001. Representatives of Iraq and the Claimants presented their views during the proceedings.

27. The views and comments of Iraq presented in its written response referred to in paragraph 23 and during the oral proceedings have been duly taken into account by the Panel. Where appropriate, these views and comments are referred to in this report.

IV. REVIEW OF MONITORING AND ASSESSMENT CLAIMS

A. Special aspects of monitoring and assessment claims

28. The monitoring and assessment claims reviewed in this report relate to expenses resulting from three different categories of activities, namely:

(a) Investigations to ascertain whether environmental damage or depletion of natural resources has occurred;

(b) Studies to quantify the loss resulting from the damage or depletion; and

(c) Assessment of methodologies to abate or mitigate the damage or depletion.

Some of the claims relate to activities falling into more than one of the above categories.

29. The monitoring and assessment claims present special problems in that they are being reviewed before decisions have been taken on the compensability of any substantive claims. Thus, the claims are being reviewed at a point where it may not have been established that environmental damage or depletion of natural resources occurred as a result of Iraq's invasion and occupation of Kuwait. Yet, the results of the monitoring and assessment activities may be critical in enabling claimants to establish the existence of damage and evaluate the quantum of compensation to be claimed. Hence, although it may be correct in some cases to say that a claimant is seeking compensation for monitoring and assessment without prior proof that environmental damage has in fact occurred, it would be both illogical and inequitable to reject a claim for reasonable monitoring and assessment on the sole ground that the claimant did not establish beforehand that environmental damage occurred. To reject a claim for that reason would, in effect, deprive the claimant of the opportunity to generate the very evidence that it needs to demonstrate the nature and extent of damage that may have occurred.

30. For that reason, the Panel does not consider that conclusive proof of environmental damage is a prerequisite for a monitoring and assessment activity to be compensable in accordance with paragraph 35 of Governing Council decision 7. In the view of the Panel, the purpose of monitoring and assessment is to enable a claimant to develop evidence to establish whether environmental damage has occurred and to quantify the extent of the resulting loss.

31. However, the Panel is of the view that compensation should not be awarded for monitoring and assessment activities that are purely theoretical or speculative, or which have only a tenuous link with damage resulting from Iraq's invasion and occupation of Kuwait. There should be a sufficient

nexus between the activity and environmental damage or risk of damage that may be attributed directly to Iraq's invasion and occupation of Kuwait. In assessing the strength of the nexus, and hence the reasonableness of the monitoring and assessment activity, the Panel has taken into account, inter alia, the following considerations:

(a) Whether there is a possibility that environmental damage or depletion of natural resources could have been caused as a result of Iraq's invasion and occupation of Kuwait. This entails an inquiry regarding the plausibility that pollutants released as a result of Iraq's invasion and occupation of Kuwait, or other effects of the invasion, could have impacted the territories of the Claimants;

(b) Whether the particular areas or resources in respect of which the monitoring and assessment activity is undertaken could have been affected by pollutants released as a result of Iraq's invasion and occupation of Kuwait, or other effects of the invasion. This entails, in appropriate cases, an examination of the possible pathways and media by which pollutants resulting from Iraq's invasion and occupation of Kuwait could have reached the areas or resources concerned;

(c) Whether there is evidence of environmental damage or risk of such damage as a result of Iraq's invasion and occupation of Kuwait; and

(d) Whether, having regard to the stated purpose of the monitoring and assessment activity and the methodologies to be used, there is a reasonable prospect that the activity will produce results that can assist the Panel in reviewing any related substantive claims.

32. In applying these considerations to determine the appropriateness of monitoring and assessment activities, due account needs to be taken of the particular circumstances of each case. Thus the possibility that a monitoring and assessment activity might not establish conclusively that environmental damage has been caused is not necessarily a valid reason for rejecting a claim for expenses resulting from that activity. In the view of the Panel, a monitoring and assessment activity could be of benefit even if the results generated by the activity establish that no damage has been caused. The same may be the case where the results indicate that damage has occurred but that it is not feasible or advisable to undertake measures of remediation or restoration. Confirmation that no damage has been caused or that measures of remediation or restoration are not possible or advisable in the circumstances could assist the Panel in reviewing related substantive claims. It could also be beneficial in alleviating the concerns of Claimants regarding potential risks of damage, and help to avoid unnecessary and wasteful measures to deal with non-existent or negligible risks.

33. A further complication presented by claims for monitoring and assessment of environmental damage and depletion of natural resources

results from the difficulty of ascertaining whether, and if so to what extent, damage identified by a monitoring and assessment activity is attributable to Iraq's invasion and occupation of Kuwait. In each of the claimant countries and in the region as a whole, there are natural and other phenomena that could result in environmental damage, depletion of natural resources or risks to public health of the same or similar type as those that are the subject of some of the claims. It is, therefore, possible that some of the damage revealed by monitoring and assessment activities resulted from causes other than the effects of Iraq's invasion and occupation of Kuwait. It is also possible that the cause of the damage was a combination of the effects of Iraq's invasion and occupation of Kuwait together with phenomena and activities that occurred before or after that event.

34. Moreover, in some of the countries there may not be adequately documented baseline information on the state of the environment or on conditions and trends regarding natural resources prior to Iraq's invasion and occupation of Kuwait. This may make it difficult in many cases to distinguish between damage attributable to Iraq's invasion and occupation of Kuwait and damage that may be due either to factors unrelated to Iraq's invasion and occupation or only partly attributable to Iraq's invasion and occupation. Where damage revealed by monitoring and assessment was not a direct result of Iraq's invasion and occupation of Kuwait, such damage would not be compensable in accordance with paragraph 35 of Governing Council decision 7. And where damage was caused partly by Iraq's invasion and occupation of Kuwait and partly by other factors, such damage may or may not be compensable. Yet the possibility that damage revealed by a monitoring and assessment activity could have been wholly or partly caused by factors unrelated to Iraq's invasion and occupation of Kuwait does not necessarily rule out compensation for that activity. Nor would monitoring and assessment be unreasonable solely because it might be difficult for the Claimant to differentiate damage resulting from Iraq's invasion and occupation of Kuwait from damage that may have resulted from other factors.

35. In deciding whether expenses incurred for a monitoring and assessment activity are compensable in accordance with paragraph 35 of Governing Council decision 7, the Panel considered, inter alia, the circumstances of the claim, including the nature of the damage to be assessed and the location and purpose of the monitoring and assessment activity and the appropriateness of the activity by reference to generally accepted scientific criteria and methodologies. Each claim has been reviewed on its own merits. In particular, the Panel has considered whether there was evidence that the activity proposed or undertaken could produce information that might be helpful in identifying environmental damage and depletion of natural resources, or that could offer a useful basis for taking preventive or remedial measures.

B. Relationship among claims

36. A number of the monitoring and assessment claims are closely related to each other. In some cases, this results from the separation of monitoring and assessment claims from the related substantive claims because, in submitting monitoring and assessment claims separately from the substantive claims, some Claimants have formulated each monitoring and assessment activity as an independent claim with its own budget.

37. The Panel believes that, in some cases, savings can be achieved by co-ordinating activities of a claimant relating to the same subject matter. In such cases, the Panel has suggested co-ordination of the relevant activities. Where the Panel has found that the costs of a particular activity can be reduced by using personnel or resources available for another activity or information available elsewhere, it has taken the possible savings into account in recommending the compensation to be awarded.

38. Most of the monitoring and assessment claims are related to substantive claims for environmental damage and depletion of natural resources because the Claimants expect to use information obtained from the monitoring and assessment activities to support their substantive claims. The Panel stresses that its recommendations on monitoring and assessment claims do not in any way prejudice its findings on related substantive claims that it may review subsequently. Each substantive claim will be reviewed on its own merits on the basis of the evidence presented to support it.

39. However, the Panel anticipates that the results of some monitoring and assessment activities will assist its review of related substantive claims. It recalls that the Governing Council's decision to authorize expedited review of monitoring and assessment claims was, in large part, intended to make funds available to claimants to finance activities that might produce information to support their substantive "F4" claims. The Panel, therefore, emphasizes the importance of early submission of the results of monitoring and assessment activities for which compensation is awarded.

40. The Panel also notes that some of the monitoring and assessment activities may need to be conducted for several years. In certain circumstances, the Panel has recommended awards of compensation for monitoring and assessment activities even though the results of the activities may not become available in time for use in the review of any substantive claims or may not be needed for such review. However, where preliminary results of long-term monitoring and assessment that could be helpful in the review of related substantive claims become available, the Claimant should make every effort to bring them to the attention of the Panel as soon as possible.

C. The review process

41. Article 36 of the Rules provides that a panel of Commissioners may "(a) in unusually large or complex cases, request further written submissions and invite individuals, corporations or other entities, Governments or international organizations to present their views in oral proceedings; [and] (b) request additional information from any other source, including expert advice, as necessary". Article 38(b) of the Rules provides that a panel of Commissioners "may adopt special procedures appropriate to the character, amount and subject-matter of the particular types of claims under consideration".

42. In evaluating the scientific and technical appropriateness of monitoring and assessment activities and assessing the reasonableness of the expenses claimed, the Panel was assisted by expert consultants retained by the Commission. In view of the complexity of the issues and the need to consider scientific, legal, social, commercial and accounting issues in evaluating the claims and assessing the amounts of compensation, the Panel considered it desirable and necessary to have the assistance of a multi-disciplinary team of experts. Expert consultants were retained in, inter alia, the following fields: chemistry; toxicology; biology (including microbiology, marine biology, biological oceanography, marine zoology and plant pathology); medicine; epidemiology; environmental, ecological and natural resource economics; geology (including geochemistry, hydrology, geo-ecology); atmospheric sciences; oil spill assessment and response; rangeland management; and accounting.

43. The expert consultants prepared professional judgement reports on all the monitoring and assessment activities for which compensation was sought. Each report included the opinion of the expert consultants regarding the appropriateness of the activity by reference to generally accepted scientific criteria, standards and methodologies. The reports also contained the expert consultants' evaluation of the reasonableness of the costs claimed, having regard to the results likely to be produced. Where appropriate, the expert consultants suggested modifications to the activities proposed or adjustments to the cost estimates presented.

44. The Panel also requested information from a number of international organizations, agencies and individual experts on issues regarding environmental damage and depletion of natural resources relevant to the claims including compensation for oil pollution damage; air quality monitoring and modelling; hydrogeology and groundwater pollution; soil remediation techniques; public health and epidemiology; and environmental and ecological economics.

45. In addition, the Panel requested additional information from the Claimants in order to clarify ambiguities or to amplify information regarding their claims. At the request of the Panel and in accordance with

its instructions, members of the secretariat and, where appropriate, the Panel's expert consultants held discussions with representatives of the Claimants in order to obtain such information.

46. In reaching its findings and formulating its recommendations on the claims, the Panel has taken due account of all the information and evidence made available to it, including the materials provided by the Claimants in the claim documents and in response to requests for additional information; the written responses submitted by Iraq; the views presented by Iraq and the Claimants during the oral proceedings; the reports of the Panel's expert consultants; and information and views received from the experts and organizations referred to in paragraph 44 above.

47. Where the Panel has found that modifications to monitoring and assessment activities are necessary or desirable, it has provided details of those modifications. These details are set out in the relevant parts of this report or in the technical annexes.

48. In the cases where the Panel found the cost estimates to be unreasonable, it made adjustments to the amounts claimed. In determining standard rates, the Panel reviewed information provided by its expert consultants concerning applicable rates, having regard to, inter alia, the location and nature of the tasks to be undertaken. In each case, the Panel assured itself that the adjustments would not prejudice the ability of the Claimant to achieve the objectives stated in the claim.

49. The Panel's findings and recommendations on each claim are based on its assessment of the totality of evidence presented.

D. Evidentiary requirements

50. Article 35(1) of the Rules provides that "[e]ach claimant is responsible for submitting documents and other evidence which demonstrate satisfactorily that a particular claim or group of claims is eligible for compensation pursuant to Security Council resolution 687 (1991)". Article 35(1) also provides that it is for each panel to determine "the admissibility, relevance, materiality and weight of any documents and other evidence submitted".

51. Article 35(3) of the Rules provides that category "F" claims "must be supported by documentary and other appropriate evidence sufficient to demonstrate the circumstances and amount of the claimed loss". The Governing Council emphasized the mandatory nature of this requirement in paragraph 37 of decision 7: "Since these [category "F"] claims will be for substantial amounts, they must be supported by documentary and other appropriate evidence sufficient to demonstrate the circumstances and the amount of the claimed loss." In addition, Governing Council decision 46 states that, for category "F" claims, "no loss shall be compensated by the Commission solely on the basis of an explanatory statement provided by the

claimant" (S/AC.26/1998/46). In this decision, the Governing Council also reaffirmed that, pursuant to article 31 of the Rules, the amounts recommended by the panels of Commissioners "can only be approved when they are in accordance with this decision".

52. In some claims, the Panel has found that a monitoring and assessment activity is reasonable in accordance with paragraph 35 of Governing Council decision 7 but has, nevertheless, recommended either that no compensation should be awarded or that compensation be awarded in an amount less than what was sought by the Claimant. For claims concerning monitoring and assessment activities already completed, no compensation has been recommended if the evidence presented to the Panel was not sufficient to demonstrate that the amounts claimed were in fact expended. For activities that are yet to be undertaken, the Panel has recommended compensation only where sufficient evidence has been provided.

E. Location of the damage

53. Some of the monitoring and assessment claims relate to environmental damage alleged to have occurred outside Kuwait or Iraq, specifically in the territories of Iran, Jordan, Saudi Arabia, Syria, and Turkey. Neither Security Council resolution 687 (1991) nor any decision of the Governing Council restricts eligibility for compensation to damage that occurred in Kuwait or Iraq. In this regard, the Panel notes that the "E2" Panel of Commissioners stated in its second report, that "the place where the loss or damage was suffered by the claimant is not in itself determinative of the Commission's competence" (Report and Recommendations made by the panel of Commissioners concerning the second instalment of "E2" claims, S/AC.26/1999/6, para. 54).

54. The Panel agrees with this view. Accordingly, it has concluded that expenses resulting from reasonable monitoring and assessment of loss or damage that may have occurred outside Iraq or Kuwait are, in principle, compensable in accordance with paragraph 35 of Governing Council decision 7.

F. Analysis of claims and recommendations

55. The Panel's analysis of the first instalment claims is set forth in the sections V through X of this report. There are separate sections for each claimant country, which are divided into subsections that describe each of the monitoring and assessment claims in the instalment, review their scientific and technical merits, analyse their cost-reasonableness, and report the Panel's recommendations regarding compensation. Additional technical recommendations are contained in technical annexes at the end of the report.

V. MONITORING AND ASSESSMENT CLAIMS OF THE ISLAMIC REPUBLIC OF IRAN

Table 2. Iran's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed (USD)</u>
5000329	Transport and Dispersion of Pollution	432,983
5000330	Transport and Dispersion of Pollution	1,984,660
5000331	Cultural Heritage	43,605
5000446	Cultural Heritage	2,734,600
5000447	Cultural Heritage	2,716,200
5000341	Cultural Heritage	783,300
5000342	Cultural Heritage	472,800
5000343	Groundwater and Surface Water	785,000
5000347	Marine and Coastal	822,400
5000349	Marine and Coastal	363,537
5000350	Marine and Coastal	822,500
5000351	Marine and Coastal	454,500
5000352	Marine and Coastal	488,630
5000344	Marine and Coastal	686,100
5000345	Marine and Coastal	143,600
5000346	Marine and Coastal	4,208,900
5000348	Marine and Coastal	594,000
5000386	Marine and Coastal	826,000
5000387	Marine and Coastal	1,035,000
5000382	Marine and Coastal	3,686,520
5000388	Marine and Coastal	178,400
5000389	Marine and Coastal	842,500
5000383	Marine and Coastal	375,700
5000384	Marine and Coastal	412,000
5000385	Marine and Coastal	865,400
5000424	Terrestrial	703,870
5000425	Terrestrial	431,000
5000420	Terrestrial	980,409
5000421	Terrestrial	871,930
5000422	Terrestrial	632,000
5000426	Terrestrial	1,037,000
5000427	Terrestrial	1,489,100
5000428	Terrestrial	2,054,600
5000423	Departure of persons from Iraq or Kuwait	678,100
5000390	Public Health	899,000
5000391	Public Health	1,468,819
5000392	Public Health	1,926,220
5000393	Public Health	449,000
5000394	Public Health	2,112,500
5000395	Public Health	459,000
<u>Total</u>		42,951,383

A. Overview

56. Iran submitted a consolidated claim for monitoring and assessment of environmental damage, depletion of natural resources and public health damage that it alleges it suffered as a result of Iraq's invasion and occupation of Kuwait. It states that Iraq's detonation of oil wells in Kuwait resulted in the release of more than 760,000 tons of smoke into the atmosphere. Over 280,000 tons of highly toxic pollutants were dispersed by air and deposited on Iranian territory, particularly the southern provinces of the country. According to Iran, over 15 million people inhaled the toxic smoke for more than 250 days. Iran further alleges that one third of its freshwater resources, its largest agricultural lands, and its most important archaeological sites are located in those provinces and were affected by the pollutants.

57. Iran further alleges that millions of barrels of crude oil were deliberately released into the Persian Gulf by Iraq's forces, and that this resulted in serious damage to the Persian Gulf's fragile ecosystem and to the natural resources of Iran.

58. Finally, Iran alleges that the damage caused to the environment will continue to have adverse impacts on its marine environment, fisheries, water resources, terrestrial environment, agricultural lands, rangelands and forests, cultural heritage sites and public health. The monitoring and assessment would enable it to evaluate the extent of the damage and to determine the most appropriate measures to abate the harm and restore the environment.

59. Iraq argues in its written response, inter alia, that Iran has failed to show that it has suffered any direct damage as a result of Iraq's invasion and occupation of Kuwait. In addition, Iraq contends that, because of the direction of the prevailing winds in the region, the smoke plume rarely reached Iranian territory. It further contends that only the "thin part" of the plume reached the coast of Iran, and just for a short period. Iraq also argues that because no sampling was conducted in Iran in 1991, Iran has no scientific basis for claiming that any damage is attributable to its actions.

60. Iraq reiterated these contentions during the oral proceedings.

61. The Panel has noted the views of Iraq. However, as indicated in paragraphs 29 and 30, it does not consider that a claimant is required to prove the existence of any specific damage before submitting a claim or claims for monitoring and assessment of environmental damage and depletion of natural resources. Moreover, as noted in the sections that follow, there is ample evidence that pollutants from the oil fires in Kuwait reached some parts of Iran and that the territory of Iran was exposed to the oil spill in

the Persian Gulf that resulted from Iraq's invasion and occupation of Kuwait.

B. Transport and dispersion of pollution

1. Claim No. 5000329

62. Iran seeks compensation in the amount of USD 432,983 for a completed study that used satellite imagery analysis and related methodologies to track the transport of airborne pollutants from the oil fires in Kuwait and the spilled oil in the Persian Gulf that resulted from Iraq's invasion and occupation of Kuwait. The purpose of the study was to determine whether and to what extent airborne pollutants from the oil fires and spilled oil reached the territory of Iran.

63. There is evidence in the scientific literature that emissions from the oil fires reached some parts of Iran. It is, therefore, likely that some airborne pollutants from the oil fires reached the ground in Iran, mainly through wet deposition. There is also evidence that the territory of Iran was affected by the oil spill in the Persian Gulf. It was, therefore, appropriate for Iran to attempt to determine whether pollutants from the oil fires and the spilled oil reached its territory.

64. Accordingly, the Panel finds that the study constituted reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

65. Iran submitted documentary evidence in support of costs incurred for 1,200 AVHRR images purchased from the International Institute for Aerospace Survey and Earth Sciences. An Advanced Very High Resolution Radiometer ("AVHRR") is an instrument carried on earth-orbiting meteorological satellites, which is used to map clouds, sea surface temperature, and some topographic features by sensing visible and near-infrared radiation. The Panel finds that the USD 120,000 claimed for the purchase of the AVHRR images is reasonable and adequately supported.

66. Iran also submitted documentary evidence in support of costs for the purchase of satellite image processing equipment and related training, and computer hardware and software. These costs totalled USD 140,000. By Procedural Order No. 2, dated 10 May 2000, the Panel requested Iran to provide, inter alia, an explanation of the need for the purchase of satellite reception equipment and the training of personnel on the use of this equipment, given that Iran had already purchased satellite images from the International Institute for Aerospace Survey and Earth Sciences. Iran did not respond to the procedural order. The Panel, therefore, finds that Iran has failed to meet the evidentiary requirements for compensation for these items.

67. Procedural Order No. 2 also requested Iran to provide documentary and other appropriate evidence in support of the expenses claimed for labour, travel, purchase of maps, printing, and miscellaneous items. The Panel did not receive this information in time to take it into account in its review of the claim. Consequently, the Panel finds that Iran has failed to meet the evidentiary requirements for compensation for these items.

68. Accordingly, the Panel does not recommend any compensation for the expenses referred to in paragraphs 66 and 67. Hence the only compensable expenditure is the amount referred to in paragraph 65.

69. The Panel, therefore, recommends compensation in the amount of USD 120,000 for this claim.

70. The date of loss for this claim (for the purpose explained in paragraph 777) is 28 May 1998.

2. Claim No. 5000330

71. Iran seeks compensation in the amount of USD 1,984,660 for a project to develop a computer-based model of the transport of air pollutants from the oil fires in Kuwait. The model would use an adjusted meso-scale atmospheric model for the region and a specialized air quality model to analyse atmospheric pollutants. (The term "meso-scale" refers to models that include effects of smaller meteorological frontal or pressure systems and that evaluate spatial grids ranging from 1 to 100 kilometres.) The project is intended to determine the short-term effects that wet and dry deposition of pollutants resulting from Iraq's invasion and occupation of Kuwait may have had on various types of vegetation in Iran.

72. The Panel considers that, given the lack of monitoring data collected in Iran at the time of the oil fires, it is reasonable for Iran to attempt to estimate the amount of air pollution that affected ground level receptors in its territory. The Panel appreciates that computer models of atmospheric transport of pollutants can only provide general guidance and cannot be used either to establish that pollution from the oil fires affected ground level receptors or to provide an accurate quantitative estimate of exposure. Nonetheless, these models can provide useful information concerning the transport and dispersion of air pollutants.

73. In the Panel's opinion, a competent computer modelling analysis could provide some useful guidance about the exposure of Iran to pollution from the oil fires. However, to succeed within a period of one to two years, such a modelling analysis would need to build upon existing models, rather than upon a newly constructed computer model. In this regard, the Panel notes that excellent meso-scale models already exist and are available for public use.

74. The Panel finds that a project using analyses of existing computer models is a reasonable attempt to determine the transport and dispersion of pollutants in Iran from the oil fires. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

75. However, the Panel considers that the modelling analysis should be supplemented by the collection of additional data, particularly data on "black rain" and "black snow". Such data would enable Iran to verify the results of the modelling effort.

76. In addition, account should be taken of data obtained from soil core samples in other monitoring and assessment projects in Iran, particularly claim Nos. 5000347 and 5000425 (paras. 113-118 and 218-222, respectively). Details of the suggested modifications are set out in annex I to this report.

77. Following a review of the cost estimates presented by Iran, the Panel has concluded that a much smaller amount would be sufficient to enable Iran to undertake a competent computer modelling analysis based on existing computer models, coupled with the collection and analysis of data on black rain and snow. The Panel's estimate of a reasonable cost of the project is USD 672,960.

78. The Panel, therefore, recommends compensation in the amount of USD 672,960 for this claim.

C. Impacts on cultural heritage materials and sites

1. Claim No. 5000331

79. Iran seeks compensation in the amount of USD 43,605 for preliminary monitoring studies that were conducted to evaluate damage that might have been caused to cultural relics in Iran by pollutants from the oil fires in Kuwait.

80. The only evidence provided by Iran to support the claim was a series of letters ordering individuals to travel to certain areas of the country to undertake a variety of activities in late 1997 and 1998. According to the letters, the purpose of the trips was to study, sample and photograph certain cultural relics and prepare reports on the extent of damage caused to those relics as a result of Iraq's invasion and occupation of Kuwait. Iran did not provide a description of the activities undertaken or the methodologies used for the studies. No reports or other evidence were submitted to show that any work had been undertaken.

81. By Procedural Order No. 2, dated 10 May 2000, the Panel requested Iran to provide, inter alia, information regarding the number of preliminary studies conducted, the dates on which they were conducted, their objectives,

the reports containing the results of the studies, and documentary and other appropriate evidence in support of the costs claimed. The Panel did not receive this information in time to take it into account during its review of the claim.

82. The Panel, therefore, finds that Iran has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

83. Accordingly, no compensation is recommended for this claim.

2. Claim No. 5000446

84. Iran seeks compensation in the amount of USD 2,734,600 for five studies to determine the extent of deterioration that may have been caused to certain outdoor cultural heritage materials in Iran by pollutants from the oil fires in Kuwait. These cultural heritage materials include stone relics in Persepolis; tilework in Eşfahan and Kermân; wall paintings in Eşfahan, Fârs and Yazd; construction materials at the Tchoga Zanbil Ziggurat in Khûzestân; and construction materials, archaeological sites and artefacts in Susa. Some wall paintings referred to herein are located outdoors, while others are indoors.

85. As previously noted (para. 63), there is evidence in the scientific literature that emissions from the oil fires reached some parts of Iran. It is, therefore, likely that some airborne pollutants from the oil fires reached the ground in Iran, mainly through wet deposition. In the Panel's opinion, although the probability of identifying damage to the outdoor cultural heritage materials by airborne pollutants from the oil fires, and differentiating such damage from other sources, is low, this cannot be ruled out completely.

86. The Panel considers that it is appropriate for Iran to attempt to determine whether any damage to outdoor cultural heritage materials occurred as a result of the oil fires. The results of the studies could be useful not only for evaluating the extent of damage suffered by the outdoor cultural heritage materials, but also in determining whether there is any need for abatement or restoration measures.

87. The Panel finds that the studies constitute reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

88. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex II to this report.

89. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The number of person-months of labour has been reduced with a consequential decrease in labour costs;

(b) The number and, therefore, cost of analytic tests has been reduced by 80 per cent; and

(c) The preparation of educational handbooks and the training of technicians and staff in the field of hazard preparedness and management have been eliminated because these activities are not necessary for the studies.

These adjustments reduce the estimated cost to USD 1,398,100.

90. The Panel, therefore, recommends compensation in the amount of USD 1,398,100 for this claim.

3. Claim No. 5000447

91. Iran seeks compensation in the amount of USD 2,716,200 for four studies to determine the extent of deterioration that may have been caused to certain indoor cultural heritage materials in its territory by pollutants from the oil fires in Kuwait. The cultural heritage materials include manuscripts and books in libraries and museums; bronze and iron objects in museums and collections; textile artefacts in museums and repositories; and easel paintings in museums and repositories.

92. As previously noted (para. 63), there is evidence that pollutants from the oil fires reached the ground in parts of Iran, mainly through wet deposition. However, damage to indoor cultural heritage materials is likely to be much less than damage to outdoor materials, because indoor materials are not exposed to air pollution to the same extent.

93. The Panel notes that, as with the outdoor cultural heritage materials, the probability of identifying damage caused by airborne pollutants from the oil fires and differentiating such damage from damage from other sources is low. Indeed, the probability is even lower in the case of indoor materials.

94. Nonetheless, there is the possibility of some exposure of the material to airborne pollutants from the oil fires; and it is appropriate for Iran to attempt to determine the existence and extent of damage that may have been caused. Moreover, the results of the studies may be useful for establishing the possible need for abatement and restoration measures.

95. For these reasons, the Panel finds that the studies constitute reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

96. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex III to this report.

97. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The overall scope of the studies has been substantially reduced to reflect a more focussed approach in the selection of sites and materials;

(b) The number of person-months of labour has been substantially reduced with a consequential decrease in labour costs;

(c) The number and, therefore, cost of analytic tests has been reduced by 80 per cent; and

(d) The preparation of educational handbooks and the training of technicians and staff in the field of hazard preparedness and management have been eliminated because these activities are not necessary for the studies.

These adjustments reduce the estimated cost to USD 575,000.

98. The Panel, therefore, recommends compensation in the amount of USD 575,000 for this claim.

4. Claim No. 5000341

99. Iran seeks compensation in the amount of USD 783,300 for a study to determine damage that may have been caused to unexcavated archaeological sites in the southern part of its territory by pollutants from the oil fires in Kuwait.

100. In the Panel's opinion, the unexcavated sites are likely to have had significantly less, if any, exposure to airborne pollutants from the oil fires than outdoor or indoor cultural heritage materials. Iran has developed neither a methodology for the study nor a procedure for selecting sites for damage assessment and unaffected control sites.

101. The Panel, therefore, finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

102. Accordingly, the Panel recommends no compensation for this claim.

5. Claim No. 5000342

103. Iran seeks compensation in the amount of USD 472,800 for a project to assess the susceptibility of museums and archaeological sites to sudden increases of pollutants and to develop strategies for air pollution control in museums and repositories in Iran. According to Iran, the purpose of the

project is to prepare a blueprint for measures to protect and preserve historic cultural objects from future pollution.

104. In the opinion of the Panel, the project is intended to establish a system to prevent future damage, rather than to evaluate or abate harm that may have been caused as a result of Iraq's invasion and occupation of Kuwait. Hence this project does not qualify as reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

105. Accordingly, no compensation is recommended for this claim.

D. Impacts on groundwater and surface water

Claim No. 5000343

106. Iran seeks compensation in the amount of USD 785,000 for a project to assess the extent of groundwater pollution by hydrocarbons and related heavy metals that may have been caused by deposition of pollutants from the oil fires in Kuwait. The project would also estimate costs of groundwater remediation.

107. According to Iran, the project would use a "tiered approach" in which areas in the southern region of Khuzestan suspected to have been affected by hydrocarbon and heavy metal contamination would be identified, sampled and classified as "low contamination" or "high contamination" zones. Groundwater in zones classified as highly contaminated would be further sampled. The data generated by the further sampling would be analysed and mapped with Geographic Information System ("GIS") methods. Transport modelling would be used to verify the results of the sampling and to assess the behaviour of pollutants in groundwater over a given period.

108. As previously noted (para. 63), evidence in the scientific literature indicates that airborne pollutants from the oil fires passed over parts of Iran. It is, therefore, likely that some of these pollutants reached the ground in Iran, mainly through wet deposition. Although the probability of identifying incremental damage to the groundwater aquifers caused specifically by the deposition of pollutants from the oil fires is low, this cannot be ruled out completely.

109. The Panel finds that the project is an appropriate attempt to determine whether pollutants from the oil fires had any adverse effects on the groundwater aquifers in Iran. Thus the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

110. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex IV to this report.

111. In addition, the Panel has adjusted the cost of labour by substantially reducing the number of person-months of labour required. This adjustment reduces the estimated cost to USD 371,656.

112. The Panel, therefore, recommends compensation in the amount of USD 371,656 for this claim.

E. Impacts on the marine and coastal environment

1. Claim No. 5000347

113. Iran seeks compensation in the amount of USD 822,400 for a project to investigate the natural revegetation capacities of mangrove trees and bioaccumulation of toxic heavy metals and oil-related hydrocarbons in mangroves in areas of the northern Persian Gulf that may have been affected by pollutants released as a result of Iraq's invasion and occupation of Kuwait.

114. As previously noted (para. 63), there is evidence in the scientific literature that pollutants from the oil spill and oil fires reached parts of Iran. There is also evidence that such pollutants can have deleterious impacts on mangrove trees. These effects can become chronic for all growth stages of the trees if the pollutants permeate soft, anaerobic sediments and are subsequently released. Hence, mangrove trees along the Iranian coast could have been adversely affected by exposure to oil pollution. Therefore, an attempt to ascertain the existence and extent of any such effects is appropriate.

115. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

116. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex V to this report.

117. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The costs of certain analytical work have been eliminated because Iran informed the Panel that it will not be undertaken;

(b) The costs of laboratory services have been adjusted to allow for petroleum fingerprinting analysis using gas chromatography/mass spectrometry;

(c) The cost of equipment has been reduced because Iran has indicated that some equipment purchased for another project will be used;

(d) The amount of labour for research personnel has been reduced with a consequential decrease in labour costs; and

(e) The costs of attendance at seminars have been eliminated because the Panel does not consider that attendance at seminars is necessary.

These adjustments reduce the estimated cost to USD 711,200.

118. Accordingly, the Panel recommends compensation in the amount of USD 711,200 for this claim.

2. Claim No. 5000349

119. Iran seeks compensation in the amount of USD 363,537 for a project to determine the current status of indicator microfaunal species and the natural recovery and remediation capacities of polluted marine environments. The purpose of the project would be to determine the extent of long-term damage to the marine environment of Iran that may have resulted from Iraq's invasion and occupation of Kuwait.

120. As previously noted (para. 63), there is evidence that the coast of Iran was exposed to oil pollution resulting from Iraq's invasion and occupation of Kuwait. There is also evidence in the scientific literature that oil pollution can have adverse effects on intertidal organisms and may cause alterations in intertidal communities, including reductions in stocks and changes in trophic structure.

121. The Panel considers that it is appropriate for Iran to attempt to find out whether any long-term damage was caused to its marine environment by the oil pollution.

122. Accordingly, the Panel finds that the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

123. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex VI to this report.

124. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The cost of labour has been reduced to take account of the decrease in research work; and

(b) The amount claimed for the purchase of binocular microscopes has been reduced.

These adjustments reduce the estimated cost to USD 263,037.

125. Accordingly, the Panel recommends compensation in the amount of USD 263,037 for this claim.

3. Claim No. 5000350

126. Iran seeks compensation in the amount of USD 822,500 for a project to assess coral reefs under its jurisdiction that may have been affected by oil pollution resulting from Iraq's invasion and occupation of Kuwait. The project would involve assessment of the current status of these reefs, recovery rate of damaged coral reefs, feasibility studies on restoration techniques and a pilot restoration programme.

127. There is evidence in the scientific literature that coral reefs can be damaged by oil pollution. Iran's marine resources were exposed to pollution resulting from Iraq's invasion and occupation of Kuwait, and Iran's coral reefs may have been affected by either the oil spill or deposition of airborne pollutants from the oil fires, or both. Accordingly, it is appropriate for Iran to attempt to identify and assess damage that may have been caused to the coral reefs.

128. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

129. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex VII to this report.

130. In addition, the Panel has adjusted the estimated cost by eliminating the costs of a "mini transport and a research submarine transport system", scuba diving, and submarine pilot courses because they are unnecessary. These adjustments reduce the estimated cost to USD 661,140.

131. Accordingly, the Panel recommends compensation in the amount of USD 661,140 for this claim.

4. Claim No. 5000351

132. Iran seeks compensation in the amount of USD 454,500 for a project to assess long-term changes to seagrass beds under its jurisdiction in the Persian Gulf that may have been caused by oil pollution resulting from Iraq's invasion and occupation of Kuwait. According to Iran, the project would involve the collection of information on the concentration of pollutants in underlying sediments.

133. There is evidence in the scientific literature that seagrass communities, which constitute an important and productive element of coastal ecosystems, are vulnerable to oil pollution. Oil retained in sediments can have a toxic effect on organisms burrowing in or living on the surface sediment. These organisms are an important component of seagrass

ecosystems. As previously noted, there is evidence that the Iranian coastline was exposed to oil pollution resulting from Iraq's invasion and occupation of Kuwait. As a result, seagrass communities along the coastline could have been damaged. It is, therefore, appropriate for Iran to attempt to assess damage that may have been caused to the seagrass beds.

134. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

135. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex VIII to this report.

136. In addition, the Panel has reduced the total amount of labour required with a consequential decrease in labour costs. This adjustment reduces the estimated cost to USD 157,776.

137. Accordingly, the Panel recommends compensation in the amount of USD 157,776 for this claim.

5. Claim No. 5000352

138. Iran seeks compensation in the amount of USD 488,630 for a project to select the most cost-effective method of restoring mangrove forests in its territory that may have been damaged as a result of Iraq's invasion and occupation of Kuwait.

139. As previously noted (para. 114), oil pollution can cause damage to mangrove forests at all growth stages. Such damage can become chronic if oil permeates soft, anaerobic sediments and is subsequently released. In the Panel's view, mangrove forests along the Iranian coast could have been affected by exposure to oil pollution resulting from Iraq's invasion and occupation of Kuwait. It is therefore appropriate for Iran to attempt to assess the means of restoring forests that may have been damaged.

140. In this connection the Panel notes that some of these mangrove forests are located in areas listed as wetlands of international importance under the 1971 Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat, United Nations Treaty Series, vol. 996, No. 14583, p. 245).

141. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

142. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex IX to this report.

143. In addition, the Panel has made adjustments to the cost estimate as follows:

- (a) The cost of labour has been reduced to reflect a decrease in the amount of labour required;
- (b) The cost of an irrigated nursery has been reduced; and
- (c) The cost of transportation has been corrected as indicated by Iran.

These adjustments reduce the estimated cost to USD 357,730.

144. Accordingly, the Panel recommends compensation in the amount of USD 357,730 for this claim.

6. Claim No. 5000344

145. Iran seeks compensation in the amount of USD 686,100 for a project to monitor plant community characteristics in areas of the Shadegan Wetland in Iran that may have been polluted as a result of Iraq's invasion and occupation of Kuwait. The purpose of the project would be to determine natural revegetation capacities and production capabilities of dominant plant species. It would also provide information that would serve as the basis for restoration activities, quantification of other environmental damage claims and calculation of the economic value of lost ecosystem resources.

146. There is evidence that the Shadegan Wetland was exposed to oil pollution resulting from Iraq's invasion and occupation of Kuwait. Wetlands provide a variety of important ecological functions that can be impaired or destroyed by oil pollution. In particular, oil can have a toxic effect on vegetation and alter an ecosystem's community structure. It is, therefore, appropriate for Iran to attempt to assess the nature of any damage that may have been caused.

147. The Panel notes that the Shadegan Wetland is listed as a wetland of international importance under the 1971 Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat, United Nations Treaty Series, vol. 996, No. 14583, p. 245).

148. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

149. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex X to this report.

150. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The cost of labour has been reduced to reflect a decrease in the scope of the project indicated by Iran;

(b) The cost of the microscope has been eliminated because Iran has stated that it will not be purchased; and

(c) A laboratory bench fee has been eliminated because it is unnecessary.

These adjustments reduce the estimated cost to USD 489,750.

151. Accordingly, the Panel recommends compensation in the amount of USD 489,750 for this claim.

7. Claim No. 5000345

152. Iran seeks compensation in the amount of USD 143,600 for a project to assess the impacts of Iraq's invasion and occupation of Kuwait on wetland bird populations in Iran by collecting and comparing current population data with pre-invasion data. The project also would assist efforts to restore wetlands and bird populations that may have been harmed by pollution resulting from Iraq's invasion and occupation of Kuwait.

153. The available evidence suggests that wetland birds in Iran are likely to have been exposed to pollution resulting from Iraq's invasion and occupation of Kuwait. In the opinion of the Panel, the project is a reasonable attempt to evaluate the reduction in wetland bird populations that may have resulted from the pollution and to identify measures needed to restore the bird populations of Iranian wetland areas.

154. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

155. The Panel finds the amount claimed reasonable and accordingly recommends compensation in the amount of USD 143,600 for this claim.

8. Claim No. 5000346

156. Iran seeks compensation in the amount of USD 4,208,900 for a project to determine the current status of Iranian fishery resources that may have been damaged by pollution resulting from Iraq's invasion and occupation of Kuwait and to provide information that may assist in restoration and rehabilitation of these resources. The project would involve an evaluation of the bioaccumulation rate of pollutants in fishery species and impacts to the fishery stock, and attempt to develop a reliable estimate of recovery rates.

157. As previously noted, there is evidence that Iranian coastal areas, fisheries resources and marine ecosystems were exposed to oil pollution that resulted from Iraq's invasion and occupation of Kuwait. There is evidence in the scientific literature that petroleum hydrocarbons can have many adverse impacts on fish, including mortality, defects in reproduction such as reduced fertility and reduced hatching success, reduced growth rates, and reduced survival of eggs and juveniles. This can have long-term adverse effects on fisheries stocks.

158. In the Panel's view, the objectives of the project are appropriate, given the dearth of information available on the state of Iran's fisheries resources before and after Iraq's invasion and occupation of Kuwait.

159. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, expenses of the project qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

160. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex XI to this report.

161. As a result of the modifications, the Panel has adjusted the cost of labour. This adjustment reduces the estimated cost to USD 2,908,274.

162. The Panel, therefore, recommends compensation in the amount of USD 2,908,274 for this claim.

9. Claim No. 5000348

163. Iran seeks compensation in the amount of USD 594,000 for a project to identify and assess the presence of pollutants, such as petroleum hydrocarbons and trace metals, in a variety of fish species in Iranian waters resulting from the pollution from Iraq's invasion and occupation of Kuwait. According to Iran, the project would seek to establish, through chemical analyses and physiological tests, the link between the concentration of hydrocarbon pollutants in soil sediments and the concentration of such pollutants in fish tissues. In addition, Iran plans to assess the short-term and long-term effects of Kuwait crude oil on selected species in its marine environment.

164. As previously noted, there is evidence that Iran's marine environment was exposed to pollution resulting from Iraq's invasion and occupation of Kuwait. In the Panel's opinion, an attempt by Iran to determine the impact of the oil spill and atmospheric deposition of pollutants on fish species is appropriate. In this connection, the Panel notes that the fish species concerned are of major economic importance for Iran.

165. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

166. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex XII to this report.

167. Taking into consideration the suggested modifications and resulting cost adjustments, the Panel has developed what it considers to be a reasonable estimate for the project. The revised estimate amounts to USD 377,900.

168. The Panel, therefore, recommends compensation in the amount of USD 377,900 for this claim.

10. Claim No. 5000386

169. Iran seeks compensation in the amount of USD 826,000 for a study on the use of genetically modified bacteria to combat residual oil pollution that may have resulted from Iraq's invasion and occupation of Kuwait. According to Iran, the study would isolate a number of bacteria from the Persian Gulf, genetically modify them and release them into its marine environment to assist biodegradation of any remaining hydrocarbons and tarballs.

170. There is evidence in the scientific literature that some bacteria are naturally capable of degrading petroleum hydrocarbons. However, the evidence suggests that a more effective way to encourage bacterial biodegradation of oil would be to add nutrients or oxygen to the contaminated area and thus assist naturally occurring bacteria to grow more rapidly, rather than introducing additional bacteria into the environment. The evidence also indicates that bacterial biodegradation of oil is most effective if undertaken soon after an oil spill. Accordingly, the Panel does not consider that the procedure proposed is likely to be effective so long after the oil spill that resulted from Iraq's invasion and occupation of Kuwait.

171. In addition, the Panel has serious reservations about the deliberate release of genetically modified organisms into the environment. It notes that widespread concerns have been expressed that the release of such organisms could pose risks to the environment and to human health. In the absence of reliable scientific knowledge about the threat posed by these organisms, it is not advisable for Iran to undertake such a potentially risky procedure. This is particularly so in view of the low probability that the experiment would have any practical utility.

172. For these reasons, the Panel finds that the proposed study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

173. The Panel, therefore, recommends no compensation for this claim.

11. Claim No. 5000387

174. Iran seeks compensation in the amount of USD 1,035,000 for a study on the use of Persian Gulf algae and cyanobacteria as a tool for bioremediation of marine ecosystems under its jurisdiction that may have been polluted as a result of Iraq's invasion and occupation of Kuwait. According to Iran, the study is intended to help it identify the species of algae and cyanobacteria that would be most effective for removing oil-borne heavy metals from the environment. The organisms so identified would be introduced into the polluted areas in Iran's marine environment to assist bioremediation of the oil-borne heavy metals in those areas.

175. There is evidence in the scientific literature that some algae and cyanobacteria are capable of absorbing metals into their cells. However, available evidence suggests that photosynthetic organisms do not have any significant ability to degrade petroleum hydrocarbons. There is, therefore, no scientific basis for assuming that algae and cyanobacteria can play an effective role in the bioremediation of environment polluted by oil.

176. The Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

177. The Panel, therefore, recommends no compensation for this claim.

12. Claim No. 5000382

178. Iran seeks compensation in the amount of USD 3,686,520 for a project to develop a "regional flow and contaminant transport model" for its marine area that may have been affected by the oil spill resulting from Iraq's invasion and occupation of Kuwait. The purpose of the project would be to help establish the extent of pollution of the Iranian coastal areas. Iran has stated that Kuwait would participate in the project and that the two states would work jointly with the Regional Organization for the Protection of the Marine Environment ("ROPME").

179. The project would consist of a modelling component and fieldwork to collect data. The modelling component would involve the development of a three-dimensional hydrodynamic model and an oil transport model for the Persian Gulf. The field effort would be designed to gather information needed to develop, calibrate and validate the model. According to Iran, the project would be used to develop a tool to determine with reasonable accuracy the areas of its marine environment exposed to oil spilled as a result of Iraq's invasion and occupation of Kuwait.

180. As previously noted, Iran's marine environment was exposed to the oil spill that resulted from Iraq's invasion and occupation of Kuwait. A three-

dimensional hydrodynamic model, when used with an oil transport model, can provide information about the fate and location of spilled oil. Such information can be used with available field data to develop a comprehensive historical picture of the spatial extent of pollution, as well as provide guidance for subsequent field investigations and remediation efforts.

181. The Panel finds that the project is an appropriate attempt to assess the extent of pollution that may have been caused by the oil spill. Consequently, it constitutes reasonable monitoring and assessment and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

182. However, the Panel does not consider it necessary for Iran to develop a separate oil transport model. Excellent models capable of performing the analysis intended are available for use by Iran. In the view of the Panel, a competent modelling analysis, building upon existing models, could provide useful guidance on the extent to which Iran's marine environment was exposed to pollution from the oil spill.

183. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex XIII to this report.

184. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The cost of labour has been decreased to take account of the reduction in the work to be undertaken;

(b) The costs of computer hardware and software have been reduced to reflect current prices;

(c) The cost of field data collection has been reduced; and

(d) All costs relating to the participation of Kuwait and ROPME have been eliminated because of uncertainty concerning the arrangement for the participation and the expenses involved.

These adjustments reduce the estimated cost to USD 953,220.

185. The Panel, therefore, recommends compensation in the amount of USD 953,220 for this claim.

186. As previously noted, the Panel emphasizes that savings and scientific benefits can be achieved by co-ordination of monitoring and assessment activities relating to the same subject matter.

13. Claim No. 5000388

187. Iran seeks compensation in the amount of USD 178,400 for a completed study to determine the presence on its shoreline of tarball residues and the extent of oil penetration in its coastal areas that may have resulted from Iraq's invasion and occupation of Kuwait. The study was carried out by the Iranian Department of the Environment between 1995 and 1996. The purpose of the study was to measure the oil pollution concentration along the coastal areas, to map the distribution of oil in the coastal areas, and to provide data for use in evaluation of technologies that could be used for the clean-up of polluted areas.

188. In the opinion of the Panel the study was an appropriate attempt to evaluate the impacts of the oil spill. Thus it constituted reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

189. A report and a one-page budget were submitted by Iran. No other appropriate evidence was submitted. Iran was requested to produce further support to demonstrate the circumstances and amount of the claimed expenditures, but failed to do so.

190. The Panel finds that Iran has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

191. The Panel, therefore, recommends no compensation for this claim.

14. Claim No. 5000389

192. Iran seeks compensation in the amount of USD 842,500 for a project to assess the extent to which Iranian coastal areas have recovered from pollution resulting from Iraq's invasion and occupation of Kuwait; and to determine methodologies for the clean-up of areas which have not recovered. According to Iran, the extent of recovery would be assessed by aerial and land surveys along the shoreline. Appropriate clean-up technologies would be selected. These would be tested on small-scale experimental sites.

193. The survey methodology proposed by Iran is consistent with standard practices in the field, and would enable Iran to locate surface oil and collect valuable data. In the Panel's view, Iran's attempt to determine the most cost-effective remedial techniques under different conditions is appropriate.

194. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

195. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex XIV to this report.

196. Upon a review of the cost estimates presented, the Panel finds that the amount claimed is reasonable.

197. The Panel recommends compensation in the amount of USD 842,500 for this claim.

198. The Panel notes that several Claimants are undertaking similar projects (paras. 419-425, 426-433, 592-599 and 606-616). The Panel emphasizes that co-ordination of efforts and sharing of information would be beneficial.

15. Claim No. 5000383

199. Iran seeks compensation in the amount of USD 375,700 for a project to monitor the amount, fate, and effects of petroleum and "black rain" pollutants that may have affected the root-zone soils of the Shadegan Wetland as a result of Iraq's invasion and occupation of Kuwait. According to Iran, the project would also undertake a cost-benefit analysis of the clean-up methodologies that may be required for the preservation of this wildlife habitat.

200. As previously noted (para. 146), the Shadegan Wetland was exposed to oil pollution as a result of Iraq's invasion and occupation of Kuwait. It is possible that this pollution affected the plant communities in the wetland. It is, therefore, appropriate for Iran to attempt to identify and evaluate possible adverse impacts on the wetland. In the Panel's view, the methods proposed by Iran are consistent with standard practices in this field.

201. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

202. Following a review of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex XV to this report.

203. Upon a review of the cost estimates presented, the Panel finds that the costs claimed are reasonable.

204. The Panel recommends compensation in the amount of USD 375,700 for this claim.

16. Claim No. 5000384

205. Iran seeks compensation in the amount of USD 412,000 for a study on the use of aquatic fungi for biodegradation of oil in its wetland and coastal regions that may have been polluted as a result of Iraq's invasion and

occupation of Kuwait. According to Iran, the purpose of the study would be to identify species of local fungi and mixed fungal cultures that are most effective for biodegrading crude oil from Kuwait. The fungi identified would be used for bioremediation of polluted areas in the wetlands.

206. Although there is evidence in the scientific literature that fungi can play an important role in the biodegradation of petroleum hydrocarbons in terrestrial environments, the literature shows that the contribution of fungi to petroleum degradation in marine ecosystems is virtually zero. Accordingly, the Panel does not consider that the procedure proposed is likely to be effective.

207. For this reason, the Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

208. Accordingly, no compensation is recommended for this claim.

17. Claim No. 5000385

209. Iran seeks compensation in the amount of USD 865,400 for a study to quantify the nature and extent of potential injury to coastal marine life in the southwestern part of Iran. According to Iran, the biodiversity and population dynamics of these marine areas were affected by pollutants resulting from Iraq's invasion and occupation of Kuwait. Iran proposes to investigate the biological and genotoxic effects of pollutants on various finfish and shellfish indicator species.

210. In the opinion of the Panel, the objectives of the study would duplicate those of claim Nos. 5000346 and 5000348 (paras. 156-162 and 163-168, respectively). Moreover, claim Nos. 5000346 and 5000348 rely on methodologies that would be more suitable to distinguish the impacts of oil pollution resulting from Iraq's invasion and occupation of Kuwait from damage due to other causes.

211. The Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

212. The Panel, therefore, recommends no compensation for this claim.

F. Impacts on the terrestrial environment

1. Claim No. 5000424

213. Iran seeks compensation in the amount of USD 703,870 for a study to investigate the impact of oil pollution from the oil fires in Kuwait on soil fertility and crop yield in the southern and southeastern provinces of Iran. Iran proposes, inter alia, to measure the levels of mineralizable carbon and

nitrogen that may have been introduced into the soil through soot and black rain resulting from the oil fires.

214. As previously noted, some airborne pollutants from the oil fires reached parts of the territory of Iran. However, the scientific evidence indicates that soil carbon and nitrogen levels are highly variable and that increases in these levels, especially in agricultural soil, may be due to a variety of factors.

215. In the opinion of the Panel, it is unlikely that the study would enable Iran to determine the extent to which pollution from the oil fires contributed to the levels of carbon that may be observed in the soil. Moreover, the objectives of the study appear to duplicate those of claim No. 5000425, paras. 218-222.

216. The Panel, therefore, finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

217. Accordingly, the Panel recommends no compensation for this claim.

2. Claim No. 5000425

218. Iran seeks compensation in the amount of USD 431,000 for a project to determine the level of soil contamination in Iran that may have been caused by deposition of heavy metals and hydrocarbons from black rain and soot as a result of the oil fires in Kuwait.

219. As previously noted, some airborne pollutants from the oil fires reached parts of the territory of Iran. In the opinion of the Panel, the project is an appropriate attempt by Iran to determine whether any of the pollutants contaminated the soil in its territory.

220. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

221. Following a review of the cost estimates presented by Iran, the Panel finds that the amount claimed is reasonable. The Panel, therefore, recommends compensation in the amount of USD 431,000 for this claim.

222. The Panel emphasizes the need for Iran to take appropriate steps to coordinate data collection and analysis in all of its projects that involve sampling of soils.

3. Claim No. 5000420

223. Iran seeks compensation in the amount of USD 980,409 for a completed study to assess the short-term effects of the oil fires in Kuwait on natural

vegetation cover in Iran, with particular reference to changes in green biomass. The study was completed in 1998.

224. As previously noted, some airborne pollutants from the oil fires reached parts of Iran. It was, therefore, appropriate for Iran to attempt to determine the effects that these pollutants might have had on vegetation and biomass in its territory.

225. The Panel finds that the study constituted reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

226. Iran presented documentary evidence in support of costs for the purchase of remote sensing images (including 329 photographic enlargements and associated negatives, and Landsat TM and SPOT images) as well as the costs for support and advisory services provided by the International Institute for Aerospace Survey and Earth Sciences. These expenses amount to USD 758,792. The Panel finds that this amount is reasonable.

227. However, Iran presented no documentary or other appropriate evidence in support of the remaining expenses claimed. Iran was requested to produce supporting documentation for the claim, but the information provided was insufficient to demonstrate the circumstances and amount of the claimed expenditures. For these expenses, the Panel finds that Iran has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46. The Panel, therefore, recommends no compensation for these expenses.

228. Accordingly, the Panel recommends compensation in the amount of USD 758,792 for this claim.

229. The date of loss for this claim (for the purpose explained in para. 777) is 3 November 1995.

4. Claim No. 5000421

230. Iran seeks compensation in the amount of USD 871,930 for seven completed studies to determine the scope of damage that might have been caused to environmental resources in Iran as a result of Iraq's invasion and occupation of Kuwait. The objectives of the studies were to identify polluted areas and sources of pollution, and to determine the economic value of the loss resulting from the damage.

231. In the opinion of the Panel, these objectives were appropriate. The Panel, therefore, finds that the studies constituted reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

232. Iran provided little evidence in support of the costs claimed for the studies. Iran was requested to produce additional evidence, but the

information provided was insufficient to demonstrate the circumstances and amount of the claimed expenditures. Consequently, the Panel finds that Iran has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

233. Accordingly, the Panel recommends no compensation for this claim.

5. Claim No. 5000422

234. Iran seeks compensation in the amount of USD 632,000 for a study to determine the best and most cost-effective method to rehabilitate areas in the southern parts of Iran that may have been polluted as a result of the oil fires in Kuwait. According to Iran, the study would evaluate and compare three restoration methods, namely, land imprinting, direct seeding and transplantation.

235. In the Panel's opinion, this study is unlikely to produce any information that is not already available in the scientific literature. The restoration techniques to be evaluated have all been well studied in other arid and semi-arid regions around the world, and the conditions under which each technique is likely to be most effective have been discussed in detail.

236. The Panel, therefore, finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

237. Accordingly, the Panel recommends no compensation for this claim.

6. Claim No. 5000426

238. Iran seeks compensation in the amount of USD 1,037,000 for a study to assess the most effective method of restoring its forest areas in Khuzestan, Bushehr, Hormozgan, Ilam, and Fars that may have been damaged by pollution resulting from the oil fires in Kuwait. Iran proposes to introduce fast-growing non-native tree species in affected areas in order to evaluate and compare their ability to survive and thrive.

239. In the opinion of the Panel, the study is unlikely to produce results that are significantly different from those already available. Revegetation has been well studied in other arid and semi-arid regions around the world, including the Middle East, and the scientific literature contains extensive information on the specific complexities of different approaches, and the advantages and disadvantages of using various species.

240. In addition, the Panel has concerns about the proposal to introduce non-native tree species into the environment. The uncontrolled release of non-native species into new environments should generally be undertaken with great caution, especially in environments with fragile ecosystems.

241. The Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

242. Accordingly, the Panel recommends no compensation for this claim.

7. Claim No. 5000427

243. Iran seeks compensation in the amount of USD 1,489,100 for a project to investigate the impacts that the pollution from the oil fires in Kuwait may have had on forests in the southern and southwestern areas of Iran. According to Iran, the project consists of two phases, the first of which was completed in 1998.

244. As previously noted, there is evidence that petroleum-related pollutants can have adverse impacts on various plant species. It is, therefore, reasonable for Iran to attempt to evaluate these impacts in regions of its territory that may have been affected by such pollutants.

245. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

246. A report and a one-page budget were presented by Iran to support the first phase of the project. No evidence was presented in support of the expenses alleged to have been incurred. Although Iran was requested to produce additional, appropriate evidence, such as contracts, invoices, receipts, salary vouchers and/or accounting records, it failed to do so.

247. In view of these evidentiary shortcomings, the Panel does not recommend any compensation for the first phase of the project. Elimination of those expenses reduces the amount claimed to USD 663,600.

248. Following a review of the second phase of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex XVI to this report.

249. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The costs of labour have been reduced to reflect a decrease in the amount of labour required;

(b) The cost of material for DNA analysis has been eliminated;

(c) Savings from eliminated DNA-related labour costs are assumed to become available for the recommended additional enzyme analyses; and

(d) Additional provision has been made for a dendrochronograph to be used for a temporal analysis of tree ring growth.

These adjustments reduce the estimated costs for the second phase of the project to USD 624,600.

250. Accordingly, the Panel recommends compensation in the amount of USD 624,600 for this claim.

251. The Panel emphasizes the need for Iran to take appropriate steps to coordinate data collection and analysis in all of its projects that involve sampling of soils.

8. Claim No. 5000428

252. Iran seeks compensation in the amount of USD 2,054,600 for a three-phase monitoring and assessment project to investigate the long-term effects of pollutants from the oil fires in Kuwait on livestock in Iran's territory. According to Iran, the project would enable it to identify trends in the incidence of diseases among the livestock.

253. The first phase of the project would involve the collection and processing of statistical data on the incidence of health disorders among livestock and poultry from eight provinces of the country. In the second phase Iran would attempt to determine the bioaccumulation rate of oil-related pollutants in the organs of livestock and poultry. The third phase would identify possible correlations between pollutants from the oil fires and adverse health effects that might be observed in livestock. Where possible, suitable preventive or remedial measures would be selected.

254. Iraq argues that diseases in livestock are caused by bacteria, viruses, parasites and other micro-organisms, but not by smoke.

255. As previously noted, some airborne pollutants from the oil fires reached parts of the territory of Iran. Some of the pollutants could have had adverse health effects on livestock. It is therefore appropriate for Iran to attempt to evaluate these impacts in the regions of its territory that may have been affected by such pollutants.

256. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

257. However, the Panel notes that ten years have elapsed since Iraq's invasion and occupation of Kuwait. Given the typical lifespan of livestock species in Iran, most of the livestock currently in the country are unlikely to have been present during the invasion and occupation of Kuwait. The Panel therefore finds that an attempt to study impacts on livestock by widespread sampling of bioaccumulation levels in organs of livestock alive today is not appropriate. Accordingly, the Panel finds that the second phase of the project does not constitute reasonable monitoring and

assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

258. Following a review of the first and third phases of the project as presented by Iran, the Panel suggests certain modifications, details of which are set out in annex XVII to this report.

259. The Panel has made adjustments to the labour costs in the first and third phases of the project to reflect changes in the scope of the project. In addition, the Panel has made adjustments to take into account the elimination of the second phase of the project. These adjustments reduce the estimated cost to USD 1,679,091.

260. The Panel, therefore, recommends compensation in the amount of USD 1,679,091 for this claim.

G. Departure of persons from Iraq or Kuwait

Claim No. 5000423

261. Iran seeks compensation in the amount of USD 678,100 for a study to investigate the nature and extent of damage that may have been caused to the Zagros Mountain range by refugees who camped there with their livestock, and to determine the likely persistence of any such damage. Iran alleges that the majority of the refugees were Kurds who fled from Iraq as a result of Iraq's invasion and occupation of Kuwait.

262. The Panel notes that, pursuant to paragraph 34(b) of Governing Council decision 7, losses resulting from the departure of persons from Iraq or Kuwait are compensable if the departures occurred within the period 2 August 1990 to 2 March 1991.

263. Iran did not provide adequate documentation to establish that the refugees departed Iraq or Kuwait during the period 2 August 1990 to 2 March 1991. The Panel is thus unable to determine if any of the refugees departed from Iraq during the period specified in Governing Council decision 7 and, consequently, whether damage resulting from their presence in Iran would qualify as direct loss.

264. Accordingly, the Panel finds that Iran has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

265. The Panel, therefore, recommends no compensation for this claim.

H. Public health impacts

1. Claim No. 5000390

266. Iran seeks compensation in the amount of USD 899,000 for a study to investigate the effects that airborne pollutants from the oil fires in Kuwait may have had on the mitochondrial respiratory condition of inhabitants of the western provinces of Iran. Iran proposes to measure mitochondrial respiratory chain enzyme activity in the platelets of non-smokers in the western provinces of Iran who are known to have been affected by pollutants from the oil fires, and compare the results with those found in the platelets of non-smoking relatives in unaffected areas.

267. The stated rationale for the study is that airborne pollutants can cause mitochondrial dysfunction and neuronal toxicity in exposed populations.

268. In its written response, Iraq argues that Iran lacks adequate baseline data against which to compare the health effects allegedly caused by exposure to pollutants from the oil fires. Iraq also questions the feasibility of detecting any adverse health effects so long after the alleged exposure.

269. In the Panel's view, there is no justification for a study that purports to detect effects of smoke inhalation on mitochondrial function by examining platelets nine to ten years after exposure to the smoke. Even if measurable effects on mitochondrial function could have been detected in platelets among a few highly exposed persons during the period of the oil fires, it is highly unlikely that such effects would still be measurable in circulating platelets of such persons after such a long lapse of time.

270. The Panel, therefore, finds that the proposed study does not constitute reasonable monitoring of public health for the purposes of paragraph 35(d) of Governing Council decision 7.

271. Accordingly, the Panel recommends no compensation for this claim.

2. Claim No. 5000391

272. Iran seeks compensation in the amount of USD 1,468,819 for a project to investigate the effects that airborne pollutants from the oil fires in Kuwait may have had on the pulmonary health of inhabitants of Iran. According to Iran, the project would be carried out by experts from the University of California/Los Angeles and the City University of New York. The purpose is to assess the impacts of the pollutants on the health of exposed populations, based on the level and duration of exposure. It would also attempt to identify, through the use of model exposure data, diseases that may arise in exposed populations in the future.

273. In the opinion of the Panel, the objectives of the study would duplicate those of claim Nos. 5000393 and 5000395 (paras. 283-287 and 291-296, respectively).

274. The Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

275. The Panel, therefore, recommends no compensation for this claim.

3. Claim No. 5000392

276. Iran seeks compensation in the amount of USD 1,926,220 for a project to investigate the psychiatric effects on the Iranian population that may have resulted from trauma experienced during Iraq's invasion and occupation of Kuwait, and to estimate the cost of treating any such psychiatric disorders. According to Iran, the project would use the Composite International Diagnostic Interview IV method to compare levels of psychiatric symptoms and rates of psychiatric disorder in the following three sections of its population:

(a) Persons who were exposed to both the war between Iran and Iraq of 1980-1988 and the oil fires in Kuwait;

(b) Persons who were exposed only to the oil fires; and

(c) Persons who were not exposed to either of the above two conditions.

277. Iraq argues that the proposed project has several flaws. First, it states that "retrospective studies are meaningless unless backed with [a] reliable database". Second, it states that no database is available, and that no sampling was carried out at the time. Third, Iraq states that the number of inhabitants covered by the study is not mentioned.

278. The evidence in the scientific literature indicates that psychiatric disorders, such as post-traumatic stress disorder ("PTSD") and associated co-morbid psychiatric disorders, may result from events such as those that occurred during Iraq's invasion and occupation of Kuwait. These disorders can persist for long periods after the events that led to the trauma. It is also possible that Iraq's invasion and occupation of Kuwait triggered in some persons a recurrence of PTSD or associated disorder that they had previously suffered as a result of the war between Iran and Iraq.

279. In the view of the Panel, it is appropriate for Iran to attempt to investigate psychiatric disorders that may have been suffered by its inhabitants as a result of Iraq's invasion and occupation of Kuwait. Thus the project constitutes reasonable monitoring of public health, and the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

280. The Panel notes that the usefulness of the results of the project will depend on how accurately the investigators are able to determine the regions of the country that were affected by the war between Iran and Iraq or by the oil fires in Kuwait or by both. Accurate determination of such regions would also provide useful information for the analysis of the incidence of disorders and costs of treatment. The Panel also emphasizes that it will be necessary to translate the Composite International Diagnostic Interview IV into Farsi in accordance with World Health Organization protocols to ensure that inferences drawn from the results of the interviews would be valid.

281. Following a review of the cost estimates presented by Iran, the Panel has made adjustments as follows:

(a) The costs of labour have been reduced to reflect a decrease in the overall amount of labour required;

(b) The rates of pay for some categories of personnel have been reduced to reflect standard rates;

(c) The costs for consumables have been reduced to take account of a correction made by Iran; and

(d) The costs for equipment and supplies have been reduced.

These adjustments reduce the estimated cost to USD 1,226,044.

282. The Panel, therefore, recommends compensation in the amount of USD 1,226,044 for this claim.

4. Claim No. 5000393

283. Iran seeks compensation in the amount of USD 449,000 for a project to investigate the possible impacts of airborne pollutants from the oil fires in Kuwait on the respiratory health of young persons in Iran. According to Iran, the project would examine a representative sample of young persons in Iran living within a radius of 400 kilometres from the centre of Kuwait, in order to determine adverse health effects that may have resulted from airborne pollutants released by the oil fires. The project would be conducted by means of questionnaires and medical examinations. The data collected would be compared with data collected from young persons living in non-affected areas.

284. The Panel considers that the project is an appropriate attempt to monitor and assess the respiratory health of young persons living in areas that could have been affected by the oil fires. The project is based on an epidemiological design that is clearly described and reasonable; and the proposed age group, sample size, and health measures are all appropriate. In the view of the Panel, the project could be further refined by including a control sample of unexposed young persons for comparison with the high-

exposure group, using a similar investigation protocol and matching the groups by sex and age.

285. The Panel finds that this project constitutes reasonable monitoring of public health. Consequently, expenses of the project qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

286. Following a review of the cost estimates presented by Iran, the Panel finds that the amount claimed is reasonable.

287. The Panel, therefore, recommends compensation in the amount of USD 449,000 for this claim.

5. Claim No. 5000394

288. Iran seeks compensation in the amount of USD 2,112,500 for a study to investigate possible links between petroleum-based pollutants from the oil fires and oil spill in Kuwait and the incidence of cancers and haematological disorders in the populations of 12 Iranian provinces. Iran proposes to compare the incidence of various haematological disorders and solid malignant neoplasms in the period prior to Iraq's invasion and occupation of Kuwait with the incidence of similar disorders after Iraq's invasion.

289. In the Panel's view, this claim is premature because it is unlikely that significant evidence of increased cancer rates will be found ten years after the release of pollutants from the oil fires and oil spill. For cancers and haematological disorders, especially solid tumour cancers, there is generally a latency period of 15 to 20 years between exposure to a carcinogen and the first clinical evidence of the cancer.

290. The Panel has, therefore, decided to transfer this claim to a later instalment, where it may be reviewed by the Panel with the substantive claims.

6. Claim No. 5000395

291. Iran seeks compensation in the amount of USD 459,000 for a project to investigate the impact of airborne pollutants from the oil fires on the health of the 3,000,000 inhabitants of the Zagros Mountains region of Iran. According to Iran, the project would involve medical examinations, with an emphasis on respiratory functions and cardiovascular diseases, of a randomly selected sample of 3,000 persons of all age groups living in that region within a radius of 200 to 500 kilometres from the oil fires in Kuwait. The medical examinations would be supplemented by questionnaires to be completed by the persons examined. The results would be extrapolated for the entire population of the region and analysed to estimate the scale of damage that may have been caused.

292. In the opinion of the Panel, the project is an appropriate attempt to assess the public health damage that might have resulted from airborne pollutants from the oil fires in Kuwait. The epidemiological design for the project is clearly stated and the target populations, sample sizes, and health measures are appropriate.

293. Thus the project constitutes reasonable monitoring of public health, and the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

294. However, the Panel stresses that the use of residents from an unaffected area as a control group, using the same investigation protocol, is essential for the usefulness of this project.

295. Following a review of the cost estimates presented by Iran, the Panel finds that the amount claimed is reasonable.

296. The Panel, therefore, recommends compensation in the amount of USD 459,000 for this claim.

Table 3. Recommended amounts for Iran's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> <u>(USD)</u>	<u>Amount recommended</u> <u>(USD)</u>
5000329	Transport and Dispersion of Pollution	432,983	120,000
5000330	Transport and Dispersion of Pollution	1,984,660	672,960
5000331	Cultural Heritage	43,605	nil
5000446	Cultural Heritage	2,734,600	1,398,100
5000447	Cultural Heritage	2,716,200	575,000
5000341	Cultural Heritage	783,300	nil
5000342	Cultural Heritage	472,800	nil
5000343	Groundwater and Surface Water	785,000	371,656
5000347	Marine and Coastal	822,400	711,200
5000349	Marine and Coastal	363,537	263,037
5000350	Marine and Coastal	822,500	661,140
5000351	Marine and Coastal	454,500	157,776
5000352	Marine and Coastal	488,630	357,730
5000344	Marine and Coastal	686,100	489,750
5000345	Marine and Coastal	143,600	143,600
5000346	Marine and Coastal	4,208,900	2,908,274
5000348	Marine and Coastal	594,000	377,900
5000386	Marine and Coastal	826,000	nil
5000387	Marine and Coastal	1,035,000	nil
5000382	Marine and Coastal	3,686,520	953,220
5000388	Marine and Coastal	178,400	nil
5000389	Marine and Coastal	842,500	842,500
5000383	Marine and Coastal	375,700	375,700
5000384	Marine and Coastal	412,000	nil
5000385	Marine and Coastal	865,400	nil
5000424	Terrestrial	703,870	nil
5000425	Terrestrial	431,000	431,000
5000420	Terrestrial	980,409	758,792
5000421	Terrestrial	871,930	nil
5000422	Terrestrial	632,000	nil
5000426	Terrestrial	1,037,000	nil
5000427	Terrestrial	1,489,100	624,600
5000428	Terrestrial	2,054,600	1,679,091
5000423	Departure of persons from Iraq or Kuwait	678,100	nil
5000390	Public Health	899,000	nil
5000391	Public Health	1,468,819	nil
5000392	Public Health	1,926,220	1,226,044
5000393	Public Health	449,000	449,000
5000394	Public Health	2,112,500	Transferred
5000395	Public Health	459,000	459,000
<u>Total</u>		42,951,383	17,007,070

VI. MONITORING AND ASSESSMENT CLAIMS OF THE HASHEMITE KINGDOM OF JORDAN

Table 4. Jordan's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> (USD)
5000353	Departure of persons from Iraq or Kuwait	1,730,000
5000354	Departure of persons from Iraq or Kuwait	1,767,042
5000355	Departure of persons from Iraq or Kuwait	295,612
5000356	Departure of persons from Iraq or Kuwait	473,192
5000357	Departure of persons from Iraq or Kuwait	602,232
5000358	Departure of persons from Iraq or Kuwait	1,345,830
5000396	Departure of persons from Iraq or Kuwait	1,993,675
5000429	Departure of persons from Iraq or Kuwait	1,735,000
5000430	Departure of persons from Iraq or Kuwait	750,000
5000431	Departure of persons from Iraq or Kuwait	1,796,366
<u>Total</u>		12,488,949

A. Overview

297. The claims of Jordan relate to losses alleged to have been suffered because of the influx of refugees and involuntary immigrants from Iraq and Kuwait as a result of Iraq's invasion and occupation of Kuwait. For the purposes of its monitoring and assessment claims, Jordan defines "refugees" as "all those people, of whatever nationality, who entered Jordan from Iraq and Kuwait as a direct result of Iraq's invasion and occupation of Kuwait, between 2 August 1990 and 1 September 1991", having left Iraq or Kuwait on or before 2 March 1991. Jordan defines "involuntary immigrants" as people who were "refugees" initially, but who were still resident in Jordan after 1 September 1991. Jordan states that large numbers of refugees entered its territory from Kuwait and Iraq as a result of Iraq's invasion and occupation of Kuwait, and that their presence resulted in considerable damage, including damage to water resources, coastal areas and the terrestrial environment.

298. In particular, Jordan alleges that groundwater extraction rates were increased in order to supply water to refugees and involuntary immigrants. This resulted in over-extraction, saline intrusion into the aquifers and, eventually, degradation of water resources and water supply infrastructure, including pumping stations and piping. It also claims that wastes from refugee camps and settlements for involuntary immigrants polluted the water supply.

299. In addition, Jordan claims that the presence of refugees and involuntary immigrants caused damage to its coastal marine environment around the port city of Aqaba, which was used as a transit point for the refugees and involuntary immigrants.

300. Jordan states that the movement and activities of refugees and involuntary immigrants, the deployment of Jordanian army personnel and equipment to defend Jordan's border with Iraq and to assist in relief operations in connection with the refugees, and the presence of large numbers of nomads and their herds caused damage to the ecosystems of its eastern desert.

301. Finally, Jordan alleges that the increased demand for water by refugees and involuntary immigrants led to a decrease in the quantity and quality of irrigation water, resulting in damage to agricultural resources in the Jordan Valley.

302. In its written comments on Jordan's monitoring and assessment claims, Iraq argues that the environmental damage caused by the transit of refugees through Jordan was not a direct result of Iraq's invasion and occupation of Kuwait. Iraq also contends that the damage alleged to have been suffered by ecosystems and natural resources of Jordan had other causes and, in any case, has been greatly exaggerated.

303. Iraq reiterated these contentions during the oral proceedings.

304. The Panel notes that, pursuant to paragraph 34 of Governing Council decision 7, a loss incurred as a result of departures of persons from Iraq or Kuwait during the period of Iraq's invasion and occupation of Kuwait constitutes direct loss, damage or injury resulting from Iraq's invasion. The decision whether any particular loss resulted from departures within the meaning of the Governing Council decision will depend on the evidence produced in each case.

B. Departure of persons from Iraq or Kuwait

1. Claim No. 5000353

305. Jordan seeks compensation in the amount of USD 1,730,000 for a project to investigate and establish the temporal and spatial distribution of refugees and involuntary immigrants who entered Jordan between 2 August 1990 and 2 March 1991 as a result of Iraq's invasion and occupation of Kuwait. According to Jordan, the project is an essential component of its efforts to assess and quantify the environmental damage that it may have suffered as a result of the presence of refugees and involuntary immigrants in its territory, and to determine appropriate measures to abate and remediate any such damage.

306. Paragraph 34 of Governing Council decision 7 states that "direct loss, damage or injury" resulting from Iraq's invasion and occupation of Kuwait includes any loss suffered as a result of "[d]eparture of persons from or their inability to leave Iraq or Kuwait (or a decision not to return) during [the] period [of 2 August 1990 to 2 March 1991]". To ensure a full assessment of damage and losses that may have resulted from the influx of

refugees and involuntary immigrants into Jordan, the Panel considers it appropriate to take into account information relating to reasonable periods before 2 August 1990 and after 2 March 1991. In this regard, the Panel notes that other panels of Commissioners have found that some expenses incurred subsequent to 2 March 1991 in connection with the departure of persons from Iraq or Kuwait during the period 2 August 1990 to 2 March 1991 may be compensable as direct losses resulting from Iraq's invasion and occupation of Kuwait. (See, e.g. S/AC.26/1999/23; S/AC.26/1999/24, para. 190.)

307. In the Panel's view, some environmental damage could have resulted from the population influx into Jordan caused by the departure of persons from Iraq or Kuwait during the period 2 August 1990 to 2 March 1991, and it is therefore appropriate for Jordan to attempt to identify damage attributable to the influx.

308. The Panel, therefore, finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

309. Following a review of the cost estimates presented by Jordan, the Panel has made adjustments as follows:

(a) The cost of travel for witnesses to appear before the Commission has been eliminated because no such witnesses are required;

(b) The cost of the services of an environmental lawyer has been eliminated because such services are not necessary;

(c) The cost of labour has been reduced to the level considered reasonable for the project; and

(d) The costs of "non-expendable" equipment have been reduced to take account of its residual value.

These adjustments reduce the estimated cost to USD 1,144,000.

310. The Panel, therefore, recommends compensation in the amount of USD 1,144,000 for this claim.

2. Claim No. 5000354

311. Jordan seeks compensation in the amount of USD 1,767,042 for a project to assess degradation in quality, and reduction in quantity, of water resources in Jordan that may have resulted from the presence of refugees and involuntary immigrants who departed from Iraq or Kuwait as a result of Iraq's invasion and occupation of Kuwait. According to Jordan, the project would also help to investigate methods for the remediation or restoration of damaged water resources.

312. Jordan alleges that the extraction of groundwater was increased in order to supply refugees and involuntary immigrants, and that this over-extraction led to saline intrusion into the aquifers with consequent degradation of water quality.

313. In the view of the Panel, the project is an appropriate attempt to identify damage to Jordan's water resources that may have resulted from the presence of persons who departed from Iraq or Kuwait during the period 2 August 1990 to 2 March 1991. The project may also provide useful information for selecting suitable remediation measures.

314. The Panel, therefore, finds that the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

315. Following a review of the cost estimates presented by Jordan, the Panel has adjusted the cost of labour by decreasing the number of hours of work and applying standard hourly rates. These adjustments reduce the estimated cost to USD 1,020,116.

316. The Panel, therefore, recommends compensation in the amount of USD 1,020,116 for this claim.

3. Claim No. 5000355

317. Jordan seeks compensation in the amount of USD 295,612 for a project to assess groundwater pollution downgradient of the As-Samra Wastewater Treatment Plant in Jordan that may have resulted from the presence of refugees and involuntary immigrants who entered Jordan as a result of Iraq's invasion and occupation of Kuwait. The project would also investigate methods to abate pollution that may be identified.

318. According to Jordan, the additional wastewater generated from refugee camps and settlements for involuntary immigrants increased the seepage of wastewater from treatment plant settling ponds, resulting in groundwater contamination.

319. The Panel finds that the project is an appropriate attempt to evaluate damage to water resources that may have resulted from the presence of persons who departed from Iraq or Kuwait during the period 2 August 1990 to 2 March 1991 in Jordan. Thus it constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

320. Following a review of the cost estimates presented by Jordan, the Panel has reduced the cost of labour by adjusting the amount of work to be undertaken and by applying standard hourly rates. These adjustments reduce the estimated cost to USD 224,361.

321. The Panel, therefore, recommends compensation in the amount of USD 224,361 for this claim.

4. Claim No. 5000356

322. Jordan seeks compensation in the amount of USD 473,192 for a project to determine the extent of bacterial contamination of freshwater springs in Jordan's four major water extraction areas (As-Salt, Rusifha, Jarash and Wadi-As-Sir) that may have resulted from disposal of human waste generated by refugees and involuntary immigrants who entered Jordan as a result of Iraq's invasion and occupation of Kuwait.

323. According to Jordan, the project would assess population increases near the springs, the duration of the presence of refugees and involuntary immigrants, their waste disposal practices, and possible pathways by which wastes from the camps and settlements could have reached the springs. The project would also assess and compare various treatment, remediation and restoration options.

324. In the Panel's opinion, it is appropriate for Jordan to attempt to assess the extent of damage that may have been caused. The Panel finds, therefore, that the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

325. Following a review of the cost estimates presented by Jordan, the Panel has adjusted the cost of labour by decreasing the number of hours of work and applying standard hourly rates. These adjustments reduce the estimated cost to USD 210,874.

326. The Panel, therefore, recommends compensation in the amount of USD 210,874 for this claim.

5. Claim No. 5000357

327. Jordan seeks compensation in the amount of USD 602,232 for a project to assess degradation in quality, and reduction in quantity, of water resources in Jordan that may have resulted from the use of unlined cesspits at camps for refugees and settlements for involuntary immigrants who entered Jordan as a result of Iraq's invasion and occupation of Kuwait. According to Jordan, the project would also select methods to abate any harm and restore damaged water resources.

328. The Panel finds that the project is an appropriate attempt to assess damage to water resources that may have resulted from the presence in Jordan of persons who departed from Iraq or Kuwait during the period 2 August 1990 to 2 March 1991. Thus the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

329. Following a review of the cost estimates presented by Jordan, the Panel has made adjustments as follows:

(a) The total amount of labour has been adjusted;

(b) The hourly rates of labour have been reduced by applying standard rates; and

(c) The cost of groundwater monitoring well installation has been reduced to take account of lower well installation costs in five areas where the water table is at a shallow depth.

These adjustments reduce the estimated cost to USD 429,799.

330. The Panel, therefore, recommends compensation in the amount of USD 429,799 for this claim.

6. Claim No. 5000358

331. Jordan seeks compensation in the amount of USD 1,345,830 for a project to quantify, in monetary terms, the damage to its water resources and related infrastructure that may have resulted from the presence in Jordan of refugees and involuntary immigrants as a result of Iraq's invasion and occupation of Kuwait.

332. Jordan proposes to develop and calibrate a computer model to assess loss or damage from degradation in water quality. The model would be used, in conjunction with other data, to evaluate the loss of supply, the increased cost of supply and the damage to infrastructure.

333. In the Panel's opinion, increases in waste disposal and water consumption by persons who departed from Iraq or Kuwait during the period 2 August 1990 to 2 March 1991 could have resulted in degradation of Jordan's water resources and related infrastructure. The project is, therefore, an appropriate attempt to assess the value of damage to water resources and infrastructure.

334. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

335. Following a review of the cost estimates presented by Jordan, the Panel has suggested a modification and made adjustments as follows:

(a) The estimated costs for data recording have been eliminated because technicians can record the necessary data;

(b) The total amount of labour has been adjusted;

(c) The hourly labour rates have been reduced by applying standard rates; and

(d) Survey expenses have been eliminated because Jordan has provided no explanation for these expenses.

These adjustments reduce the estimated cost to USD 515,392.

336. The Panel, therefore, recommends compensation in the amount of USD 515,392 for this claim.

7. Claim No. 5000396

337. Jordan seeks compensation in the amount of USD 1,993,675 for a project to assess and quantify damage to its coastal marine environment that may have been caused by the presence of refugees and involuntary immigrants in and around the port city of Aqaba as a result of Iraq's invasion and occupation of Kuwait.

338. Jordan proposes to assess damage and identify its causes by examining the current environmental conditions in areas potentially affected by refugee camps and settlements for involuntary immigrants. Data would be collected on, *inter alia*, the number of refugees that were in the camps, anchorage areas for ships and boats, and the departure routes used by the refugees. The data would be used to identify damaged marine areas, establish the degree of degradation and determine any necessary remediation or restoration measures. The project would also use "Habitat Equivalency Analysis", a methodology for scaling restoration alternatives to reflect the magnitude and temporal extent of resource injuries, to quantify, in monetary terms, the loss of ecosystem services.

339. In the Panel's view, it is appropriate for Jordan to attempt to assess these environmental impacts and examine restoration options, and the methods proposed are internationally recognized.

340. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

341. On review of the claim, the Panel has made adjustments to the cost estimates presented by Jordan as follows:

(a) The amount of labour for non-technical support personnel has been reduced; and

(b) The hourly labour rates have been reduced by applying standard rates.

These adjustments reduce the estimated cost to USD 1,016,435.

342. The Panel, therefore, recommends compensation in the amount of USD 1,016,435 for this claim.

8. Claim No. 5000429

343. Jordan seeks compensation in the amount of USD 1,735,000 for a project to assess and quantify damage that may have been caused to the ecosystems of its eastern desert (Badia) by the movement and activities of refugees and involuntary immigrants fleeing Iraq and Kuwait as a result of Iraq's invasion and occupation of Kuwait; by the deployment of Jordanian army personnel and equipment; and as a result of the presence of large numbers of nomads and their herds in the Jordanian Badia.

344. According to Jordan, the project would have seven components. The first is the analysis of the numbers and movement patterns of refugees and involuntary immigrants. The second is the quantification of the total area disturbed by military operations and assessment of the current state of these allegedly disturbed environments. The third component is the estimation of the number of sheep and goats that crossed the Iraqi border into Jordan, and the definition of their spatial and temporal distribution. The fourth component is aimed at obtaining region-specific information on average damage caused per animal for the purposes of determining the magnitude of livestock impact on the environment. The fifth is the establishment of baseline conditions through the characterization of ecological conditions of affected areas, both before and after Iraq's invasion and occupation of Kuwait. The sixth component is aimed at determining whether there has been an increase in the incidence of livestock disease in wildlife, and at quantifying the changes in the disease transfer rate. The last component is the quantification of damage to the desert ecosystems, the identification of restoration options, and the use of "Habitat Equivalency Analysis" to quantify, in monetary terms, the loss of ecosystem services.

345. Iraq, in its written response, notes that the sixth component of this claim assumes that goat and sheep disease transfer occurred, but that no such cases have been reported. Moreover, Iraq states that other livestock border crossings, such as smuggling, may have occurred after 1991, which would also provide a pathway for disease transfer.

346. In the Panel's view, it is appropriate for Jordan to attempt to assess environmental impacts on its desert ecosystems. However, expenses to determine the areas affected by operations of Jordanian military personnel and equipment are not eligible for compensation because, pursuant to paragraph 34(a) of Governing Council decision 7, damage caused by military activities is only compensable if it results from "military operations or threat of military action by either side". The "E2" Panel found that, "to find a threat of military action by Iraq outside Iraq or Kuwait for the purpose of establishing the Commission's jurisdiction over a claim based on that threat ... a specific threat by Iraq must have been directed at that location ... [and] ... the target of that threat, if any, must have been within the range of Iraq's military reach" (S/AC.26/1996/6, para. 68). The

"F2" Panel noted that "military operations did not take place within the land territory of Jordan. Nor was that land territory the subject of an Iraqi threat of military action, even though it was within the range of Iraqi military reach" (Report and Recommendations Made by the Panel of Commissioners Concerning the First Instalment of "F2" Claims, S/AC.26/1999/23, para. 25). Moreover, Jordan has provided no evidence that its territory was the subject of military action or the threat of military action from Iraq.

347. The Panel finds that the fourth component of the project (developing region-specific information on rates of per-animal damage to the environment) can be incorporated in the data analysis included in the third component of this claim. Similarly, the Panel does not consider the sixth component of the project to be appropriate, because a review of historical data concerning livestock disease in wildlife can be incorporated in the characterization of regional biodiversity in the fifth component of this claim.

348. The Panel finds that the project, with the exception of the second, fourth and sixth components, constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

349. Following a review of the costs presented, the Panel has eliminated expenses relating to the second, fourth and sixth components of the project. Elimination of these expenses reduces the estimated cost to USD 1,060,000.

350. The Panel, therefore, recommends compensation in the amount of USD 1,060,000 for this claim.

9. Claim No. 5000430

351. Jordan seeks compensation in the amount of USD 750,000 for a project to assess and quantify damage to its wetland ecosystems that may have been caused by the decrease in the quantity and quality of water supplying wetlands. Jordan alleges that the increased water demand from refugees and involuntary immigrants resulted in decreased water flow and increased salinity levels. Jordan also alleges that troop deployment may have caused damage to the wetland ecosystems.

352. There are three components of the project. The first is the delineation of the location and extent of the wetlands. The second is the documentation of water quality and quantity alterations. The third is the quantification of the extent of the damage to the wetland ecosystems, the identification of restoration options, and the use of "Habitat Equivalency Analysis" to quantify, in monetary terms, the loss of ecosystem services.

353. The Panel finds that it is appropriate for Jordan to attempt to assess the damage that may have been caused to its wetland ecosystems.

Accordingly, the Panel finds that the claim constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

354. However, the Panel finds that the budget estimate presented by Jordan for the second component of the project exceeds what is needed to conduct a review of the available documentation concerning alterations in water quality and quantity in the wetlands. The Panel has, therefore, made adjustments to the cost estimates for that component. These adjustments reduce the estimated cost to USD 640,000.

355. The Panel, therefore, recommends compensation in the amount of USD 640,000 for this claim.

10. Claim No. 5000431

356. Jordan seeks compensation in the amount of USD 1,796,366 for a project to evaluate damage that may have been caused to agricultural resources in the Jordan Valley by reduction in quantity and quality of irrigation water caused by the influx of refugees and involuntary immigrants into Jordan as a result of Iraq's invasion and occupation of Kuwait.

357. Jordan alleges that the influx into its territory of unanticipated numbers of refugees and involuntary immigrants led to the diversion of irrigation water to satisfy the increased demand for water. Jordan also alleges that accelerated extraction from underground aquifers led to increased salinity in groundwater and irrigation water.

358. The project consists of five components. The first is the quantification of the nature and extent of agricultural damage resulting from the influx of refugees and involuntary immigrants during and after Iraq's invasion and occupation of Kuwait. The second is the building of an irrigation supply network model to determine the effects of effluent from the As-Samra treatment plant on the quantity and quality of irrigation water. The third is the verification of the network model. The fourth component is the evaluation of restoration actions necessary to deal with the increased salinity of the effluent. The final component is the quantification, in monetary terms, of the loss in agricultural productivity from 1991 to the present.

359. The Panel considers that it is appropriate for Jordan to attempt to evaluate the damage to its agricultural resources. However, the Panel finds that the fourth component to evaluate restoration actions duplicates Jordan's other groundwater and surface water monitoring and assessment projects (claim Nos. 5000354, 5000355, 5000356 and 5000357).

360. The Panel finds that the project, with the exception of the fourth component, constitutes reasonable monitoring and assessment. Consequently,

the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

361. Following a review of the cost estimates presented by Jordan, the Panel has made adjustments as follows:

(a) The amount of labour required for the second component of the project has been adjusted; and

(b) The costs of labour have been reduced by applying standard hourly rates.

These adjustments reduce the estimated cost to USD 799,648.

362. The Panel, therefore, recommends compensation in the amount of USD 799,648 for this claim.

Table 5. Recommended amounts for Jordan's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> <u>(USD)</u>	<u>Amount recommended</u> <u>(USD)</u>
5000353	Departure of persons from Iraq or Kuwait	1,730,000	1,144,000
5000354	Departure of persons from Iraq or Kuwait	1,767,042	1,020,116
5000355	Departure of persons from Iraq or Kuwait	295,612	224,361
5000356	Departure of persons from Iraq or Kuwait	473,192	210,874
5000357	Departure of persons from Iraq or Kuwait	602,232	429,799
5000358	Departure of persons from Iraq or Kuwait	1,345,830	515,392
5000396	Departure of persons from Iraq or Kuwait	1,993,675	1,016,435
5000429	Departure of persons from Iraq or Kuwait	1,735,000	1,060,000
5000430	Departure of persons from Iraq or Kuwait	750,000	640,000
5000431	Departure of persons from Iraq or Kuwait	1,796,366	799,648
<u>Total</u>		12,488,949	7,060,625

VII. MONITORING AND ASSESSMENT CLAIMS OF THE STATE OF KUWAIT

Table 6. Kuwait's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> (USD)
5000373	Groundwater and Surface Water	842,812
5000374	Groundwater and Surface Water	981,635
5000375	Groundwater and Surface Water	830,661
5000376	Groundwater and Surface Water	10,922,933
5000377	Marine and Coastal	612,600
5000378	Marine and Coastal	57,554,587
5000397	Marine and Coastal	76,620,762
5000398	Marine and Coastal	157,249,044
5000399	Marine and Coastal	543,792
5000400	Marine and Coastal	1,985,633
5000401	Marine and Coastal	208,455
5000402	Marine and Coastal	184,125
5000432	Terrestrial	84,575,306
5000433	Terrestrial	160,344
5000434	Terrestrial	38,684,607
5000435	Terrestrial	390,920
5000436	Terrestrial	184,125
5000403	Public Health	6,906,162
5000404	Public Health	1,150,771
5000405	Public Health	4,940,547
5000406	Public Health	14,121,103
5000407	Public Health	770,190
<u>Total</u>		460,421,114

A. Overview

363. Kuwait submitted claims for monitoring and assessment of environmental damage, depletion of natural resources and public health damage that it alleges it suffered as a result of Iraq's invasion and occupation of Kuwait. It states that Iraq's detonation of Kuwait's oil wells during the final days of Iraq's occupation of Kuwait resulted in the release of over one billion barrels of crude oil into the environment. Crude oil was released into the atmosphere primarily in the form of products of incomplete combustion (smoke and oil mist), and returned to the ground as soot and oil droplets. Oil lakes were formed in the desert by oil both from wells that did not ignite and from wells that continued to gush oil after the fires were extinguished.

364. Kuwait estimates that, although approximately 24 million barrels of oil were recovered, 22.6 million cubic metres of oil-contaminated soil, covering approximately 49 square kilometres of the desert surface, still remain, and that this contamination could affect groundwater.

365. According to Kuwait, the desert soils and vegetation were severely disrupted by the construction of antitank ditches, berms, bunkers, trenches, and pits; the emplacement of mines; and the extensive movement of military vehicles. These activities are alleged to have resulted in, inter alia, increased soil erosion; the formation and movement of sand sheets and dunes; long-term deterioration in soil productivity; increased risk of damage to human health from inhalation of polluted air; increased sedimentation in the Persian Gulf; and increased risk of adverse effects on desert ecosystems and biodiversity.

366. Kuwait further alleges that the massive amounts of oil released into the Persian Gulf polluted beaches, intertidal areas, the seabed, coastal waters and fishery resources.

367. Finally, Kuwait claims that an assessment of the health of its population has revealed strong links between current health problems and the results of Iraq's invasion and occupation of Kuwait, including damage to the environment, trauma to the population, and devastation of the country's health support system.

368. Iraq's comments with respect to Kuwait's monitoring and assessment claims are summarized below.

369. With regard to Kuwait's claims for damage to groundwater, Iraq states that before extensive effort is put into long-term monitoring efforts, the vast body of scientific literature that exists on groundwater contamination by hydrocarbons should be consulted. Further, Iraq argues that groundwater monitoring will only be useful if there is appropriate data that pre-dates 2 August 1990 against which results can be compared.

370. According to Iraq, past studies carried out by Kuwait have been unable to confirm contamination of the aquifers by hydrocarbons. Iraq therefore questions the need for additional monitoring. Furthermore, Iraq states that any assessment of groundwater treatment technologies is premature, given that no contamination has been confirmed. Iraq also argues that even if the monitoring wells detected the presence of hydrocarbons, that would not prove that leaks were occurring from oil well casings. Any such contamination could be the result of ongoing oil industry operations at the oil fields that are near the aquifers.

371. With regard to Kuwait's allegations of damage to its marine environment, Iraq states that Kuwait's coastal area has been subject to high volumes of oil production, loading and transportation activities, both nationally and internationally. Kuwait's marine environment is exposed to chronic oil pollution from the tanker traffic and associated operational discharges and spills:

"The Arabian Gulf is the most exposed body of water, to oil pollution, in the world. This is due to its role as the 'Middle East's Oil

Highway'. In the seventies, approximately 1 million barrels of oil were spilled annually in the Gulf. This figure had risen to 2 million barrels in the eighties prior to the 1991 war. Thirty-nine confirmed incidents of oil pollution, out of total reported 422 incidents, were recorded from May 1981 to June 1987 in the Gulf. The incidents varied from sighting of oil sheen to oil well blow-out." (Citations omitted)

372. Iraq states that "barely 1 per cent of the spilled oil may get dispersed, suspended or dissolved in water" and that because the biodegradation process takes place quite quickly in warm water, one can "optimistically presume that in warm tropical water roughly half of the spilled oil will disappear during the first 24h after an oil spill". Iraq concludes that oil originating from the spill may have left the Persian Gulf region "in dissolved/dispersed form in deeper out flowing water, perhaps with a few drifting tarballs, through the Strait of Hormuz via the Gulf of Oman".

373. With regard to Kuwait's claims for the monitoring of the oil lakes, Iraq argues that the true extent of the oil lakes is "ambiguous", and that even though Kuwait states that the affected area is 49 square kilometres, "probably now there is none". Iraq also states that because Kuwait pumped and sold all of the oil that could be collected after the spills, "the remaining fraction is heavy end products which are exposed [to] photo-oxidation that weather the compounds into inert carbon fragments which do not affect plant growth or public health". Indeed, Iraq argues that "such heavy end compounds are very useful in improving soil productive properties". Further, Iraq states that the oil lakes pose no risk of groundwater contamination because the oil did not penetrate the soil to depths greater than 40 centimetres.

374. Further, and in any event, Iraq maintains that very high temperatures over a long time "will influence the degradation of oil compounds in addition to very high solar radiation and the accumulation of soil particles". All the above-mentioned factors, "will accelerate ... the degradation of oil compound[s] chemically and physically".

375. Iraq argues that the proposed remediation technologies for the oil lakes are expensive, complicated and environmentally unsafe, and that biodegradation and photo-oxidation are easier, less expensive and environmentally safe. Any testing of soil remediation technologies should be carried out on limited patches of soil.

376. Iraq's objections were challenged by Kuwait during the oral proceedings. According to Kuwait, the objective of monitoring and assessment activities is to identify the nature, quantum and source of damage that may have been suffered as a result of Iraq's invasion and occupation of Kuwait. As such, they are intended to help Kuwait to determine whether environmental damage has been suffered and, if so, what is

the nature and extent of the damage. Consequently, Kuwait maintains that it is neither logical nor appropriate to require a claimant to demonstrate the presence of pollutants, or to specify the nature of the damage that has been caused, prior to the commencement of monitoring and assessment.

377. As previously noted by the Panel in paragraphs 29 and 30, proof of environmental damage is not a prerequisite for a monitoring activity to be compensable in accordance with paragraph 35 of Governing Council decision 7; nor should a monitoring and assessment activity be considered unreasonable solely because it might be difficult for a claimant to differentiate between damage resulting from Iraq's invasion and occupation of Kuwait and damage that may have resulted from other causes.

B. Impacts on groundwater and surface water

1. Claim No. 5000373

378. Kuwait seeks compensation in the amount of USD 842,812 for two completed studies that investigated the extent of pollution of the Raudhatain and Umm Al-Aish aquifers as a result of Iraq's invasion and occupation of Kuwait. Kuwait alleges that these aquifers were polluted by the oil lakes and by the water used to fight the oil fires.

379. One study, to assess groundwater pollution caused by oil from the damaged oil wells, was completed in 1992. The other study, to assess the long-term risk of pollution to the aquifers, was completed in 1996. The studies were undertaken by the Kuwait Institute of Scientific Research ("KISR") under contract with Kuwait.

380. The Panel finds that the studies constituted reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

381. Kuwait provided only summary information on the costs of these studies. No invoices or receipts were provided. Statements from two KISR employees were filed to explain this evidentiary shortcoming. The first statement alleged that Iraq destroyed much of KISR's infrastructure for project management and the monitoring of costs, with the result that KISR was unable to track labour costs for these two studies. The second statement asserted that total approved budgets for KISR projects represent a conservative estimate of the actual costs of the projects, and that actual expenditures for KISR projects commonly exceed the total approved budgets.

382. The Panel finds that the evidence provided by Kuwait is insufficient to demonstrate the circumstances and amount of the claimed loss. Kuwait has not provided a convincing explanation for the absence of such evidence.

383. The Panel, therefore, finds that Kuwait has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

384. Consequently, no compensation is recommended for this claim.

2. Claim No. 5000374

385. Kuwait seeks compensation in the amount of USD 981,635 for a project to investigate current groundwater quality in the Raudhatain and Umm Al-Aish aquifers. Kuwait proposes to determine the extent of petroleum contamination of groundwater that may have been caused by the oil lakes and oil-laden fire-fighting water that resulted from Iraq's invasion and occupation of Kuwait. According to Kuwait, the project is intended to confirm and build upon the initial findings of the studies in claim No. 5000373 (paras. 378-384), and would involve the installation of monitoring wells.

386. In the Panel's opinion, it is appropriate for Kuwait to follow up the groundwater monitoring work previously undertaken, and collect additional data before considering remedial options. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

387. Following a review of the project as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XVIII to this report.

388. In addition, the Panel has made adjustments to the cost estimate as follows:

- (a) The cost of well installation has been reduced;
- (b) The cost of equipment has been reduced; and
- (c) The cost of labour has been reduced to reflect a decrease in the labour required for work plan development and preparation of the final report.

These adjustments reduce the estimated cost to USD 441,523.

389. The Panel, therefore, recommends compensation in the amount of USD 441,523 for this claim.

3. Claim No. 5000375

390. Kuwait seeks compensation in the amount of USD 830,661 for a project to evaluate technologies for treating groundwater in the Raudhatain and Umm Al-Aish aquifers that may have been contaminated as a result of Iraq's invasion

and occupation of Kuwait. Kuwait proposes to conduct pump tests at strategic locations of the two aquifers. Treatability tests will be conducted to assess the effectiveness of the three treatment processes proposed: calcium removal, air stripping and carbon adsorption.

391. In the view of the Panel, it is appropriate for Kuwait to attempt to evaluate cost-effective strategies for the treatment of groundwater that may have been contaminated.

392. The Panel, therefore, finds that the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

393. Kuwait calculated the cost of this project by applying "an indirect cost mark-up factor" to the total estimated cost of constructing and installing a groundwater treatment system. An additional amount was included as "contingency". In the Panel's opinion, this method of cost estimation has resulted in a substantial overstatement of the costs and is, in any case, not appropriate for a project of this type.

394. The Panel has developed an estimate of the reasonable cost of the project. This estimate involves costing the pump tests, the treatment processes and the labour required. Water quality tests have been eliminated because they should be conducted as part of the groundwater investigation programme in claim No. 5000374 (paras. 385-389). The resulting estimate amounts to USD 638,516.

395. The Panel, therefore, recommends compensation in the amount of USD 638,516 for this claim.

4. Claim No. 5000376

396. Kuwait seeks compensation in the amount of USD 10,922,933 for a ten-year programme to monitor groundwater near oil wells that were damaged as a result of Iraq's invasion and occupation of Kuwait. The purpose of the programme would be to determine whether any leaking oil from damaged well casings is affecting or may affect groundwater aquifers. Kuwait proposes to install a network of monitoring wells in five oil fields between the oil wells and water wells. Sampling and analysis of each monitoring well would be undertaken quarterly to detect the presence of, inter alia, petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylenes, polynuclear aromatic hydrocarbons, nickel and vanadium.

397. In the Panel's opinion, leaks from damaged oil well casings could contaminate Kuwait's groundwater resources with the passage of time. Damage to these casings may not be readily apparent. It is, therefore, appropriate for Kuwait to attempt to monitor potential leaks from the well casings.

398. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

399. Following a review of the programme as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XIX to this report.

400. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) Installation costs of monitoring the wells have been reduced;
and

(b) Labour and equipment costs have been adjusted.

These adjustments reduce the estimated cost to USD 4,873,620.

401. The Panel, therefore, recommends compensation in the amount of USD 4,873,620 for this claim.

C. Impacts on the marine and coastal environment

1. Claim No. 5000377

402. Kuwait seeks compensation in the amount of USD 612,600 for expenses related to three completed preliminary studies to monitor and assess the effects on its marine resources of the oil pollution that resulted from Iraq's invasion and occupation of Kuwait.

403. According to Kuwait, the first study, which was completed in 1992, assessed the impact of oil pollution on zooplankton resources in Kuwait's marine environment. The second study, completed in 1993, assessed the impact of oil pollution on feed-water for desalination plants. The third study, which assessed the impact of oil pollution on Kuwait's shrimp nursery grounds, was completed in 1995.

404. Kuwait contracted with KISR to conduct the first and second studies. Kuwait contracted with KISR, the Kuwait Foundation for the Advancement of Sciences and the Environmental Protection Council to conduct the third study.

405. There is evidence in the scientific literature which suggests that there is a link between damage to Kuwait's marine environment and the millions of barrels of oil released into the Persian Gulf as a result of Iraq's invasion and occupation of Kuwait.

406. The Panel finds that the three studies constituted reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

407. The amount claimed appears to be a reasonable cost for the three studies. However, Kuwait provided only summary information on the costs of the studies. No invoices or receipts were provided. Statements from two KISR employees were filed to explain this evidentiary shortcoming. The first statement asserted that Iraq destroyed much of KISR's infrastructure for project management and the monitoring of costs, with the result that KISR was unable to track labour costs for these three studies. The second statement asserted that total approved budgets for KISR projects represent a conservative estimate of the actual costs of the projects, and that actual expenditures for KISR projects commonly exceed the total approved budgets.

408. The Panel finds that the evidence provided by Kuwait is insufficient to demonstrate the circumstances and amount of the expenses claimed. Kuwait has not provided a convincing explanation for the absence of such evidence.

409. The Panel, therefore, finds that Kuwait has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

410. Consequently, no compensation is recommended for this claim.

2. Claim No. 5000378

411. Kuwait seeks compensation in the amount of USD 57,554,587 for a five-year monitoring programme to identify and assess the long-term impacts on Kuwait's marine environment of the millions of barrels of oil released into the Persian Gulf as a result of Iraq's invasion and occupation of Kuwait.

412. The Panel notes that although several studies have been conducted to evaluate the impacts of oil on marine resources in the Persian Gulf, existing data are insufficient to enable a full assessment of the long-term effects on the productivity of marine fisheries and nurseries in Kuwait. In the Panel's view, the approaches and protocols to be followed in the programme are internationally recognized. Kuwait's intention to use existing data to assist study design and help determine whether there are incremental impacts due to Iraq's invasion and occupation of Kuwait, is appropriate. The period of five years proposed is reasonable, given that the purpose of the programme is to assess the long-term impacts of the oil pollution on the marine environment.

413. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

414. Following a review of the project as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XX to this report.

415. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) All costs relating to the proposed analysis of volatile organic compounds in subtidal sediment and water samples have been eliminated because it is unlikely that such analysis will provide useful information ten years after the release of oil;

(b) The cost of proposed fish bioassays has been reduced to take into account a reduced number of bioassays; and

(c) The proposed rental costs of vessels, the costs estimated for professional and technician labour during the scientific cruises, and the costs of report preparation have been reduced.

These adjustments reduce the estimated cost to USD 37,546,888.

416. The Panel, therefore, recommends compensation in the amount of USD 37,546,888 for this claim.

3. Claim No. 5000397

417. Kuwait seeks compensation in the amount of USD 76,620,762 for a monitoring programme to obtain information on the amount and type of oil pollution caused to its shoreline as a result of Iraq's invasion and occupation of Kuwait. The data obtained would provide the basis for the evaluation of treatment technologies for the "oiled shoreline".

418. Iraq, in its written response, argues that the coastal environment of the Persian Gulf has always been subject to chronic oil pollution of varying degrees. Iraq further contends that the scientific properties of oil are such that "barely 1 per cent of the spilled oil may get dispersed, suspended or dissolved in water". In addition, Iraq states that the environment of the Persian Gulf is conducive to the biodegradation of oil compounds in the marine environment, and that such biodegradation is a "well recognized factor of self-purification".

419. The Panel recognizes that some biodegradation of released oil took place. However, the evidence in the scientific literature indicates that large quantities of oil were washed onto the shores of Kuwait; shoreline studies conducted several years after the spill indicate that substantial amounts remain. Therefore, it is appropriate for Kuwait to attempt to ascertain the extent of shoreline contamination attributable to Iraq's invasion and occupation of Kuwait.

420. The Panel considers that the objectives of the programme and the methods to be used are appropriate. The programme is, therefore, likely to provide useful data on the extent, concentration, nature, and origin of oil pollution along the coast of Kuwait.

421. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

422. However, the Panel considers that the scale of the programme should be reduced. In particular, the number and type of chemical analyses proposed can be reduced substantially while still providing a sound basis for ascertaining the extent of pollution and for taking decisions on possible measures of remediation. Further, the Panel finds the time and labour needed to complete the programme to be less than that stated in the claim.

423. Following a review of the project as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XXI to this report.

424. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The costs of laboratory analyses have been reduced to reflect the reduced number of samples;

(b) The cost of labour has been reduced to take account of the reduction in the amount of labour required; and

(c) The cost of equipment and vehicles has been reduced.

These adjustments reduce the estimated cost to USD 18,077,770.

425. The Panel, therefore, recommends compensation in the amount of USD 18,077,770 for this claim.

4. Claim No. 5000398

426. Kuwait seeks compensation in the amount of USD 157,249,044 for a project to study technologies to treat areas of its shoreline that may have been contaminated by oil as a result of Iraq's invasion and occupation of Kuwait. The project would consist of a screening process to assess different technologies that might be effective in treating and restoring contaminated areas ("oiled shoreline").

427. As previously noted, the evidence in the scientific literature indicates that Kuwait's shoreline was heavily polluted by oil as a result of Iraq's invasion and occupation of Kuwait. The evidence also shows that persistent contamination by oil poses risks to the environment and to human health. It is, therefore, appropriate for Kuwait to attempt to identify technologies for eliminating or reducing any such contamination.

428. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

429. Following a review of the project as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XXII to this report.

430. Kuwait developed its estimate of the cost of the project by applying an "indirect cost mark-up factor" to the estimated total cost of recovering and disposing of contaminated material from the affected shoreline. The "direct cost" of recovery and disposal was calculated on the basis of an estimated amount of contaminated material to be treated or disposed of plus the assumed unit cost of a thermal remediation technology to be used for the purpose. A "quantity contingency" of ten per cent was added to obtain the "implemented cost", and a series of indirect cost mark-up factors was then applied to this "implemented cost" to determine the "indirect cost" of the remediation programme.

431. In the Panel's opinion, this method of cost estimation has resulted in a substantial overstatement of the costs and is, in any case, not appropriate for a project of this type. The Panel has developed a revised estimate of the reasonable cost of the project by separately costing the various components. This revision has resulted in a drastic reduction of the estimated cost of the project. The revised estimate amounts to USD 8,237,792.

432. The Panel, therefore, recommends compensation in the amount of USD 8,237,792 for this claim.

433. The Panel notes that this project is virtually identical to the project proposed by Saudi Arabia in claim No. 5000411 (paras. 606-616). The Panel considers that the two Claimants could reduce costs, increase scientific benefits, and produce consistent results by co-ordinating their efforts and sharing information. The Panel, therefore, considers that it would be desirable for Kuwait and Saudi Arabia to co-operate in undertaking their respective projects.

5. Claim No. 5000399

434. Kuwait seeks compensation in the amount of USD 543,792 for a study to determine whether there is any sunken oil in its marine environment as a result of the release of oil during Iraq's invasion and occupation of Kuwait. Kuwait proposes to use aerial surveys, acoustical technology and commercial divers for this study.

435. Iraq, in its written response, states that most of the oil that might have sunk would have been in the form of droplets that are not capable of physically conglomerating. Iraq has also pointed out that the temperature in the region, photo-oxidation, and the high salinity of the Persian Gulf would have changed the physical nature of the oil, making it unlikely that significant amounts of sunken oil remain in the Persian Gulf.

436. In the Panel's view, the methodology proposed for the study has several defects. Aerial surveys are not likely to generate useful information because any sunken oil would most probably have been buried by sediment during the ten years that have elapsed since Iraq's invasion and occupation of Kuwait, and thus would not be visible from the air. In addition, water clarity in the area is poor, further limiting the usefulness of aerial surveys.

437. Furthermore, Kuwait has not indicated how the study would differentiate sunken oil resulting from Iraq's invasion and occupation of Kuwait from other oil that was released into the Persian Gulf prior to or following the invasion.

438. In the Panel's opinion, the study as proposed is unlikely to identify sunken oil attributable to Iraq's invasion and occupation of Kuwait in quantities that would pose a significant risk to the environment so long after Iraq's invasion.

439. The Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

440. The Panel, therefore, recommends no compensation for this claim.

6. Claim No. 5000400

441. Kuwait seeks compensation in the amount of USD 1,985,633 for a study to assess technologies to deal with sunken oil that may have resulted from Iraq's invasion and occupation of Kuwait. The study would use a screening process to assess different technologies for collecting and treating sunken oil and associated contaminated material, and for restoring marine and coastal resources that may have been affected.

442. For the reasons stated in relation to claim No. 5000399 (paras. 434-440) the Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

443. Accordingly, the Panel recommends no compensation for this claim.

7. Claim No. 5000401

444. Kuwait seeks compensation in the amount of USD 208,455 for a study to assess and evaluate loss of beach use that may have resulted from Iraq's invasion and occupation of Kuwait. Kuwait states that during Iraq's invasion and occupation of Kuwait, residents of Kuwait were not allowed near the beaches. After liberation, the beaches could not be used until mines and ordnance were cleared. This resulted in the loss of a valuable environmental amenity for Kuwait and its residents. Kuwait would use the "travel cost" methodology to determine the value of the loss.

445. Kuwait has failed to provide details of the project that would make it possible to evaluate its potential usefulness. In the view of the Panel, the passage of time and high turnover rates of the expatriate communities in Kuwait would make it difficult for Kuwait to obtain reliable data from interviews occurring more than ten years after Iraq's invasion and occupation of Kuwait. Furthermore, the possibility that changes in recreational beach use patterns may be due to other factors, would raise questions about the validity of any results obtained from the study.

446. Accordingly, the Panel finds that the study does not constitute reasonable monitoring and assessment of environmental damage for the purposes of paragraph 35(c) of Governing Council decision 7.

447. The Panel, therefore, recommends no compensation for this claim.

8. Claim No. 5000402

448. Kuwait seeks compensation in the amount of USD 184,125 for a study to assess the loss of recreational sport fishing opportunities that may have resulted from Iraq's invasion and occupation of Kuwait. Kuwait alleges that recreational sport fishing was banned during Iraq's invasion and occupation of Kuwait. The shoreline was declared a restricted zone and marina managers were not allowed to enter their marinas. After the liberation of Kuwait, the risks posed by the presence of mines and other ordnance restricted sport fishing throughout Kuwaiti waters. The study would use the "travel cost" methodology to determine the value of the loss suffered by Kuwait.

449. In the view of the Panel, this study suffers from the same defects as those indicated in respect of the study on loss of beach use (claim No. 5000401, paras. 444-447). For the reasons given for rejecting that claim, the Panel considers that this study is unlikely to be of much utility. Accordingly, it finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

450. The Panel, therefore, recommends no compensation for this claim.

D. Impacts on the terrestrial environment

1. Claim No. 5000432

451. Kuwait seeks compensation in the amount of USD 84,575,306 to monitor and assess environmental damage caused by the oil lakes that were created as a result of Iraq's invasion and occupation of Kuwait, and to assess oil lake treatment technologies to abate harm and restore the environment. Kuwait states that the oil lakes were created when Iraqi forces damaged 798 oil wellheads with explosives, releasing vast quantities of oil. Kuwait maintains that over 20 million cubic metres of petroleum-contaminated soil covering more than 49 square kilometres still remain in the areas covered by

the oil lakes. According to Kuwait, the oil lakes present a continuing risk to Kuwait's public health, groundwater resources, vegetation, and wildlife.

452. The purpose of the programme would be to determine the spatial extent and physical nature of the oil lakes and to determine the most efficient and cost-effective technology to clean up the contaminated soil.

453. Iraq argues that the true spatial extent of the oil lakes is "ambiguous", and that even though Kuwait states that the affected area is 49 square kilometres, "probably now there is none". Iraq further states that, to the extent that any oil remains, such oil would be heavy end products that are useful in improving soil productive properties. Regarding the proposed technology treatment assessment, Iraq argues that the proposed remediation technologies are expensive, complicated and environmentally unsafe. Iraq argues that biodegradation and photo-oxidation are easier, less expensive and environmentally safe.

454. Iraq also states that this claim duplicates another claim for environmental damage that has been filed by the Kuwait Oil Company. Kuwait, however, has specifically stated in its Statement of Claim that the present claim does not include any monitoring and assessment covered by the claim of the Kuwait Oil Company.

455. In any case, the Panel will review the Kuwait Oil Company claim in question in a future instalment and will ensure that there is no duplication in compensation.

456. There is abundant evidence in the scientific literature of the extensive contamination of Kuwait's environment by the oil lakes that were directly caused by the actions of Iraqi forces. The Panel is also aware that considerable amounts of oil currently remain in the oil lakes. These oil lakes may pose persistent ecological and human health risks, including risks to scarce groundwater resources. It is therefore appropriate for Kuwait to attempt to assess the nature and extent of these risks.

457. With regard to Iraq's comments on the cost-effectiveness of remediation techniques, the Panel notes that one of the purposes of the programme is to evaluate the effectiveness and costs of different techniques.

458. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

459. Kuwait developed its estimate of the cost of the programme by applying an "indirect cost mark-up factor" to the estimated total cost of recovering and disposing of the contaminated soil. This method of cost estimation has resulted in a substantial overstatement of the costs and is, in any case, not appropriate for a programme of this type.

460. Following a review of the project as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XXIII to this report.

461. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The budget for the analysis of remote sensing data has been reduced;

(b) The cost of hiring a contractor to clear ordnance from the oil lakes prior to conducting fieldwork has been reduced;

(c) The budget for the Geographic Information System has been reduced to cover only the incremental costs of incorporating additional information obtained from the programme;

(d) The cost of the ecological risk assessment has been reduced to reflect reductions in the overall effort for this project; and

(e) A reduction has been made to take into account Kuwait's statement that the human health risk assessment described in this claim will be carried out in conjunction with its public health monitoring.

These adjustments reduce the estimated cost to USD 10,484,988.

462. The Panel, therefore, recommends compensation in the amount of USD 10,484,988 for this claim.

463. The Panel notes that much of the information generated during the treatment technology assessment for Kuwait's "oiled shoreline" (claim No. 5000398) will be directly applicable to the remediation of the oil lakes. Therefore, the Panel recommends that these two programmes be co-ordinated in order to avoid duplication of effort.

464. The Panel also urges that the risks of remediation be carefully considered, especially when it involves excavation of sensitive desert soils. Although in some areas the degree of contamination might make excavation unavoidable, in less contaminated areas excavation could pose greater environmental risk than natural recovery.

2. Claim No. 5000433

465. Kuwait seeks compensation in the amount of USD 160,344 for a project to determine the area of its desert surface that was damaged by the construction and removal of military fortifications, and to conduct an assessment of remediation technologies.

466. Kuwait alleges that military activities resulting from Iraq's invasion and occupation of Kuwait caused extensive disruption of its fragile desert

surface, and that this accelerated soil erosion, increased sand movement and increased the incidence of dust and sand storms. The construction of military fortifications and vehicular movements also caused significant damage to natural vegetation and wildlife. Kuwait contends that restoration of "desert pavement" areas and re-vegetation of other damaged areas are essential to prevent further encroachment of sand dunes into its metropolitan areas.

467. In its written response, Iraq challenges Kuwait's statement that the erosion of desert soil was caused by military activities. Iraq argues that erosion is a natural phenomenon of the desert ecosystem in Kuwait. It states that most of the military vehicles used paved roads in Kuwait, even outside cities, and that this reduced the effect of the vehicles on desert surface sediment and vegetation. Iraq further argues that truck movements, fortifications, defence lines, oil trenches, mines, smoke oil mist and soot had only a temporary influence on the desert ecosystems which should be distinguished from permanent factors such as ploughing, digging of shrubs, and severe overgrazing. In addition, Iraq states that such disturbances in the desert ecosystem can be recovered by good years of rainfall and the ability of desert shrubs to adapt to such disturbances.

468. There is abundant evidence in the scientific literature that the military activities in Kuwait caused damage to the desert environment. There is also evidence that much of this damage occurred in desert areas other than paved roads. Furthermore, the evidence indicates that the effects of these activities were not temporary and may still persist. Accordingly, it is appropriate for Kuwait to attempt to monitor and assess the scale of any such damage.

469. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

470. Following a review of the cost estimates presented by Kuwait, the Panel finds that the amount claimed is reasonable.

471. The Panel, therefore, recommends compensation in the amount of USD 160,344 for this claim.

3. Claim No. 5000434

472. Kuwait seeks compensation in the amount of USD 38,684,607 for a project to monitor and assess areas of its desert surface contaminated by the "tarcrete" that formed as a result of oil releases and fallout from the oil fires that were caused as a result of Iraq's invasion and occupation of Kuwait. Tarcrete was formed when oil droplets released by the oil fires into the atmosphere were deposited on the desert surface, where they mixed with sand and gravel to form a concrete-like layer.

473. There is evidence in the scientific literature that Kuwait's desert environment was subjected to extensive tarcrete contamination as a result of the oil releases and oil fires. Because the "tarcrete"-affected areas may pose persistent ecological and human health risks, it is appropriate for Kuwait to attempt to identify and evaluate effective remediation strategies.

474. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

475. Kuwait developed its estimate of the cost of the programme by applying an "indirect cost mark-up factor" to the estimated total cost of recovering and disposing of the contaminated material. This method of cost estimation has resulted in a substantial overstatement of the costs and is, in any case, not appropriate for a programme of this type.

476. Following a review of the project as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XXIV to this report.

477. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The budget for the analysis of remote sensing data has been reduced;

(b) The budget for the Geographic Information System has been reduced to provide only for the incremental costs of incorporating additional information gathered by the programme; and

(c) The cost of the ecological risk assessment has been reduced to reflect reductions in the overall effort for this project; and

(d) A reduction has been made to take into account Kuwait's statement that the human health risk assessment described in this claim will be carried out in conjunction with its public health monitoring.

These adjustments reduce the estimated cost to USD 7,246,880.

478. The Panel, therefore, recommends compensation in the amount of USD 7,246,880 for this claim.

479. The Panel notes that much of the information generated during the treatment technology assessment for the oil lakes (claim No. 5000432) will be directly applicable to this project. Therefore, the Panel recommends that these two projects be co-ordinated in order to avoid duplication of effort.

480. The Panel also urges that the risks of remediation be carefully considered, especially when it involves excavation that causes additional

disturbance to sensitive desert soils. Although in some areas the degree of contamination might make excavation unavoidable, in less contaminated areas, excavation could pose a greater environmental risk than natural recovery.

4. Claim No. 5000435

481. Kuwait seeks compensation in the amount of USD 390,920 for a project to monitor and assess environmental damage in its territory from saturation bombing and the open burning or detonation of unexploded ordnance. Kuwait states that following Iraq's invasion and occupation of Kuwait, thousands of tons of unexploded ordnance and over a million land mines were recovered. The majority of these munitions were destroyed, either in place or at centralized locations. Kuwait states that open burning or detonation of ordnance and saturation bombing cause environmental damage in the form of residual chemical contamination of soil.

482. Kuwait proposes to collect information on the location, distribution patterns and levels of residual explosives and explosive-related contamination in the sites in Kuwait where there was open burning or detonation of unexploded ordnance or saturation bombing. Kuwait also proposes to collect information on technologies to restore the desert surface.

483. Iraq argues in its written response that the mines and ordnance were used by the military in very limited areas, that they had very minor effects on the total vegetation of the desert, and that the plants could have recovered in a short time.

484. In the Panel's opinion, the destruction of large amounts of mines and unexploded ordnance could have led to environmental damage, including soil contamination and loss of vegetation. Thus, it is appropriate for Kuwait to undertake studies to assess the extent of such damage or loss.

485. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

486. Following a review of the cost estimates presented by Kuwait, the Panel finds that the amount claimed is reasonable.

487. The Panel, therefore, recommends compensation in the amount of USD 390,920 for this claim.

488. The Panel urges Kuwait to consider carefully the risks of remediation, especially when it involves excavation. In ordnance disposal sites with low levels of contamination, active remediation may pose a greater environmental risk than natural recovery.

5. Claim No. 5000436

489. Kuwait seeks compensation in the amount of USD 184,125 for a study to assess the economic value of the loss of desert recreational camping opportunities that may have resulted from Iraq's invasion and occupation of Kuwait. Kuwait states that during Iraq's invasion and occupation of Kuwait, its residents were not allowed to use desert camping sites, and that, after liberation, the sites could not be used until mines and ordnance were cleared. The study would use the "travel cost" methodology to determine the economic value of the loss of this amenity.

490. In its written response, Iraq asserts that camping activities are a "personal matter", and that, although they may affect some people economically, they have no relation to environmental problems. Iraq further argues that camping itself is an activity that usually results in deterioration of the environment.

491. In the view of the Panel, this study suffers from the same defects as those stated in relation to the studies on loss of beach use (claim No. 5000401, paras. 444-447) and loss of recreational sport fishing opportunities (claim No. 5000402, paras. 448-450). For the same reasons, the Panel considers that this study is unlikely to be of much utility.

492. Accordingly, the Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

493. The Panel, therefore, recommends no compensation for this claim.

E. Public health impacts

1. Common elements

494. Kuwait alleges that Iraq's invasion and occupation of its territory resulted in many adverse public health effects, and will continue to pose serious risks to the health of its population. According to Kuwait, long-term risks to public health are posed by pollutants that were released into the environment from the oil spill and oil fires, the traumatic stress experienced by the population, and the collapse of Kuwait's public health infrastructure during Iraq's invasion and occupation of Kuwait.

495. According to Kuwait, although short-term and medium-term adverse health effects of Iraq's invasion and occupation of Kuwait have already been identified, the long-term effects remain largely unknown. Kuwait, therefore, considers it necessary to conduct a surveillance programme to enable it to identify any increased long-term health risks so that appropriate prevention and treatment measures may be undertaken.

496. According to Kuwait, a carefully designed surveillance programme would enable it to "co-ordinate the collection of existing and future data on all

health-related aspects of the Iraqi Aggression; identify and monitor exposed individuals; provide diagnoses of diseases in their primary stages; and study associations between environmental contamination, public health infrastructure damage, and traumatic events resulting from the Iraqi Aggression and adverse health effects".

497. Kuwait contends that failure to conduct such a surveillance programme would leave substantial gaps in knowledge concerning the long-term human health effects of Iraq's invasion and occupation of Kuwait which could prevent the identification and implementation of appropriate prevention and treatment programmes.

498. The surveillance programme proposed by Kuwait consists of five related components:

(a) Establishment and operation of a data repository and exposure registry for five years;

(b) A human health risk assessment;

(c) Studies to determine long-term health impacts. These studies would also provide support and guidance for other environmental monitoring and assessment activities relating to Iraq's invasion and occupation of Kuwait;

(d) A five-year clinical monitoring programme; and

(e) A public health survey.

These components are reviewed separately as claim Nos. 5000403 to 5000407 in paragraphs 506-532 below.

499. In its written response, Iraq raises general objections to the public health monitoring and assessment claims of Kuwait. It states that the detection of a substance does not, in any way, imply that it will cause damage. According to Iraq "[b]oth the concentration and duration must be of a certain magnitude in order to cause the damage". Iraq also argues that it is "illogical" to ask for compensation for unspecified "health damage", and that such damage must be specified clearly so that the source can be identified. It states that more details and more precise "effects" must be identified before any monitoring and assessment programme can commence.

500. Furthermore, Iraq questions how Kuwait would be able to identify any damage to public health ten years after the events that are alleged to have given rise to the damage. In particular, it doubts whether Kuwait would be able to distinguish damage or risks to public health attributable to pollutants released by the oil fires from damage or risks from other pollutants to which the populations of the region are continuously exposed. In this regard, Iraq notes that Kuwait is located in one of the major sand

and dust storm regions of the world, and is also exposed to persistent emissions from operational flares of oil wells.

501. Iraq reiterated these views and contentions during the oral proceedings.

502. In its submissions during the oral proceedings, Kuwait stressed that its proposed monitoring activities were intended to identify the nature, quantum and source of adverse health effects that its population may have suffered as a result of Iraq's invasion and occupation of its territory. The proposed activities would assist it to determine whether any environmental damage had been caused and, if so, whether the damage posed significant health risks. Consequently, it argued that it is not reasonable to suggest that it should prove that specific damage had been caused before submitting a claim or claims for monitoring.

503. As stated in paras. 29-30, the Panel does not consider that the absence of prior proof of damage constitutes a valid objection to the award of compensation for reasonable monitoring for the purposes of paragraph 35(d) of Governing Council decision 7.

504. Although the Panel also recognizes that, with the passage of time, it may be difficult for Kuwait to identify public health damage that is solely or primarily attributable to Iraq's invasion and occupation of Kuwait, as opposed to other possible causes, that difficulty does not make it inappropriate for Kuwait to undertake reasonable studies to determine the existence and nature of potential damage.

505. With regard to the contention that some damage to public health could be the result of ambient pollutants in the region, such as those from sand and dust storms or operational flares of oil wells, the evidence in the scientific literature indicates that the adverse effects of these phenomena are distinguishable from those originating from the oil fires and massive oil spill that resulted from Iraq's invasion and occupation of Kuwait. The evidence also shows that the dispersion of large quantities of airborne pollutants from the oil fires and oil spill could have increased the risks of certain health problems, such as respiratory ailments. These risks have the capacity to persist for many years after the events that gave rise to them.

2. Claim No. 5000403

506. Kuwait seeks compensation in the amount of USD 6,906,162 for a programme to establish and operate a data repository and an exposure registry. The data repository would collect and manage health information, including documents and data concerning health problems that may have resulted from Iraq's invasion and occupation of Kuwait, and the medical records of persons participating in the programme. The exposure registry would be used to identify persons who were exposed to environmental pollution and consequential traumas or who were adversely affected by the damage to

Kuwait's medical infrastructure as a result of Iraq's invasion and occupation of Kuwait.

507. There are valid reasons for the inclusion of a data repository and an exposure registry in a long-term public health surveillance programme. These facilities provide a central resource useful to epidemiological and clinical researchers because they help to co-ordinate medical data in a central location. This would make it easier to identify diseases and their potential causes.

508. The Panel finds that the programme constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

509. Kuwait provided estimates of the costs for staffing, labour and equipment, including computers. The Panel finds these estimates reasonable.

510. Kuwait proposes to construct a new building to house the data repository and exposure registry. The Panel finds that such a facility is necessary for the effectiveness of the programme. The Panel agrees with Kuwait that it would be more cost-effective to construct a new building than to enter into a long-term lease of premises. However, the estimated construction costs presented by Kuwait are excessive and do not take account of the residual value of the building after completion of the programme. The Panel has adjusted the costs accordingly. These adjustments reduce the estimated cost to USD 6,763,546.

511. The Panel, therefore, recommends compensation in the amount of USD 6,763,546 for this claim.

3. Claim No. 5000404

512. Kuwait seeks compensation in the amount of USD 1,150,771 to conduct a human health risk assessment programme. The purpose of the programme would be to identify the potential risks of long-term adverse health effects in Kuwait resulting from Iraq's invasion and occupation of Kuwait. The risk assessment consists of five components, namely:

(a) Compilation of background information and a conceptual model of potential human exposures;

(b) Identification of pollutants considered as presenting potential risks to human health;

(c) An assessment to identify possible pathways by which people were exposed to pollutants, and the likely amounts of exposure;

(d) A toxicity assessment of each potential contaminant considered to present risks to human health; and

(e) A risk assessment integrating the results of the exposure assessment and toxicity assessment.

513. Human health risk assessments are commonly used to identify and assess potential health risks and to provide guidance on the design of monitoring programmes and the development of clean-up standards. In the view of the Panel the basic methodology proposed by Kuwait is consistent with standard practices.

514. The Panel finds that the programme constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

515. The total amount claimed consists of estimated labour costs. The Panel finds that these costs are reasonable.

516. The Panel, therefore, recommends compensation in the amount of USD 1,150,771 for this claim.

4. Claim No. 5000405

517. Kuwait seeks compensation in the amount of USD 4,940,547 for a programme to identify and assess the long-term health impacts of Iraq's invasion and occupation of its territory. A major part of the programme would be to compare persons exposed to the environmental and infrastructure damage during Iraq's invasion and occupation of Kuwait with those who were not exposed. The programme would also provide support and guidance for other environmental monitoring and assessment activities being undertaken by Kuwait.

518. The programme would involve long-term epidemiological studies, and investigations into relationships between invasion-related environmental damage and changes in disease patterns. The programme would also provide necessary data for the exposure registry envisaged in claim No. 5000403 (paras. 506-511).

519. The Panel finds that the programme constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

520. Kuwait has presented an estimate of the costs of the various components of the programme, including staffing and labour. The Panel finds that most of the estimates are reasonable and necessary to achieve the objectives stated in the claim.

521. One of the components of the programme is a "feasibility studies working seminar" to be held in Kuwait. The cost estimate includes provision for 12 medical experts to travel from the United States to attend the seminar for five days. The Panel does not consider such a seminar to be necessary, and

has therefore eliminated all expenses related to it. Elimination of these expenses reduces the estimated cost to USD 4,846,396.

522. The Panel, therefore, recommends compensation in the amount of USD 4,846,396 for this claim.

5. Claim No. 5000406

523. Kuwait seeks compensation in the amount of USD 14,121,103 for a clinical monitoring programme. The purpose of the programme would be to trace persons in Kuwait whose health may have been adversely affected as a result of Iraq's invasion and occupation of Kuwait, and to track the development of their clinical symptoms and health problems. The clinical monitoring programme would involve:

- (a) A review of existing clinical studies and data;
- (b) Clinical testing (pulmonary function tests, X-rays, blood tests, etc.);
- (c) Comprehensive medical screening and examinations for sections of the population who may be identified by the exposure registry to be established under claim No. 5000403 (paras. 506-511); and
- (d) Integration of the data obtained from the tests and screenings into Kuwait's existing national health care database.

524. The programme is expected to last for at least 40 years. However, the amount claimed is for costs to be incurred during the first five years of the programme.

525. Kuwait has stated, and the Panel agrees, that many public health effects from Iraq's invasion and occupation of Kuwait may only be identified after many years. It is, therefore, appropriate for Kuwait to undertake a long-term clinical monitoring programme as proposed.

526. Accordingly, the Panel finds that the programme constitutes reasonable monitoring of public health, and the expenses qualify as compensation in accordance with paragraph 35(d) of Governing Council decision 7.

527. Following a review of the project as presented by Kuwait, the Panel suggests certain modifications, details of which are set out in annex XXV to this report. In particular, the frequency of medical and X-ray examinations should be reduced. To take account of these modifications, the Panel has made adjustments to the estimates provided by Kuwait. These adjustments reduce the estimated cost of the programme to USD 7,278,268.

528. The Panel, therefore, recommends compensation in the amount of USD 7,278,268 for this claim.

6. Claim No. 5000407

529. Kuwait seeks compensation in the amount of USD 770,190 for a public health survey. The purpose of the survey is to assess the costs of dealing with the increased incidence of various diseases that may have resulted from Iraq's invasion and occupation of Kuwait. Kuwait states that the survey would enable it to obtain health statistics needed to identify disease prevalence patterns among persons who received treatment in the national health care system of Kuwait as well as those who may have received treatment in other ways.

530. The Panel finds that the survey constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

531. Following a review of the cost estimates presented by Kuwait, the Panel finds that the amounts claimed are reasonable.

532. The Panel, therefore, recommends compensation in the amount of USD 770,190 for this claim.

Table 7. Recommended amounts for Kuwait's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> <u>(USD)</u>	<u>Amount recommended</u> <u>(USD)</u>
5000373	Groundwater and Surface Water	842,812	nil
5000374	Groundwater and Surface Water	981,635	441,523
5000375	Groundwater and Surface Water	830,661	638,516
5000376	Groundwater and Surface Water	10,922,933	4,873,620
5000377	Marine and Coastal	612,600	nil
5000378	Marine and Coastal	57,554,587	37,546,888
5000397	Marine and Coastal	76,620,762	18,077,770
5000398	Marine and Coastal	157,249,044	8,237,792
5000399	Marine and Coastal	543,792	nil
5000400	Marine and Coastal	1,985,633	nil
5000401	Marine and Coastal	208,455	nil
5000402	Marine and Coastal	184,125	nil
5000432	Terrestrial	84,575,306	10,484,988
5000433	Terrestrial	160,344	160,344
5000434	Terrestrial	38,684,607	7,246,880
5000435	Terrestrial	390,920	390,920
5000436	Terrestrial	184,125	nil
5000403	Public Health	6,906,162	6,763,546
5000404	Public Health	1,150,771	1,150,771
5000405	Public Health	4,940,547	4,846,396
5000406	Public Health	14,121,103	7,278,268
5000407	Public Health	770,190	770,190
<u>Total</u>		460,421,114	108,908,412

VIII. MONITORING AND ASSESSMENT CLAIMS OF THE KINGDOM OF SAUDI ARABIA

Table 8. Saudi Arabia's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> (USD)
5000359	Marine and Coastal	3,533,670
5000360	Marine and Coastal	19,549,743
5000361	Marine and Coastal	6,442,735
5000362	Marine and Coastal	1,414,740
5000363	Marine and Coastal	52,337,910
5000364	Marine and Coastal	11,475,985
5000365	Marine and Coastal	693,000
5000408	Marine and Coastal	612,000
5000409	Marine and Coastal	163,907,795
5000410	Marine and Coastal	1,708,685
5000411	Marine and Coastal	148,470,998
5000412	Marine and Coastal	756,553
5000437	Terrestrial	163,879
5000438	Terrestrial	4,143,221
5000439	Terrestrial	554,300
5000440	Terrestrial	3,781,647
5000441	Terrestrial	6,329,843
5000442	Terrestrial	342,496
5000413	Public Health	585,960
5000414	Public Health	13,925,945
5000415	Public Health	1,538,791
5000416	Public Health	9,975,047
5000417	Public Health	28,502,000
5000418	Public Health	1,410,000
<u>Total</u>		482,156,943

A. Overview

533. Saudi Arabia submitted claims for monitoring and assessment of the environmental damage, depletion of natural resources and public health damage that it alleges to have suffered as a result of Iraq's invasion and occupation of Kuwait.

534. Saudi Arabia claims that the massive amounts of oil released into the Persian Gulf polluted its beaches, intertidal areas, seabed, and coastal waters. It states that additional marine and coastal pollution resulted from the oil fires in Kuwait. It alleges that the pollution caused damage to its flora and fauna, and may have impacts on public health.

535. Saudi Arabia also claims that its desert soils and vegetation were severely disrupted by military activities and the effects of the oil fires. These activities are alleged to have resulted in, inter alia, increased soil

erosion; increased risk of damage to human health from inhalation of polluted air; and increased risk of severe adverse effects on desert ecosystems and biodiversity.

536. Finally, Saudi Arabia claims that its population suffered short-term, medium-term, and long-term adverse health effects as a result of this environmental damage.

B. Impacts on the marine and coastal environment

1. Common elements

537. Saudi Arabia seeks compensation for an integrated monitoring and assessment programme to determine the extent of the damage to its marine and coastal resources that may have resulted from Iraq's invasion and occupation of Kuwait. The programme would also provide a scientific basis on which to develop measures to remediate and restore damaged resources. The programme consists of eight projects for monitoring and assessing impacts on the marine and coastal environment, claim Nos. 5000359, 5000360, 5000361, 5000408, 5000409, 5000410, 5000411, 5000412; and four projects for monitoring and assessing impacts on fisheries, claim Nos. 5000362, 5000363, 5000364, 5000365.

538. Saudi Arabia alleges that its offshore waters and nearly 1,000 kilometres of its coastline north of Abu Ali were affected by the oil spill resulting from Iraq's invasion and occupation of Kuwait. According to Saudi Arabia, between 10 and 20 million barrels of oil were released into the Persian Gulf as a result of Iraq's invasion and occupation of Kuwait. This includes oil which Iraq deliberately spilled from five oil tankers, from the Al Ahmadi north tank field via the Sea Island Tanker Terminal, and from the Min al Bakr terminal in Iraq, in addition to leakage from battle-damaged tankers and terminals after the hostilities. Furthermore, Saudi Arabia states that unknown amounts of oil aerosols, soot, toxic combustion products and gases from the oil fires affected the coastal marine environment.

539. Saudi Arabia observes that some of the spilled oil can be accounted for by oil recovery operations that were undertaken in 1991, as well as volatilization and dissolution of oil in the water. However, it alleges that approximately 58 per cent of the oil released remains in the marine and coastal environment. Saudi Arabia states that normal weathering forces may have been relatively ineffective because in many cases the oil penetrated 15 to 20 centimetres below the surface.

540. Saudi Arabia believes that approximately 3.7 million barrels of oil may have sunk to the sea floor. According to Saudi Arabia, its industrial fishing fleet's offshore catch dropped precipitously and has not recovered, possibly because toxic compounds released by sunken oil continue to damage fish populations. However, Saudi Arabia also notes that research carried out in 1992 failed to find sunken oil.

541. Saudi Arabia alleges that oil spilled as a result of Iraq's invasion and occupation of Kuwait caused harm to human health and the environment. It states that continuing human exposure to toxic components of crude oil may occur through swimming, boating, or other recreational activities in the sea, through construction in the coastal zone or through consumption of fish and shrimp from the Persian Gulf. Saudi Arabia states that damage occurred to areas of the coastline which support much of the biological productivity for the entire Persian Gulf. It refers to reports in the scientific literature identifying pervasive contamination which impacted all habitat types and organisms ranging from algal mats to seabirds. Saudi Arabia alleges that scientists found approximately 30 per cent of its mangroves were killed by the spill, and that the mangrove forests continue to decline. Similar impacts were observed in salt marshes, sand beaches and tidal flats.

542. Iraq, in its written response, raises several objections to Saudi Arabia's marine and coastal monitoring and assessment claims. Iraq states that the monitoring and assessment which Saudi Arabia seeks to carry out is unnecessary because the information sought is already available. In particular, it argues that the proposed shoreline survey is unnecessary, because the shoreline area of Saudi Arabia affected by the oil spill was documented in a report and contemporaneous satellite images. It states that all remediation work should be confined to the area identified in the report and satellite images.

543. Iraq states that many studies of post-invasion pollution in the Persian Gulf concluded that the level of pollution was not different from the level before 1991. Specifically, Iraq states that "the source of oil spilled in the Arabian Gulf during the 1991 events was mainly from the oil loading terminals ... [and] ... four sunken and leaking vessels The total capacity of the tankers was about ... 2 million barrels".

544. Iraq alleges that natural degradation of petroleum has already remediated the harm, because conditions in the Persian Gulf favour natural petroleum degradation. According to Iraq, although certain petroleum hydrocarbons have direct toxic effects at high rates of exposure, these compounds are highly volatile and are lost to the atmosphere shortly after an oil spill. Iraq states that compounds with possible bioaccumulative effects are mainly polyaromatic hydrocarbons and, in particular, the carcinogen benzo-a-pyrene, which is biodegradable.

545. Iraq asserts that the ongoing pollution of the Persian Gulf makes it impossible to isolate the war as the source of pollution of Saudi Arabia's coastal and marine environment. It contends that if hydrocarbons were detected they would be the result of other recent oil spills, and would be unrelated to the 1991 spill. Iraq alleges that independent studies demonstrated that levels of total hydrocarbons in Persian Gulf waters and sediments after 1991 were lower than levels recorded before 1991.

546. Iraq argues that the proposed oceanographic survey is not essential to the assessment of impacts on fisheries because physical oceanography is not a standard tool to assess fisheries productivity. Iraq further argues that any bioaccumulative effect on finfish would have been observed in the form of tumours on fish bodies, and that no such effect has been recorded in the Persian Gulf. Iraq also states that the marine animals which are claimed to have been affected have relatively short life spans and any bioaccumulative effect of the 1991 oil spill would no longer be apparent. Iraq concludes that overfishing and not oil pollution has always been the main environmental concern in the Persian Gulf regarding commercial fisheries.

547. Iraq reiterated these contentions during the oral proceedings.

548. The Panel finds that there is evidence in the scientific literature that substantial quantities of oil entered Saudi Arabia's marine and coastal environment as a result of Iraq's invasion and occupation of Kuwait. Although some literature suggests that levels of oil contaminants in some habitats are similar to levels observed before Iraq's invasion and occupation of Kuwait, other studies have found evidence of higher pollution levels after 1991 relative to earlier years. Leaching of oil within sediments into the sea was observed by international scientists as recently as two to three years ago. While several studies have pointed towards recovery after 1991, not all parts of the Persian Gulf have received equal attention in the published literature, and areas with elevated levels of oil pollution may persist.

549. The Panel notes that petroleum compounds undergo significant degradation due to a variety of natural chemical, physical, and biological processes. A great deal of weathering occurs within the first 24 hours to a week after a spill. Degradative processes may further reduce the amount of petroleum-based contamination over the course of months or years. However, there is evidence that these processes have not been able to degrade all fractions of the oil even after many years have passed. Furthermore, some localities may have conditions unfavourable to these processes and may therefore still contain pockets of unweathered oil. Several studies have identified such pockets of oil more than two years after the spill. Without investigation, it is impossible to determine the degree to which petroleum remnants and unweathered pockets of oil remain a concern. Thus, in the Panel's view the results of well-designed and conducted surveys, risk assessments, technology treatment assessments, and similar work should develop information useful in assessing possible ongoing impacts and remediation alternatives.

550. Although the Panel recognizes that, with the passage of time, it may be difficult for Saudi Arabia to identify damage that is solely or primarily attributable to Iraq's invasion and occupation of Kuwait, that difficulty does not make it inappropriate for Saudi Arabia to undertake reasonable studies to determine the existence and nature of potential damage. The Panel encourages Saudi Arabia to use a variety of techniques that may allow

researchers to determine the likely source of oil at any particular location (e.g. time trend analyses, spatial analyses, the use of control sites, and the use of oil fingerprinting techniques). Thus, in the Panel's view, studies that investigate the degree to which it is possible to link current levels of oil pollution with Iraq's invasion and occupation of Kuwait should produce useful information.

2. Claim No. 5000359

551. Saudi Arabia seeks compensation in the amount of USD 3,533,670 for a preliminary assessment of the areas of its marine environment that were affected by Iraq's invasion and occupation of Kuwait, including areas that have already been remediated. The assessment would be based on a review of existing marine and coastal data. Saudi Arabia also proposes to establish a GIS and data management system that would incorporate data from other projects in its marine and coastal resources monitoring and assessment programme. In addition, limited field sampling and analysis would be undertaken.

552. As previously noted, there is evidence of damage to Saudi Arabia's marine and coastal areas as a result of Iraq's invasion and occupation of Kuwait. In the Panel's view, it is reasonable for Saudi Arabia to conduct a preliminary assessment of those areas. Saudi Arabia's proposal to refine existing GIS maps is also appropriate.

553. The Panel finds that the programme constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7. However, the Panel considers that certain modifications are necessary.

554. The proposed sampling and analysis component is not necessary because the information to be gained from it can be obtained from a review of existing studies coupled with a less intensive visual shoreline survey of the type discussed in annex XXVIII to this report. This shoreline survey should be conducted to assess the coverage, thickness, and weathering of observed oil, using established post-spill shoreline survey techniques. The survey would provide sufficient information to verify the current distribution of heavily oiled, moderately oiled, and lightly oiled areas, and assist in estimating natural degradation of the oil and in determining the impacts of past clean-up and remediation activities. This survey should use the same staffing and the same sampling transects as proposed for the sampling and analysis component.

555. For the reasons set out below, the Panel does not find the component of the project relating to the survey of sunken oil (claim No. 5000410, paras. 600-605) and the lost beach use survey (claim No. 5000412, paras. 617-619) appropriate.

556. On the basis of the suggested modifications, the Panel has made adjustments to the cost estimates as follows:

(a) The costs relating to the sunken oil and lost beach use surveys have been eliminated;

(b) The costs of laboratory analysis have been eliminated;

(c) Transportation and accommodation costs have been reduced by applying standard rates; and

(d) The costs of travel of local personnel to the United States have been eliminated.

These adjustments reduce the estimated cost to USD 1,861,174.

557. The Panel, therefore, recommends compensation in the amount of USD 1,861,174 for this claim.

3. Claim No. 5000360

558. Saudi Arabia seeks compensation in the amount of USD 19,549,743 for a project to assess the effectiveness of clean-up and remediation measures in coastal areas affected by oil pollution resulting from Iraq's invasion and occupation of Kuwait, and to determine whether additional remediation is required.

559. According to Saudi Arabia, this project is intended to monitor changes in the coastal zone, and is expected to be undertaken after the implementation of clean-up and remediation activities.

560. The Panel notes that claims for remediation activities are to be reviewed in future instalments. Consequently, it has decided to transfer this claim to a later instalment, where it may be reviewed by the Panel with the substantive claims.

4. Claim No. 5000361

561. Saudi Arabia seeks compensation in the amount of USD 6,442,735 for a project to determine the damage that may have been caused to its coastal and offshore coral reefs as a result of Iraq's invasion and occupation of Kuwait. Saudi Arabia proposes to establish sampling sites and transects to estimate the density, diversity and condition of the fish and algal populations of coral reefs, and the incidence of disease among them. For this purpose, 1,000 transects would be sampled through pneumatic coring in ten mainland and island coral reef sampling sites. Data obtained would be used to assess damage to the coral reefs. The data would also serve as a reference for future pollution studies and the selection of remedial options.

562. In its written comments, Iraq contends that this project might duplicate other monitoring and assessment projects proposed by Saudi Arabia.

563. The Panel observes that duplication can be avoided by co-ordination of projects, and has taken the necessary steps to eliminate duplication, where appropriate, or to reduce costs where there is a risk of duplication with other projects that are closely related.

564. Given the quantity of oil that was introduced into the Persian Gulf as a result of Iraq's invasion and occupation of Kuwait, and the large amounts of oil that polluted the coastal zone of Saudi Arabia, the Panel considers it appropriate for Saudi Arabia to attempt to determine the long-term effects of the pollution on the coral reefs in the area.

565. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

566. Following a review of the project as presented by Saudi Arabia, the Panel suggests certain modifications, details of which are set out in annex XXVI to this report.

567. On the basis of the suggested modifications, the Panel has made adjustments to the cost estimates as follows:

- (a) The costs of laboratory analysis have been decreased;
- (b) The costs of field transport have been reduced; and
- (c) Labour costs have been reduced.

These adjustments reduce the estimated cost to USD 4,418,360.

568. Accordingly, the Panel recommends compensation in the amount of USD 4,418,360 for this claim.

5. Claim No. 5000362

569. Saudi Arabia seeks compensation in the amount of USD 1,414,740 to develop an "implementation plan" for projects to evaluate the status of its Persian Gulf fisheries, and to value losses to those fisheries resulting from Iraq's invasion and occupation of Kuwait. Saudi Arabia proposes to develop detailed study designs, including specific sampling plans, sampling locations, control sites, data evaluation methods, and approaches for integrating existing data in the following monitoring and assessment claims: claim No. 5000363 (paras. 574-579); claim No. 5000364 (paras. 580-583); and claim No. 5000365 (paras. 585-587).

570. The implementation plan would review existing data on commercial, subsistence and recreational fisheries. It would also review and identify

gaps in data on fishery stocks, habitats, and overall conditions in the Persian Gulf. This project includes the incremental cost of incorporating data from Saudi Arabia's fishery projects into Saudi Arabia's GIS database and the cost of creating a database to serve all the projects covered by the implementation plan.

571. Historic fishery and pollution data indicates that the Persian Gulf fisheries may have been damaged as a result of Iraq's invasion and occupation of Kuwait. However, as discussed in paragraphs 580-583 and 584-587, the Panel finds that two of the three studies covered by the implementation plan (claim No. 5000364 and claim No. 5000365) are not reasonable. With regard to the third study (oceanographic survey and sampling), the Panel finds that the proposed design work can be better accomplished as part of claim No. 5000363 as modified (paras. 574-579) which includes provision for the costs of the GIS work proposed in this claim.

572. The Panel, therefore, finds that the implementation plan is not necessary, and thus does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

573. Accordingly, the Panel recommends no compensation for this claim.

6. Claim No. 5000363

574. Saudi Arabia seeks compensation in the amount of USD 52,337,910 to undertake a five-year oceanographic survey and sampling project to evaluate long-term adverse effects on its fishery resources in the Persian Gulf of the pollution from the oil spill resulting from Iraq's invasion and occupation of Kuwait. According to Saudi Arabia, the project would include near-shore and offshore sampling of marine organisms, water and sediments, and monitoring of near-shore currents. Approximately 20 analytical tests would be conducted on each sample. Saudi Arabia intends to evaluate both pre-invasion and current data collected from monitoring stations along the coast as part of the implementation plan prior to the commencement of this project.

575. As previously noted, there is evidence in the scientific literature that a large quantity of oil was released into the Persian Gulf during Iraq's invasion and occupation of Kuwait, and that part of this may still be contaminating Saudi Arabia's coastal zone. The results of the project could be useful for an understanding of the potential long-term effects of Iraq's invasion and occupation of Kuwait on the marine environment, and the evaluation of remediation and restoration alternatives.

576. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

577. Following a review of the project as presented by Saudi Arabia, the Panel suggests certain modifications, details of which are set out in annex XXVII to this report. In particular, the number of samples analysed at each site could be reduced without reducing the spatial or temporal scope of the project.

578. On the basis of the modifications suggested, the Panel has developed a revised estimate of the reasonable cost of the programme to achieve the purposes intended. This takes into account programme design and co-ordination, evaluation of coastal monitoring station data and the GIS component originally envisaged under claim No. 5000362. The modifications reduce the estimated cost to USD 18,142,163.

579. The Panel, therefore, recommends compensation in the amount of USD 18,142,163 for this claim.

7. Claim No. 5000364

580. Saudi Arabia seeks compensation in the amount of USD 11,475,985 to assess the loss of commercial fisheries resources that it may have suffered as a result of pollution caused by Iraq's invasion and occupation of Kuwait.

581. The Panel finds that this study would duplicate the work to be undertaken in other monitoring and assessment claims of Saudi Arabia. In particular, the Panel finds that information from the oceanographic survey and sampling project (claim No. 5000363, paras. 574-579), if properly organized, could provide information that would enable Saudi Arabia to achieve several objectives of this study.

582. For that reason the Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

583. The Panel, therefore, recommends no compensation for this claim.

8. Claim No. 5000365

584. Saudi Arabia seeks compensation in the amount of USD 693,000 for a travel cost survey to quantify the loss to its population of recreational fishing opportunities as a result of Iraq's invasion and occupation of Kuwait. Saudi Arabia alleges that the oil spill denied access to the natural and physical resources that support sport fishing, and damaged the natural resource base. The study would include telephone interviews and intercept surveys of individuals at beach sites and boat landings to determine current and pre-invasion use of fishing grounds. Information about the contribution of recreational fishing to household diet would also be collected.

585. In the view of the Panel, the proposed travel cost survey is unlikely to produce reliable data on the effects of Iraq's invasion and occupation of

Kuwait on recreational fishing practices in Saudi Arabia, for comparison with data for the period before Iraq's invasion. The long lapse of time since Iraq's invasion and occupation of Kuwait and the high rate of turnover of expatriate communities would make it difficult to obtain reliable information on sport fishing patterns from current interviews of resource users.

586. The Panel, therefore, finds that the project does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

587. Accordingly, the Panel recommends no compensation for this claim.

9. Claim No. 5000408

588. Saudi Arabia seeks compensation in the amount of USD 612,000 for a project to assess risks to human health and ecological risks posed by oil pollution of its marine and coastal environment as a result of Iraq's invasion and occupation of Kuwait. According to Saudi Arabia, the information obtained from the project would be used in the planning of programmes to repair damage to the marine and coastal environment.

589. In the Panel's view, a project for risk assessment is appropriate, and the methods proposed are internationally recognized. Accordingly, the Panel finds that the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

590. Upon review of the cost estimates presented by Saudi Arabia, the Panel finds that the rates proposed for accommodations are higher than the applicable standard rates. It also finds the amounts claimed for the purchase of vehicles excessive. The Panel has made adjustments to the costs of these items. These adjustments reduce the estimated cost to USD 567,985.

591. The Panel, therefore, recommends compensation in the amount of USD 567,985 for this claim.

10. Claim No. 5000409

592. Saudi Arabia seeks compensation in the amount of USD 163,907,795 for a project to survey the "oiled shoreline" between the Kuwait border and Abu Ali in Saudi Arabia. The purpose of the survey is to obtain information on the location, amount and type of oil pollution of the shoreline that may have occurred as a result of Iraq's invasion and occupation of Kuwait. Saudi Arabia proposes to perform analytical tests on a large number of samples collected during the survey, including tests for volatile organic compounds. The data obtained would provide the basis for detailed remediation planning.

593. The evidence in the scientific literature indicates that extensive oil pollution occurred along Saudi Arabia's Persian Gulf coastline and that the contamination persists in many areas. In the view of the Panel, a survey of the type proposed is a prerequisite to any remediation of the damaged area, and the methods proposed for the survey are internationally recognized.

594. Iraq, in its written response, argues that testing for volatile organic compounds is unrealistic because they are the first to evaporate following an oil spill.

595. The evidence in the scientific literature indicates that, while many of the volatile organic compounds are lost through evaporation, some of them can persist on the shoreline in deeply buried oil deposits. Accordingly, it is appropriate for Saudi Arabia to perform tests for volatile organic compounds on soil samples from the shoreline. However, in the opinion of the Panel, the number and type of chemical analyses can be reduced substantially without impairing Saudi Arabia's ability to obtain useful results.

596. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

597. Following a review of the project as presented by Saudi Arabia, the Panel suggests certain modifications, details of which are set out in annex XXVIII to this report.

598. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The costs of laboratory tests and analyses have been reduced to reflect the decrease in the scale of sampling; and

(b) Corresponding downward adjustments have been made to the costs of labour, travel, accommodation, equipment, field transport and field survey by the application of standard rates or reduction in quantities.

These adjustments reduce the estimated cost to USD 34,976,723.

599. Accordingly, the Panel recommends compensation in the amount of USD 34,976,723 for this claim.

11. Claim No. 5000410

600. Saudi Arabia seeks compensation in the amount of USD 1,708,685 for a study to determine the quantity and location of sunken oil in its marine environment that may have resulted from Iraq's invasion and occupation of Kuwait. Saudi Arabia proposes to develop a survey plan using bathymetric and oceanographic data, together with fate and trajectory modelling of the oil spill. The search for sunken oil would be undertaken, mainly in deep

waters, using aerial and sonar surveys. If sunken oil is found, Saudi Arabia proposes to use divers to examine it visually and retrieve samples for analysis. The information obtained from the survey would eventually be used to formulate a remediation plan.

601. Iraq argues in its written response that the proposed programme would have no utility. According to Iraq, oil droplets from a spill would not combine to form oil pools, but might form small tarballs.

602. The Panel finds several technical problems with the proposed methodology of the survey. Aerial surveys are not likely to detect sunken oil in deep water ten years after it was released, because the oil most probably would have been buried by sediment during that time. Even if sunken oil were found, diver identification and sampling of sunken oil becomes limited in the deep waters where Saudi Arabia proposes to look for them.

603. In the Panel's opinion, the study as proposed is unlikely to identify sunken oil attributable to Iraq's invasion and occupation of Kuwait in quantities that would pose a significant risk to the environment so long after Iraq's invasion.

604. Accordingly, the Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

605. The Panel, therefore, recommends no compensation for this claim.

12. Claim No. 5000411

606. Saudi Arabia seeks compensation in the amount of USD 148,470,998 for a project to evaluate technologies for the remediation of its marine and coastal environment areas from oil pollution resulting from Iraq's invasion and occupation of Kuwait. The programme would assess technologies for treating polluted coastal areas ("oiled shoreline") and for removing and disposing of any sunken oil.

607. Iraq argues in its written response that the proposed assessment of remediation technologies is no more than a feasibility study that would normally be carried out by companies competing for the remediation contract.

608. As noted previously in paragraphs 548-549, evidence in the scientific literature indicates that extensive oil pollution occurred in Saudi Arabia's marine and coastal environment as a result of Iraq's invasion and occupation of Kuwait, and that pollution persists in many areas.

609. In the Panel's opinion it is appropriate for Saudi Arabia to attempt to identify the different technologies that may be used for the remediation of its coastal areas polluted by oil. The results of the assessment would assist Saudi Arabia in selecting appropriate technologies, comparing the

risks and benefits of different remediation measures, and evaluating their cost-effectiveness.

610. The Panel finds that a project to assess technologies for the remediation of polluted shoreline areas constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

611. However, with regard to the sunken oil survey, the Panel has already found that a project to survey for sunken oil does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7 (claim No. 5000410, paras. 600-605). For the same reason, the part of the project that seeks to assess technologies for the remediation of sunken oil does not constitute reasonable monitoring and assessment.

612. Saudi Arabia developed the cost estimate for the project by applying a contingency factor to the estimated cost of remediation of the entire affected area, including treatment of sunken oil. In the Panel's opinion, this method of cost estimation has resulted in a substantial overstatement of the costs and is, in any case, not appropriate for a project of this type.

613. Following a review of the project as presented by Saudi Arabia, the Panel suggests certain modifications, details of which are set out in annex XXIX to this report.

614. The Panel has developed a revised cost estimate for the project by separately costing its various components and using standardized rates. For the reasons already indicated, all costs relating to work on sunken oil have also been eliminated. The revised cost estimate developed by the Panel amounts to USD 12,793,477.

615. Accordingly, the Panel recommends compensation in the amount of USD 12,793,477 for this claim.

616. The Panel notes that this project is closely related to the project of Kuwait in claim No. 5000398 (paras. 426-433). The Panel emphasizes, once again, that effective co-operation between the Claimants is likely to result in reduced costs and increased scientific benefits for both of them. The Panel, therefore, considers that it would be desirable for Kuwait and Saudi Arabia to co-operate in undertaking their respective projects.

13. Claim No. 5000412

617. Saudi Arabia seeks compensation in the amount of USD 756,553 to study the extent to which recreational use of beaches in Saudi Arabia declined as a result of Iraq's invasion and occupation of Kuwait. The study would use a travel cost survey of nationals and expatriates, as well as government

records of beach use, to assess the reduction in beach use and to estimate the economic value of the loss of this amenity as a result of the inability of its residents to use the beaches.

618. For the reasons given by the Panel in relation to claim No. 5000365 (paras. 584-587) the Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

619. The Panel, therefore, recommends no compensation for this claim.

C. Impacts on the terrestrial environment

1. Common elements

620. Saudi Arabia seeks compensation for an integrated monitoring and assessment programme to determine the extent of the damage to its terrestrial resources that may have resulted from Iraq's invasion and occupation of Kuwait. The programme would also provide a scientific basis on which to develop measures to mitigate the damage or to remediate and restore damaged resources. The programme consists of the six projects reviewed as claim Nos. 5000437 to 5000442 (paras. 632-664).

621. Saudi Arabia alleges that damage was caused to large areas of the northeastern Saudi Arabian desert by pollutants from the oil fires. The damage is alleged to include adverse impacts on nomadic agriculture, the desert ecosystem and its biodiversity, soil productivity, and groundwater resources. In addition, deposition of airborne pollutants from the oil fires in Kuwait could have affected the chemistry of soils and the survival of plant species on the ground surface as well as the quality of groundwater resources.

622. Saudi Arabia alleges that damage also resulted from the deployment and movement of troops and associated support and combat vehicles. According to Saudi Arabia, most of the northern regions of its territory are plains covered by gravel and rock fragments that form a desert pavement. In many areas this desert pavement is bound by mineral matter to form a stable crust above fine soils that are highly susceptible to wind erosion. Saudi Arabia alleges that disruption of the desert pavement by troop and vehicle movements increased soil erosion and the frequency and magnitude of dust and sandstorms.

623. In its written response, Iraq states that the northeastern region of Saudi Arabia is a thinly populated "barren desert plateau with a low annual precipitation and very rare sparse vegetation". Iraq further states that "the dry hot climate affects the development of the soil, which is immature, primitive desert soil; characterized by shallow depth, light texture, and negligible content of organic substances", and that it is located in one of the major sand and dust storms regions of the world. Iraq argues that the

area is subject to constant air pollution as a result of the operations of the oil industry.

624. With regard to testing for groundwater pollution, Iraq alleges that "[a]ccording to our knowledge of the geohydrology of Saudi Arabia there exist[s] no possibility of ground water pollution by any of the actions described in the claim".

625. Iraq argues that the terrestrial monitoring and assessment programme is the responsibility of the environmental authority in Saudi Arabia. Iraq states that only if and when there is evidence of a threat or damage directly caused by Iraq, will Saudi Arabia be entitled to submit a claim. Moreover, Iraq contends that the claimed costs of the implementation plan are exaggerated.

626. Iraq reiterated these contentions during the oral proceedings.

627. The scientific literature indicates that extensive damage was caused in the territory of Saudi Arabia as a result of the oil fires in Kuwait and the military activities resulting from Iraq's invasion and occupation of Kuwait.

628. Paragraph 34(a) of Governing Council decision 7 provides that a direct loss includes damage, loss or injury suffered as a result of "[m]ilitary operations or threat of military action by either side during the period 2 August 1990 to 2 March 1991".

629. In the opinion of the Panel, it is possible that the desert surface, groundwater, and ecology of the Saudi Arabian desert were damaged as a result of the oil fires and the extensive movements of military personnel and equipment. It is, therefore, appropriate for Saudi Arabia to undertake monitoring and assessment to evaluate the damage and determine the need for, and means of, remediation.

630. The Panel recognizes that some of the damage to the desert ecology of Saudi Arabia may be due to causes other than Iraq's invasion and occupation of Kuwait. However, the possibility that damage could have resulted from other causes does not make it inappropriate for Saudi Arabia to attempt to identify the nature and extent of damage that resulted from Iraq's invasion and occupation of Kuwait. Indeed, this is a major purpose of monitoring and assessment.

631. With regard to Iraq's general objection to monitoring and assessment claims, the Panel reiterates its view, stated in paragraphs 29-30, that proof of environmental damage is not a prerequisite for compensability in accordance with paragraph 35 of Governing Council decision 7.

2. Claim No. 5000437

632. Saudi Arabia seeks compensation in the amount of USD 163,879 for a programme to co-ordinate the various projects for the monitoring and

assessment of impacts on its terrestrial environment resulting from Iraq's invasion and occupation of Kuwait. The programme would review available data, conduct a basic field survey, undertake preliminary fieldwork, and develop the final design of the programme.

633. In the Panel's view, the project is an appropriate component of Saudi Arabia's monitoring and assessment programme. In particular, integration of past research and co-ordination of the activities proposed would help to avoid duplication of effort, ensure efficient use of resources, and enhance the scientific accuracy and utility of the monitoring and assessment activities.

634. The Panel, therefore, finds that the programme constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

635. One of the projects to be co-ordinated by the programme is the travel survey on the loss of desert camping opportunities in claim No. 5000442 (paras. 662-664). As stated below, the Panel finds that that claim does not constitute reasonable monitoring and assessment. For that reason, expenses related to this portion of the claim have been eliminated. The Panel has, therefore, made the necessary adjustments to the estimated cost of this programme.

636. In addition, the costs of field transport, accommodations and air travel have been reduced by applying standard rates. These adjustments reduce the estimated cost to USD 137,573.

637. Accordingly, the Panel recommends compensation in the amount of USD 137,573 for this claim.

3. Claim No. 5000438

638. Saudi Arabia seeks compensation in the amount of USD 4,143,221 for development of a GIS database to facilitate analysis of field observations and data regarding damage to its terrestrial environment resulting from Iraq's invasion and occupation of Kuwait. This would entail updating and expanding Saudi Arabia's existing GIS by creating base maps of all terrestrial study areas, incorporating data, and developing the analytical tools to manage the data.

639. The Panel considers it appropriate for Saudi Arabia to use GIS in its terrestrial monitoring and assessment programme. The Panel notes that Saudi Arabia has indicated that this project is to be integrated with the other GIS projects for which Saudi Arabia seeks compensation.

640. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

641. However, the Panel considers that the database for this project can be completed in one year instead of the two years proposed. This will reduce the costs of labour.

642. Following a review of the cost estimates presented by Saudi Arabia, the Panel has made adjustments as follows:

(a) The amount of labour has been reduced to take account of the decrease in the time for the completion of the database;

(b) The costs of the researcher and field biologist have been eliminated because they are not necessary for the development of a GIS database;

(c) The costs of air travel, accommodation and field transport have been reduced by, inter alia, the application of standard rates; and

(d) The cost of Global Positioning System units and software have been reduced to reflect current market prices.

These adjustments reduce the estimated cost to USD 2,440,130.

643. Accordingly, the Panel recommends compensation in the amount of USD 2,440,130 for this claim.

4. Claim No. 5000439

644. Saudi Arabia seeks compensation in the amount of USD 554,300 to assess risks to human health and ecology from damage to its terrestrial environment caused as a result of Iraq's invasion and occupation of Kuwait. The information obtained would be used to plan remediation programmes for the damaged areas.

645. In the Panel's view, the objectives of the project are appropriate and the methods to be used are internationally recognized.

646. The Panel, therefore, finds that the project constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

647. However, the Panel considers that the assessment should be designed to take advantage of existing and proposed data collection in other studies. In addition, the Panel notes that the human health risk assessment component of this programme duplicates the human health risk assessment proposed in claim No. 5000415 (paras. 684-688). The Panel has, therefore, eliminated expenses related to that component from the costs of this programme.

648. Following a review of the cost estimates presented by Saudi Arabia, the Panel has made adjustments as follows:

(a) The costs related to the human health risk assessment have been eliminated;

(b) The rates for field transport, accommodations and air travel have been reduced by applying standard rates; and

(c) The costs of preparation and production of reports have been reduced to what the Panel considers reasonable.

These adjustments reduce the estimated cost to USD 407,428.

649. Accordingly, the Panel recommends compensation in the amount of USD 407,428 for this claim.

5. Claim No. 5000440

650. Saudi Arabia seeks compensation in the amount of USD 3,781,647 for a project to evaluate remediation and restoration technologies for desert surface, vegetation and groundwater resources in its territory which may have been damaged as a result of Iraq's invasion and occupation of Kuwait. The proposed technology assessment includes the following three components: technology screening; environmental impact analysis; and least-cost analysis.

651. In the view of the Panel, the objectives of the project are appropriate. Assessment of remediation technologies is a useful preliminary step in selecting suitable remediation measures. The proposal to test the performance of selected technologies under various field conditions is justified because no single technology will be appropriate for all damaged areas.

652. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

653. Following a review of the cost estimates presented by Saudi Arabia, the Panel has reduced the costs of field transport, accommodation and air travel by applying standard rates. The reductions bring the estimated cost to USD 3,601,754.

654. Accordingly, the Panel recommends compensation in the amount of USD 3,601,754 for this claim.

655. The Panel urges that the risks of remediation be carefully considered. Intrusive remediation techniques, especially those including excavation, could cause additional disturbance to sensitive desert areas.

6. Claim No. 5000441

656. Saudi Arabia seeks compensation in the amount of USD 6,329,843 for a project that would use field reconnaissance, sampling, and satellite and aerial imaging to determine the extent of damage and natural recovery processes in areas of its territory which may have been adversely affected as a result of Iraq's invasion and occupation of Kuwait. Saudi Arabia states that information about the current state of its environment is necessary to enable it to design remediation that may be needed.

657. The Panel finds that some damage to the desert surface, groundwater, and ecology of the Saudi Arabian desert may have resulted from Iraq's invasion and occupation of Kuwait.

658. Accordingly, the Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

659. Following a review of the project as presented by Saudi Arabia, the Panel suggests certain modifications, details of which are set out in annex XXX to this report.

660. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The costs of analytical tests have been reduced to reflect a decrease in the number of laboratory analyses and the application of standard rates;

(b) The total amount of labour required has been reduced; and

(c) The costs of field transport, accommodation and air travel have been reduced by applying standard rates.

These adjustments reduce the estimated cost to USD 2,840,824.

661. Accordingly, the Panel recommends compensation in the amount of USD 2,840,824 for this claim.

7. Claim No. 5000442

662. Saudi Arabia seeks compensation in the amount of USD 342,496 for a travel cost survey to assess the economic value of the loss of desert recreational camping opportunities that may have resulted from Iraq's invasion and occupation of Kuwait.

663. For the reasons given in relation to claim Nos. 5000365 and 5000412 (paras. 584-587 and 617-619), the Panel finds that the study does not

constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

664. Accordingly, no compensation is recommended for this claim.

D. Public health impacts

1. Common elements

665. Saudi Arabia seeks compensation for an integrated public health monitoring programme to identify and assess the adverse health effects in its territory resulting from Iraq's invasion and occupation of Kuwait. The programme consists of six related components which are reviewed separately as claim Nos. 5000413 to 5000418 in paragraphs 672-706 below.

666. Saudi Arabia alleges that the effects of Iraq's invasion and occupation of Kuwait continue to pose serious long-term health risks to its population. According to Saudi Arabia, these risks result primarily from pollutants that were released into the environment as a consequence of the oil spill and the oil fires, as well as the traumatic stress experienced by the population.

667. Saudi Arabia states that although short-term and medium-term adverse health effects have already been identified, the long-term health effects remain largely unknown. Accordingly, Saudi Arabia proposes to conduct a long-term surveillance programme to identify any such health risks and to select prevention and treatment measures.

668. According to Saudi Arabia, the long-term surveillance programme will co-ordinate the collection of existing and future public health data; identify and monitor persons suspected to have been exposed to the effects of Iraq's invasion and occupation of Kuwait; provide diagnoses of diseases in their primary stages; and study possible causal links between the diseases and environmental pollution. Saudi Arabia contends that failure to conduct such a programme would leave substantial gaps in knowledge concerning the long-term human health effects of Iraq's invasion and occupation of Kuwait, and that this could make it difficult to identify and implement appropriate prevention and treatment measures.

669. In its written response to the claims of Saudi Arabia, Iraq states that no data are available to assess and separate the contribution of airborne particulates generated by the vast number of flares and sand storms in the area.

670. Iraq reiterated these contentions during the oral proceedings.

671. The Panel notes that there is evidence in the scientific literature indicating that some harmful airborne pollutants from the oil fires reached Saudi Arabia. The evidence also suggests that the adverse health effects of airborne pollutants originating from oil fires are distinguishable from those originating from operational flares and natural sources such as

sandstorms. It is possible, therefore, that pollutants from the oil fires have increased the long-term risks of certain diseases in the affected population, including respiratory and pulmonary diseases.

2. Claim No. 5000413

672. Saudi Arabia seeks compensation in the amount of USD 585,960 to develop and co-ordinate the scope of work, specific requirements, schedules and costs of the five separate elements of its programme to monitor the impacts that Iraq's invasion and occupation of Kuwait may have had on public health in its territory.

673. In the Panel's view, such a detailed plan is appropriate for the co-ordination of the various elements of the public health monitoring programme. The Panel, therefore, finds that the plan is an appropriate component of reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

674. However, the Panel considers that the staffing proposed should include the disciplines of epidemiology, medicine, survey methodology, air quality monitoring and modelling, and biostatistics.

675. Following a review of the cost estimates presented by Saudi Arabia, the Panel has made adjustments as follows:

(a) The costs of transportation, travel, accommodation, and daily subsistence allowance have been reduced by, inter alia, the application of standard rates; and

(b) The costs of office, scientific and medical equipment have been eliminated because they should be provided from awards recommended for Saudi Arabia's other public health monitoring claims.

These adjustments reduce the estimated cost to USD 405,633.

676. The Panel, therefore, recommends compensation in the amount of USD 405,633 for this claim.

3. Claim No. 5000414

677. Saudi Arabia seeks compensation in the amount of USD 13,925,945 for a programme to establish and operate a data repository and an exposure registry. According to Saudi Arabia, the data repository would collect and manage documents and data relating to changes in the environment, particularly those that may have impacts on the health of the population, in the periods before and after Iraq's invasion and occupation of Kuwait. It would also maintain the medical records of persons participating in the programme. The exposure registry would identify persons who might have been

affected by Iraq's invasion and occupation of Kuwait, and maintain data on their health status.

678. There are valid reasons for the inclusion of a data repository and an exposure registry in a long-term public health surveillance programme. These facilities provide a central resource useful to epidemiological and clinical researchers because they help to co-ordinate medical data in a central location. This would make it easier to identify diseases and their potential causes.

679. The Panel finds that the programme constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

680. Following a review of the claim, the Panel suggests certain modifications including, in particular, an increase in the number of households to be surveyed for recording in the exposure registry. Details of the suggested modifications are set out in annex XXXI to this report.

681. Saudi Arabia proposes to construct a new building to house the data repository and exposure registry. The Panel finds that such a facility is necessary for the effectiveness of the programme. The Panel agrees with Saudi Arabia that it would be more cost-effective to construct a new building than to enter into a long-term lease of premises. However, the estimated construction costs presented by Saudi Arabia are excessive and do not take account of the residual value of the building after completion of the programme. The Panel has adjusted the costs accordingly.

682. In addition, the Panel has made adjustments to the cost estimates as follows:

(a) The cost of labour has been reduced by applying standard rates; and

(b) The cost of the surveys has been increased to reflect their expanded scope.

These adjustments reduce the estimated cost to USD 12,590,100.

683. The Panel, therefore, recommends compensation in the amount of USD 12,590,100 for this claim.

4. Claim No. 5000415

684. Saudi Arabia seeks compensation in the amount of USD 1,538,791 for a project to monitor and assess risks to human health as a result of Iraq's invasion and occupation of Kuwait. According to Saudi Arabia, the purpose of the project would be to facilitate prioritization of the potential health risks to focus ongoing environmental remediation efforts on substances or locations that pose the greatest risks to human health. In addition, the

project would provide a foundation for efforts to prevent and treat diseases that may have resulted from Iraq's invasion and occupation of Kuwait.

685. In the Panel's opinion, it is appropriate for Saudi Arabia to undertake such a project, given the large quantities of pollutants that were released into the environment, and the likelihood that the population will continue to be exposed to some of these pollutants through a variety of pathways. Human health risk assessments are commonly used to identify and assess potential health risks and to provide guidance on the design of monitoring programmes and the development of clean-up standards. In the Panel's view, the basic methodology proposed by Saudi Arabia is consistent with standard practices.

686. The Panel finds that the programme constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

687. Upon a review of the estimated costs presented by Saudi Arabia, the Panel considers that the estimated labour costs are reasonable. However, the Panel has adjusted the costs of travel and accommodation by applying standard rates. These adjustments reduce the estimated cost to USD 1,521,143.

688. The Panel, therefore, recommends compensation in the amount of USD 1,521,143 for this claim.

5. Claim No. 5000416

689. Saudi Arabia seeks compensation in the amount of USD 9,975,047 for a project to determine the long-term health effects on its population that may have resulted from Iraq's invasion and occupation of Kuwait. The project would involve long-term epidemiological studies, and investigations into relationships between invasion-related environmental damage and changes in disease patterns. The project would also provide necessary data for the exposure registry envisaged in claim No. 5000414 (paras. 677-683).

690. The Panel finds that the programme constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

691. Upon review of the cost estimates presented by Saudi Arabia, the Panel finds that the level of labour proposed exceeds what is necessary for the programme. The Panel has therefore reduced the labour costs by approximately half.

692. One of the components of the programme is a "feasibility studies working seminar" to be held in Saudi Arabia. The cost estimate includes provision for 40 medical experts to travel from the United States to attend the seminar for five days. The Panel does not consider such a seminar to be

necessary, and has therefore eliminated all expenses related to it. Together with the reduction in labour costs, these adjustments reduce the estimated cost to USD 5,106,058.

693. The Panel, therefore, recommends compensation in the amount of USD 5,106,058 for this claim.

6. Claim No. 5000417

694. Saudi Arabia seeks compensation in the amount of USD 28,502,000 for a clinical monitoring programme that would trace the development of clinical symptoms and diseases in persons identified as having suffered adverse health effects caused by pollution resulting from Iraq's invasion and occupation of Kuwait.

695. The monitoring programme would involve the following:

- (a) Review of existing clinical studies and data;
- (b) Clinical testing of selected persons, including tests for pulmonary function, X-rays, and blood tests;
- (c) Comprehensive medical screening and examinations for sections of the population that would be identified by the exposure registry to be established under claim No. 5000414 (paras. 677-683); and
- (d) Integration of the data obtained from the tests and screening into Saudi Arabia's existing national health care database.

696. Testing would be carried out on persons identified as having been exposed to pollution resulting from Iraq's invasion and occupation of Kuwait and on a suitable control sample of unexposed persons. The programme is expected to last for at least 40 years. However, the claim is for costs to be incurred during the first five years of the programme.

697. In the view of the Panel, it is likely that some of the adverse health effects will only become apparent after many years. It is, therefore, appropriate for Saudi Arabia to establish and operate a long-term clinical monitoring programme as proposed.

698. The Panel finds that the programme constitutes reasonable monitoring of public health. Consequently, expenses of the programme qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

699. However, the Panel considers that several aspects of the programme should be modified. In particular, the scale of the sampling programme is larger than necessary to achieve the stated objectives and should be reduced. The frequency of medical examinations should also be reduced.

Details of the suggested modifications are set out in annex XXXII to this report.

700. On the basis of these modifications, the Panel has developed a revised estimate of the cost of the programme that it considers to be reasonable to achieve the purpose intended. The revised estimate amounts to USD 7,162,958.

701. The Panel, therefore, recommends compensation in the amount of USD 7,162,958 for this claim.

7. Claim No. 5000418

702. Saudi Arabia seeks compensation in the amount of USD 1,410,000 for a public health survey. The purpose of the survey is to assess the costs of dealing with the increased incidence of various diseases within its population that may have resulted from Iraq's invasion and occupation of Kuwait. According to Saudi Arabia, this programme would enable it to obtain health statistics needed to identify disease prevalence patterns among persons who received treatment in the Saudi Arabian health care system as well as those who may have received treatment in other ways.

703. In the view of the Panel, the objective of the survey is appropriate. The Panel, therefore, finds that the programme constitutes reasonable monitoring of public health, and the expenses qualify for compensation in accordance with paragraphs 35(d) of Governing Council decision 7.

704. Following a review of the project as presented by Saudi Arabia, the Panel suggests certain modifications, details of which are set out in annex XXXIII to this report.

705. In addition, the Panel has made adjustments to the cost estimate as follows:

(a) The costs of labour have been reduced by the application of standard rates;

(b) The costs of sundries and contingencies have been reduced; and

(c) The cost of office rental has been reduced to what is considered reasonable.

These adjustments reduce the estimated cost to USD 611,177.

706. The Panel, therefore, recommends compensation in the amount of USD 611,177 for this claim.

Table 9. Recommended amounts for Saudi Arabia's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> (USD)	<u>Amount recommended</u> (USD)
5000359	Marine and Coastal	3,533,670	1,861,174
5000360	Marine and Coastal	19,549,743	Transferred
5000361	Marine and Coastal	6,442,735	4,418,360
5000362	Marine and Coastal	1,414,740	nil
5000363	Marine and Coastal	52,337,910	18,142,163
5000364	Marine and Coastal	11,475,985	nil
5000365	Marine and Coastal	693,000	nil
5000408	Marine and Coastal	612,000	567,985
5000409	Marine and Coastal	163,907,795	34,976,723
5000410	Marine and Coastal	1,708,685	nil
5000411	Marine and Coastal	148,470,998	12,793,477
5000412	Marine and Coastal	756,553	nil
5000437	Terrestrial	163,879	137,573
5000438	Terrestrial	4,143,221	2,440,130
5000439	Terrestrial	554,300	407,428
5000440	Terrestrial	3,781,647	3,601,754
5000441	Terrestrial	6,329,843	2,840,824
5000442	Terrestrial	342,496	nil
5000413	Public Health	585,960	405,633
5000414	Public Health	13,925,945	12,590,100
5000415	Public Health	1,538,791	1,521,143
5000416	Public Health	9,975,047	5,106,058
5000417	Public Health	28,502,000	7,162,958
5000418	Public Health	1,410,000	611,177
<u>Total</u>		482,156,943	109,584,660

IX. MONITORING AND ASSESSMENT CLAIMS OF THE SYRIAN ARAB REPUBLIC

Table 10. Syria's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> (USD)
5000366	Transport and Dispersion of Air Pollution	97,800
5000367	Transport and Dispersion of Air Pollution	214,000
5000368	Transport and Dispersion of Air Pollution	129,862
5000369	Transport and Dispersion of Air Pollution	914,223
5000370	Cultural Heritage	12,000
5000371	Cultural Heritage	979,000
5000372	Groundwater and Surface Water	815,500
5000443	Terrestrial	416,300
5000444	Terrestrial	651,000
5000419	Public Health	1,394,200
<u>Total</u>		5,623,885

A. Overview

707. Syria submitted claims to monitor and assess damage to the environment and public health due to Iraq's invasion and occupation of Kuwait. It states that Iraq's detonation of Kuwait's oil wells during the final days of Iraq's invasion and occupation of Kuwait resulted in the release of large quantities of smoke into the atmosphere and that, as a result, sulphur dioxide and other harmful gases reached Syrian territory and caused adverse impacts.

708. Syria alleges that the adverse impacts of the oil fires were not restricted to changes in air quality. It claims that the increased concentration of pollutants affected its water, cultural heritage and agricultural resources, polluted its soil, killed its livestock, and adversely affected public health.

709. Iraq, in its written response, questions the basis of Syria's contention that air pollution from the oil fires reached its territory. Iraq contends that, because of the direction of the prevailing winds in the region, the smoke plume from the oil fires extended mostly southward, in the opposite direction from Syria. It also states that Syria has failed to show that it has suffered any direct damage as a result of Iraq's invasion and occupation of Kuwait. Iraq further argues that, because of the composition of the soil in Syria, soil contamination due to acid rain would not be possible.

710. Iraq reiterated these contentions during the oral proceedings.

711. The Panel has taken note of the views of Iraq. However, as previously indicated in paragraphs 29-30, a claimant is not required to prove that it has suffered damage before it can submit a claim for monitoring and assessment of environmental damage and depletion of natural resources. The purpose of monitoring and assessment is to enable the claimant to develop evidence to establish whether environmental damage has occurred, and to quantify the extent of the damage. Accordingly, the Panel does not consider it unreasonable for Syria to attempt to find out if air pollutants from the oil fires in Kuwait reached its territory and had any adverse effects there.

B. Transport and dispersion of air pollution

1. Claim No. 5000366

712. Syria seeks compensation in the amount of USD 97,800 for a preliminary study that was completed in 1997. The purpose of the study was to determine the amount of pollutants that might have been transported to Syria from the oil fires that resulted from Iraq's invasion and occupation of Kuwait. A report on the study was filed with the Commission.

713. There is evidence in the scientific literature that emissions from the oil fires may have reached parts of Syria, albeit infrequently. The evidence suggests that, given the distance between Syria and Kuwait, and the regional wind patterns, the amount of pollutants from the oil fires that might have reached Syrian territory is likely to be small, although that possibility cannot be ruled out completely.

714. Under the circumstances, it was appropriate for Syria to attempt to determine whether pollutants from the oil fires reached its territory. The Panel, therefore, finds that the study constituted reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

715. Syria did not submit sufficient evidence to support the expenses it claimed for the preliminary study.

716. The Panel, therefore, issued Procedural Order No. 5, dated 18 October 2000, in which it requested Syria to provide, inter alia, documentary and other appropriate evidence in support of the claim. In response, Syria submitted a one-and-a-half-page document explaining in general terms the basis for the expenses claimed. No evidence such as contracts, invoices, receipts, salary vouchers, accounting records, time sheets or budgets was provided, and no explanation was given for the failure to provide such evidence.

717. The Panel finds that Syria has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

718. The Panel, therefore, recommends no compensation for this claim.

2. Claim No. 5000367

719. Syria seeks compensation in the amount of USD 214,000 for a project to determine the damage that may have been caused in Syria by airborne pollutants from the oil fires resulting from Iraq's invasion and occupation of Kuwait. Syria proposes to review and analyse weather charts in the Syrian Meteorological Department for the period between February and October 1991 in order to verify the mathematical model used in the preliminary study referred to in claim No. 5000366 (paras. 712-718). The project would also attempt to determine the dates during this period when winds blew from Kuwait toward Syria, and to establish the accompanying formation of atmospheric lows and highs in Syria.

720. There is evidence in the scientific literature that the smoke plume from the oil fires remained one to five kilometres above the ground. The Panel notes, however, that a review of weather charts would only provide information on surface wind patterns. In order to be useful, a project would need to include measurements at higher altitudes. Hence, re-analysis of surface wind patterns is unlikely to achieve the objectives of the project. Information from Syria indicates that it does not have adequate facilities to undertake the necessary higher altitude measurements.

721. The Panel finds that this project does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

722. The Panel, therefore, recommends no compensation for this claim.

3. Claim No. 5000368

723. Syria seeks compensation in the amount of USD 129,862 for a project to map the dispersion over Syria of pollutants which may have been generated by the oil fires that resulted from Iraq's invasion and occupation of Kuwait. A major component of the costs claimed is for the purchase and analysis of satellite images.

724. Syria did not provide sufficient evidence regarding the nature of this project or the basis for the estimated costs. The Panel, therefore, finds that Syria has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

725. Consequently, no compensation is recommended for this claim.

4. Claim No. 5000369

726. Syria seeks compensation in the amount of USD 914,223 for expenses relating to a project on atmospheric modelling. According to Syria, it would participate in the atmospheric modelling project to be undertaken by

Iran (claim No. 5000330, paras. 71-78). Syria intends to use the results of the project to assess the transport and deposition of pollutants from the oil fires on its territory. The amount claimed is stated to include Syria's share of the costs of the Iranian project, the cost of developing Syrian meteorological data for use in the model, and the cost of a computer work station to be purchased by Syria.

727. At the Panel's request, the secretariat asked Syria to provide evidence of its participation in the Iranian project. The information provided to the Panel during its review of this claim was not sufficient either to show that Syria was participating in the Iranian project or to explain the basis on which Syria's alleged share of the costs was calculated.

728. The Panel, therefore, finds that Syria has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

729. Consequently, no compensation is recommended for this claim.

C. Impacts on cultural heritage materials and sites

1. Claim No. 5000370

730. Syria seeks compensation in the amount of USD 12,000 for a preliminary study to assess damage to cultural heritage sites in its territory that may have been caused by pollutants from the oil fires in Kuwait. The study was completed in 1998 and involved field visits by qualified persons to a number of archaeological sites in Syria to determine if the sites had suffered any environmental damage. The study was descriptive in nature; visual observations of the deterioration of structures were noted, but no analytical testing was done.

731. As noted in paragraph 713, there is evidence in the scientific literature that some airborne pollutants from the oil fires may have reached parts of Syria, albeit infrequently. In the Panel's opinion, given the distance between Syria and Kuwait, and the regional wind patterns, the amount of pollutants that might have reached Syrian territory was likely to be small, although the possibility that Syrian cultural heritage sites were affected by pollutants from the oil fires cannot be ruled out completely.

732. The Panel considers that it was appropriate for Syria to attempt to determine whether damage was caused to its cultural heritage sites by pollutants resulting from Iraq's invasion and occupation of Kuwait.

733. The Panel, therefore, finds that the study constituted reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

734. Syria did not provide evidence such as contracts, invoices, receipts, salary vouchers, accounting records, time sheets or budgets to support the

claimed expenses. At the request of the Panel, Syria provided further information. The Panel finds that this additional information is insufficient to demonstrate the circumstances and amount of the expenses claimed.

735. Consequently, the Panel finds that Syria has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

736. The Panel, therefore, recommends no compensation for this claim.

2. Claim No. 5000371

737. Syria seeks compensation in the amount of USD 979,000 for a project to assess damage that may have been caused to cultural heritage sites in Syria by pollutants from the oil fires in Kuwait. According to Syria, the project would consist of field surveys; collection, documentation and analysis of data; and identification of damaged sites, methods of treatment and estimated costs. On the basis of the information obtained, recommendations would be formulated to develop a surveillance system for the regular assessment of rehabilitation measures.

738. The Panel finds that the project is an appropriate attempt to determine whether pollutants from the oil fires had any impact on cultural heritage sites in Syria. Thus it constitutes reasonable monitoring and assessment, and the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

739. Following a review of the project as presented by Syria, the Panel suggests certain modifications, details of which are set out in annex XXXIV to this report.

740. Following a review of the cost estimate presented by Syria, the Panel has developed a revised cost estimate for a project of reduced scope that it considers reasonable. This involves a substantial reduction in labour costs. The revised estimate amounts to USD 250,000.

741. Accordingly, the Panel recommends compensation in the amount of USD 250,000 for this claim.

D. Impacts on groundwater and surface water

Claim No. 5000372

742. Syria seeks compensation in the amount of USD 815,500 for a project to assess the pollution of surface water and groundwater in its territory that may have been caused by pollutants from the oil fires that resulted from Iraq's invasion and occupation of Kuwait. The purpose of the study would be to investigate and verify the extent and impact on surface water and

groundwater of pollution from the oil fires, including acidification caused by acid rain precursors (nitrogen oxides and sulphur dioxide).

743. As previously noted, pollutants from the oil fires may have reached parts of Syria, albeit infrequently. In the view of the Panel, given the distance between Syria and Kuwait, and the regional wind patterns, the amount of pollutants from the oil fires in Kuwait that might have reached Syrian territory is likely to be small. However, although the possibility that the oil fires affected groundwater in Syria is very low, it cannot be ruled out completely. It is, therefore, appropriate for Syria to attempt to ascertain whether any pollutants reached its territory and, if so, whether they caused any damage.

744. The Panel finds that the project constitutes reasonable monitoring and assessment. Consequently, the expenses qualify for compensation in accordance with paragraph 35(c) of Governing Council decision 7.

745. Following a review of the project as presented by Syria, the Panel suggests certain modifications, details of which are set out in annex XXXV to this report.

746. Taking account of the suggested modifications, the Panel has made adjustments as follows:

- (a) The total amount of labour required has been reduced to take account of the reduced scope of the project;
- (b) The costs of computers and software have been reduced; and
- (c) The cost of apparatus to measure heavy metals has been eliminated.

These adjustments reduce the estimated cost to USD 159,600.

747. The Panel, therefore, recommends compensation in the amount of USD 159,600 for this claim.

E. Impacts on the terrestrial environment

1. Claim No. 5000443

748. Syria seeks compensation in the amount of USD 416,300 for a study to determine the effects of the oil fires in Kuwait on Syrian livestock and to estimate the costs of any damage that may have occurred. According to Syria, air pollution from the oil fires spread to Syria from February to November 1991, leading to acid rain, the build-up of residue in shrubs and grasses, and the long-term bioaccumulation of pollutants in shrubs and grasses. Syria alleges that sheep mortality increased as a result of grazing on contaminated grassland and drinking contaminated water.

749. Syria proposes to determine the size of the sheep population before and after the period during which the oil fires burned, define the contaminated areas and the number of sheep in these areas, identify the effects of contaminants on natural rangelands and on rain water, investigate cases of disease in sheep and their treatment, and develop an economic and statistical analysis of any damage identified.

750. Iraq, in its written response, argues that Syria did not provide substantial evidence of any harm detected in livestock.

751. As previously noted (paras. 29-30), the Panel does not consider that proof of environmental damage is a prerequisite for compensability.

752. However, the Panel notes that Syria has failed to provide details regarding the proposed methodology and it has not indicated how the study would link sheep mortality to air pollution resulting from Iraq's invasion and occupation of Kuwait.

753. The Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

754. Accordingly, no compensation is recommended for this claim.

2. Claim No. 5000444

755. Syria seeks compensation in the amount of USD 651,000 for a study to determine the effect of the oil fires in Kuwait on Syria's forest resources, and to estimate the costs of any damage that may have occurred. According to Syria, the air pollution from the oil fires damaged a large number of young seedlings and dried pasture shrubs.

756. Syria proposes to survey the areas suspected to have been damaged by pollution from the oil fires, assess the age and types of trees in those areas before and after 1991, and identify specific causes of damage.

757. Iraq, in its written response, argues that Syria did not provide substantial evidence of any harm detected in its forest sector.

758. As previously noted (paras. 29-30), the Panel does not consider that proof of environmental damage is a prerequisite for compensability.

759. However, the Panel notes that Syria has not provided any details of the proposed methodology; nor has it indicated how the study would differentiate vegetation contaminated as a result of Iraq's invasion and occupation of Kuwait from that contaminated by other sources.

760. The Panel finds that the study does not constitute reasonable monitoring and assessment for the purposes of paragraph 35(c) of Governing Council decision 7.

761. Accordingly, no compensation is recommended for this claim.

F. Public health impacts

Claim No. 5000419

762. Syria seeks compensation in the amount of USD 1,394,200 for a project to assess the state of health of its population before, during and after the oil fires in Kuwait. According to Syria, air pollution from the oil fires spread to Syria from February to November 1991, with adverse impacts on public health.

763. Syria proposes to examine various health indicators, focusing on birth rates, mortality, fertility, mortality of children under one year and under five years of age as well as on diseases and deaths classified by the tenth International Classification of Diseases (International Statistical Classification of Diseases and Related Health Problems, 10th revision, vol. 3 (Geneva, WHO, 1992-c1994)). Data would be collected from hospitals and health centres across Syria. A study of each indicator would be performed in order to detect any statistically significant increases in these indicators that might be attributed to Iraq's invasion and occupation of Kuwait.

764. The evidence in the scientific literature indicates that prevailing winds in the region generally move from Syria toward Kuwait, and that conditions conducive to the airborne transport of pollutants from Kuwait to Syria occur infrequently. Nevertheless, the Panel accepts that the possibility that some pollutants from the oil fires reached parts of Syria cannot be ruled out completely.

765. In the view of the Panel, the project is based on appropriate objectives, and constitutes reasonable monitoring of public health. Consequently, the expenses qualify for compensation in accordance with paragraph 35(d) of Governing Council decision 7.

766. However, the Panel has some concerns regarding the selection and number of health indicators, the scope of the project and its duration. To address these concerns it suggests certain modifications, details of which are set out in annex XXXVI to this report.

767. In addition, the Panel has made adjustments to the cost estimate as follows:

- (a) The total amount of labour required has been reduced;
- (b) The costs of transportation and equipment have been reduced; and
- (c) The costs of proposed visits by the members of the project team to neighbouring countries have been eliminated because such visits are not necessary.

The revised estimate amounts to USD 264,600.

768. The Panel, therefore, recommends compensation in the amount of USD 264,600 for this claim.

Table 11. Recommended amounts for Syria's monitoring and assessment claims

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed</u> <u>(USD)</u>	<u>Amount recommended</u> <u>(USD)</u>
5000366	Transport and Dispersion of Air Pollution	97,800	nil
5000367	Transport and Dispersion of Air Pollution	214,000	nil
5000368	Transport and Dispersion of Air Pollution	129,862	nil
5000369	Transport and Dispersion of Air Pollution	914,223	nil
5000370	Cultural Heritage	12,000	nil
5000371	Cultural Heritage	979,000	250,000
5000372	Groundwater and Surface Water	815,500	159,600
5000443	Terrestrial	416,300	nil
5000444	Terrestrial	651,000	nil
5000419	Public Health	1,394,200	264,600
<u>Total</u>		5,623,885	674,200

X. MONITORING AND ASSESSMENT CLAIM OF THE REPUBLIC OF TURKEY

Table 12. Turkey's monitoring and assessment claim

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed (USD)</u>
5000445	Departure of persons from Iraq or Kuwait	3,770,300
<u>Total</u>		3,770,300

Claim No. 5000445

769. Turkey seeks compensation in the amount of USD 3,770,300 for a study to determine the effects on its forest resources of the refugees who entered Turkey as a result of Iraq's invasion and occupation of Kuwait. Specifically, Turkey proposes to study the changes in carbon emission and storing, the soil losses caused by erosion, the changes in biodiversity, and the socio-economic losses resulting from large quantities of wood having been cut down by the refugees.

770. Turkey alleges that 200,000 refugees entered Turkey during Iraq's invasion and occupation of Kuwait in early spring of 1991. Because of the cold weather conditions, the refugees cut down trees for heating fuel, and thereby damaged the forests.

771. The Panel notes that, pursuant to paragraph 34(b) of Governing Council decision 7, losses resulting from the departure of persons from Iraq or Kuwait are compensable if the departures occurred during the period 2 August 1990 to 2 March 1991.

772. Turkey has provided inadequate evidence to establish the dates of departure of the refugees, the countries from which they departed, or the duration of their stay. Therefore, the Panel is unable to determine whether any losses suffered by Turkey as a result of the presence of the refugees would qualify as direct loss resulting from Iraq's invasion and occupation of Kuwait.

773. The Panel finds that Turkey has failed to meet the evidentiary requirements for compensation specified in article 35(3) of the Rules and Governing Council decision 46.

774. The Panel, therefore, recommends no compensation for this claim.

Table 13. Recommended amounts for Turkey's monitoring and assessment claim

<u>Claim number</u>	<u>Subject matter</u>	<u>Amount claimed (USD)</u>	<u>Amount recommended (USD)</u>
5000445	Departure of persons from Iraq or Kuwait	3,770,300	nil
<u>Total</u>		3,770,300	nil

XI. RELATED ISSUES

A. Currency exchange rate

775. The Commission issues awards in United States dollars. The majority of claims were filed in United States dollars, and therefore these costs do not raise currency exchange rate issues. However, some items of expenditure in some of the claims were presented in other currencies and converted into United States dollars at specified rates. In the course of its review, the Panel determined whether the exchange rates used by the Claimants were reasonable approximations of the applicable rates in the United Nations Monthly Bulletin of Statistics.

776. The Panel accepted the exchange rates used by the Claimants, except where fluctuations in exchange rates would have resulted in an overstatement of the value of the claim. In such cases, the Panel applied the rates in the United Nations Monthly Bulletin of Statistics.

B. Interest

777. Governing Council decision 16 provides that "[i]nterest will be awarded from the date the loss occurred until the date of payment, at a rate sufficient to compensate successful claimants for the loss of use of the principal amount of the award" (S/AC.26/1992/16, para. 1). It also provides that the Governing Council will consider the methods of calculation and payment of interest at the appropriate time, and that interest will be paid after the principal amount of awards. Accordingly, the Panel must determine the date from which interest will run, where relevant.

778. The majority of the monitoring and assessment claims are for financial expenditures that have not yet been incurred. In such cases, no interest is due and, accordingly, no date of loss has been indicated. With respect to completed studies, the Panel has selected the mid-point of the period during which expenses were incurred as the date of loss.

XII. SUMMARY OF RECOMMENDATIONS

779. Based on the foregoing, the Panel recommends that the amounts set out in table 14 below be paid in respect of the claims included in the first instalment of "F4" claims.

Table 14. Summary of recommended awards for monitoring and assessment claims

<u>Country</u>	<u>Total number of claims</u>	<u>Amount claimed (USD)</u>	<u>Amount recommended (USD)</u>
Iran	40	42,951,383	17,007,070
Jordan	10	12,488,949	7,060,625
Kuwait	22	460,421,114	108,908,412
Saudi Arabia	24	482,156,943	109,584,660
Syria	10	5,623,885	674,200
Turkey	1	3,770,300	nil
<u>Total</u>	107	1,007,412,574	243,234,967

Geneva, 28 March 2001

(Signed) Thomas A. Mensah
Chairman

(Signed) José R. Allen
Commissioner

(Signed) Peter H. Sand
Commissioner

TECHNICAL ANNEXES TO THE REPORT ON THE FIRST INSTALMENT OF "F4" CLAIMS

Introduction

1. In the course of its review of claims for monitoring and assessment of environmental damage and depletion of natural resources, the Panel identified possible modifications in the design and methodology of some of the monitoring and assessment activities proposed. Where the Panel found that modifications in the technical content of an activity, or the extent of work proposed, would be appropriate in the light of the stated objectives of the claim, it has so indicated in its comments on the claim concerned. As noted in paragraph 47 of the report, the specific modifications suggested are set out in the respective annexes.

2. The purpose of these modifications is to improve the technical quality of the tasks to be undertaken, to enhance the value of the results to be produced, and to increase the overall cost-effectiveness of the monitoring and assessment activities. The Panel recognizes that, in the course of practical implementation of monitoring and assessment activities, further variations are likely to be required to achieve the objectives stated in the claims. Where such variations affect the implementation of an activity for which compensation has been awarded, the Panel recommends that the claimant inform the Commission of the reasons for variation.

3. The specific modifications suggested in the annexes also address a number of common concerns that apply to all or most of the monitoring and assessment activities proposed by Claimants. These common concerns may be summarized as follows:

A. Distinguishing invasion-related impacts from other factors

4. Distinguishing the various factors that may have contributed to observed impacts on environmental quality, natural resources and human health is an important but very difficult task, given the passage of time, ongoing pollution inputs, natural variability in the environment of the region, and other possible causes of environmental change. In many cases, well-established techniques exist to assist in determining whether, and to what extent, observed impacts are attributable to Iraq's invasion and occupation of Kuwait, as opposed to other causal factors.

5. Where available, data from the period prior to Iraq's invasion and occupation of Kuwait should be taken into account in the selection of the most suitable sampling sites or populations, and in evaluating the significance of post-invasion information.

6. Wherever feasible, data should be collected and analysed from sites or populations that were not affected by Iraq's invasion and occupation of Kuwait but are otherwise similar or comparable to sample sites or populations in the impact area.

7. Certain types of chemical analyses (e.g. gas chromatography/mass spectrometry) may generate information that can help to identify (fingerprint) or rule out specific sources as the causes of observed damage or pollutants.

8. Analyses of spatial and temporal patterns in pollution may generate information that can improve an understanding of the relative, or proportionate, importance of various pollution sources.

B. Consideration of published literature

9. There is substantial information in the published scientific and technical literature on the issues of damage assessment, risk assessment, remediation and restoration options that need to be examined in many of the proposed monitoring and assessment activities. Claimants should endeavour to make the fullest use of the techniques, methodologies and models recognized in the literature, and they should carefully consider the results of similar monitoring and research conducted by other investigators when evaluating their findings.

C. Use of tiered (iterative) sampling and testing

10. For proposed monitoring and assessment activities with significant sampling components, initial sampling and analysis should be undertaken to evaluate a relatively broad set of samples, using "simple" tests capable of determining the presence or absence of significant pollution impacts. Once these initial screening evaluations have been performed, subsequent sampling efforts, and more "complex" (and costly) analytical testing of the samples obtained, should be reserved for those impacted areas or populations where further testing appears most likely to assist in the identification of damage and causes, estimation of recovery possibilities, and choice of remediation options.

D. Analysis of environmental impacts of remediation

11. Claimants should take special care to analyse the potentially negative environmental impacts of remediation activities. Some remediation techniques have significant potential for further damaging ecological systems (e.g. using gravel to stabilize desert pavements). All monitoring and assessment studies should provide thorough analyses of the potential ecological effects of the remediation activity itself.

E. Use of standard rates

12. In the calculation of reasonable labour and equipment costs, and the costs of related items such as travel, accommodations etc., standard local rates should normally be applied, except where the use of foreign personnel or equipment is justified. Standard rates are also available for foreign personnel and equipment and should be used wherever applicable. Cost

calculations should also take into account possible savings in terms of multiple use and residual value of facilities.

F. Co-ordination of related activities

13. In many cases, the Claimants could improve their monitoring and assessment activities (and reduce costs) by co-ordinating sampling designs, sharing data and jointly evaluating information obtained from other related activities undertaken by the same Claimant or, in some cases, by other Claimants. Claims for which such co-ordination appears possible and desirable have been identified in this Panel report. Co-ordination may involve, in particular, joint use of personnel and technical facilities, mutual alignment of timetables and areas and subjects for sampling and analysis, wherever feasible.

Annex I

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000330 (IRAN)
(paragraphs 71-78)

1. To succeed within a one to two-year period, the project should make use of existing models, data and research knowledge. Excellent meso-scale models already exist and the work of several research groups has helped to refine these models and make them more suitable to predict the movement of the smoke from the fires in Kuwait.
2. The data collection effort should concentrate primarily on the search for data that would be useful for verifying the results of the modelling, such as data on "black rain" or "black snow" in Iran before, during and after the oil fires in Kuwait.
3. Consideration should be given to conducting direct measurements of black carbon in order to evaluate the stratigraphy and chemical composition of layers found in core samples of soils so as to identify airborne pollutants that may have been deposited before, during and after the oil fires in Kuwait. See, for example, M. Garstang and others, "Atmospheric transport of particulate and gaseous products of fires", Sediment Records of Biomass Burning and Global Change, (James S. Clark and others, eds.), (NATO ASI Series,) vol. 1, p. 51 (Berlin, Heidelberg, Springer Verlag, 1977).
4. Two senior scientists and one programmer from an established modelling group, working full time, could complete the project with assistance from a research assistant and clerical support. One of the senior scientists should serve as project manager and spend 33 per cent of his/her time on that function.
5. While no new computer hardware or software will be required, because all established modelling groups already have the needed equipment, funding will be needed for the purchase of mainframe computer time for model refinement and operating runs.
6. The funds proposed to cover labour costs for the development of meteorological data, and for a data/information specialist, should be allocated instead to comprehensive efforts to identify and utilize any data in Iran on the composition of black rain, black snow or other forms of pollution from the oil fires in Kuwait, that would be useful to verify the predictions of any model.

Annex II

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000446 (IRAN)
(paragraphs 84-90)

1. The proposed studies should endeavour to differentiate damage caused by background pollution, combined with on-going processes such as general weathering, corrosion and degradation, from damage resulting from pollution from the oil fires in Kuwait. There are five general approaches scientists may use to estimate incremental damage to cultural artefacts: (1) before-and-after comparisons; (2) stratigraphic measurements; (3) fingerprinting studies; (4) comparisons of affected artefacts to unaffected control artefacts; and (5) mathematical damage functions. Of these approaches, before-and-after studies and fingerprinting are most likely to provide useful information for evaluating damage or loss attributable to the effects of Iraq's invasion and occupation of Kuwait.
2. If significant soiling is found on the artefacts that can be attributed to the oil fires in Kuwait, the development of cleaning instructions may be appropriate. To develop appropriate cleaning methods, "test" cleanings should be performed to identify methods that are both effective and safe to the artefact.
3. Each of the studies can be completed within a period of 24 months.
4. The amount of labour should be reduced by approximately 50 per cent.
5. The number of analytical tests should be reduced by 80 per cent, which will be sufficient to characterize the condition of the artefacts and determine whether a fingerprint can be established.
6. Considering that several of the sites concerned are listed as world heritage sites under the 1972 World Heritage Convention (Convention for the Protection of the World Cultural and Natural Heritage, United Nations Treaty Series, vol. 1037, No. 15511, p. 151), monitoring and assessment activities for these sites should proceed in consultation and coordination with the World Heritage Centre of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Annex III

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000447 (IRAN)
(paragraphs 91-98)

1. As described in annex II, there are five general approaches scientists could use to estimate incremental damage to cultural artefacts. Of those approaches, before-and-after studies and fingerprinting are most likely to provide useful information for evaluating damage or loss that may have resulted from Iraq's invasion and occupation of Kuwait.
2. If significant soiling is found on the artefacts that can be attributed to the oil fires in Kuwait, the development of cleaning instructions may be appropriate. To develop appropriate cleaning methods, "test" cleanings should be performed to identify the methods that are both effective and safe to the artefacts.
3. The scope of work should be reduced by 50 per cent, which will be sufficient to produce useful results in relation to indoor materials.
4. Each of the studies can be completed within a period of 24 months.
5. The amount of labour should be reduced by approximately 70 per cent.
6. The number of analytical tests should be reduced by 80 per cent, which will be sufficient to characterize the condition of the artefacts and determine whether a fingerprint can be established.

Annex IV

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000343 (IRAN)
(paragraphs 106-112)

1. The proposed Geographic Information System framework should
 - (a) Consider areas known to be exposed to soot; and
 - (b) Incorporate principal geological and hydrogeological factors which would affect transport of airborne pollutants into underlying aquifers (e.g. hydraulic conductivity and depth of aquifer).

Consideration of these factors in the initial stages of the investigation would help to pinpoint the areas most likely to be at risk to groundwater pollution.

2. In the absence of baseline data, measuring incremental groundwater pollution from the oil fires would require either
 - (a) Selection of comparable control aquifers (i.e. unaffected groundwater resources) to compare with areas affected by oil fires; or
 - (b) A method such as chemical fingerprinting to link pollutants in groundwater to the oil well fires.
3. The project can be completed within a period of 12 months. This would result in a reduction of 60 per cent in the number of person-months required.

Annex V

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000347 (IRAN)
(paragraphs 113-118)

1. The project should evaluate measures, such as the per cent cover of epibiota on prop roots, mobile biota living in the prop root area, observations of bark fissuring, epithelial scarring, lenticel expansion, leaf deformities and chlorosis, and propagule stunting or bending. These indices could provide useful information about forest recovery potential.
2. Sediment samples should be collected in study plots to interpret revegetation results. Submission of plot-specific sediment cores collected by researchers for oil fingerprinting analysis (using, for example, gas chromatography/mass spectrometry ("GC/MS")) may provide an indication of the degree to which oil from Kuwait is responsible for observed effects on mangroves. This approach might allow researchers to correlate revegetation potential and metal uptake with varying degrees of exposure to oil from Kuwait and atmospheric deposition.
3. The researcher level of effort can be reduced by 50 per cent. Further, all the work involving electrophoresis can be eliminated without prejudice to the objectives of the project. This would result in a reduction of the effort at the assistant researcher level by 10 to 15 per cent.
4. An additional set of sediment samples (i.e., one sample composited from each of the 100 plots) should be selected for petroleum fingerprinting analysis using GC/MS to confirm exposure to oil from Kuwait.
5. Monitoring deposition of airborne pollutants should be co-ordinated with other projects dealing with the long-range transport of air pollutants from the oil fires (in particular, claim No. 5000330), to ensure compatibility of site selection and timing.

Annex VI

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000349 (IRAN)
(paragraphs 119-125)

1. The project should take both sediment deposition rates and physical and biological mixing of sediments into account to determine the time of pollutant deposition. Sedimentation rates in the intertidal zone are not constant in time or space, so each site will be different, based on the type of intertidal habitat (e.g. beach, mudflat, sand flat, mangrove forest). It is likely that substantial variations in the sedimentation rate will occur within the large project area (i.e., from Khuzestan Province to the Strait of Hormuz). The project should attempt to account for these differences in sedimentation rates and should also consider the impacts of physical and biological mixing. As a result, increasing the size of the core subsamples (every five centimetres rather than every one-two centimetres as proposed) should be considered. Due to the physical and biological mixing that could have occurred in the marine environments proposed for sampling, using one-two centimetres core subsamples may not improve the project's ability to assign contamination to time periods and may in fact lead to erroneous conclusions about the age of the sediment layers.
2. The project should use chemical fingerprinting analyses using gas chromatography/mass spectrometry ("GC/MS") and atomic absorption spectrophotometry techniques in order to investigate possible links between potential changes in microfaunal community structure and pollution resulting from Iraq's invasion and occupation of Kuwait. Evaluation of the ratios of trace metal concentrations can provide some indication of the source of oil pollution (and provide further information about the cause of any observed sediment toxicity). Total petroleum hydrocarbon tests will not help to distinguish the sources of oil. Correctly conducted, GC/MS analysis may enhance the project's ability to differentiate between the sources of petroleum hydrocarbons in intertidal sediments. In order to link changes in microfaunal community structure to chemical exposure, fingerprinting analyses should be conducted in the same locations as those used for microfaunal community structure analyses.
3. The number of subsamples for microfauna and chemical analyses should be reduced. The amount of work at the researcher level can thus be reduced by approximately 35 per cent, and at the assistant researcher level by approximately 50 per cent.

4. The proposed analytical tests should be replaced by GC/MS and metals analysis for the 350 GC/MS and metals subsamples (i.e., 35 cores x 10 subsamples per core).

Annex VII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000350 (IRAN)
(paragraphs 126-131)

1. Mass spectrometry should be used in conjunction with the proposed gas chromatography work to obtain more accurate hydrocarbon characterization and to help identify the source of any petroleum hydrocarbons found in the sediment cores.
2. The impacts of physical and biological mixing should be considered in the evaluation of sediment samples. For example, increasing the size of the core subsamples (every five centimetres rather than every one-two centimetres as proposed) should be considered. Due to the physical and biological mixing that has probably occurred in the marine environments proposed for sampling, using one-two centimetres core subsamples may not improve the study's ability to assign contamination to time periods and/or lead to erroneous conclusions about the age of the sediment layers.
3. The project should involve the collection of core samples from the coral reefs themselves. Layers within coral cores can be fingerprinted for petroleum hydrocarbons, and layers can be dated using the corals' growth rings. This approach might identify the source(s) of hydrocarbons to which the corals were exposed at different times. If coral growth is also measured using the rings, it might also be possible to detect growth changes associated with exposure to petroleum hydrocarbons.
4. In selecting control sites, careful thought should be given both to the sites' ability to provide information on potential confounding factors and the requirements of statistical validity.
5. For the project to generate useful information on the relative success of restoration techniques, at least one year, and preferably several years, should be allotted for monitoring and evaluation of the sites. For this purpose, the budget proposed for an "advisor" (20 person-months), could be re-allocated to the design and implementation of a longer-term study that will generate useful data to inform future restoration decisions. The "advisor" could, for example, spend nine months selecting the sites and establishing the restoration projects, revisit and monitor the sites for two months per year for the following four years, and finally spend three months writing a final report on the project results.
6. The amount of work for sediment analyses should be increased to allow for gas chromatography/mass spectrometry analyses in addition to the proposed nickel and vanadium analyses for each of the sediment subsamples.

Annex VIII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000351 (IRAN)
(paragraphs 132-137)

1. Accurate characterization of sedimentation rates is essential in dating sediment core layers. In addition the impacts of local physical and biological mixing should be carefully considered. Ignoring bioturbation can result in substantial errors in dating core layers. For these reasons, the study should increase the size of the core subsamples (every five centimetres rather than every one-two centimetres as proposed). Due to the physical and biological mixing that has probably occurred in the marine environments proposed for sampling, using one-two centimetres core subsamples may not improve the study's ability to assign contamination to time periods and may in fact lead to erroneous conclusions about the age of the sediment layers.
2. Because accurately characterizing the sedimentation rate and sediment mixing is likely to be difficult, the project should be focused on the proposed atomic absorption spectrophotometry work and on gas chromatography/mass spectrometry ("GC/MS") analyses. In particular, using ultraviolet fluorescence to evaluate petroleum hydrocarbon concentrations in sediment will not provide adequate resolution to determine the source of the oil pollution. Instead, GC/MS may enhance the project's ability to discriminate between different sources of oil pollution.
3. The level of work for all labour categories can be reduced by 79 per cent as follows:
 - (a) Researcher staff level: one person-month for the field effort, four person-months for laboratory analyses, and six person-months for report preparation.
 - (b) Advisor staff level: one person-month for the field effort and three person-months for report preparation.
 - (c) Assistant researcher staff level: two person-months for laboratory analyses and six person-months for report preparation.
 - (d) Technical staff: two person-months for field work and four person-months for laboratory analyses.
 - (e) Driver: two person-months are needed for field work and two person-months for the laboratory analyses.

Annex IX

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000352 (IRAN)
(paragraphs 138-144)

1. The plot size should be reduced from 300 square metres to 100 square metres per plot. In addition, the proposed level of effort to be devoted to seedling production, seed collection, and wild seedling collection should be increased because it is far too low given the project's scope. When reforesting mangroves, a minimum of one plant per square metre is recommended. The submitted claim specifies producing only 800 seedlings in a nursery, planting 800 seeds, and collecting 450 wild seedlings. Even if a three metre distance were used as proposed, the project's plan would require far more plant material than is currently envisaged. Reducing the plot size and acquiring additional seedling/seed stock will address these issues.
2. Tissue culture should be eliminated from the proposed reforestation methodologies because it is an inappropriate technique in the context of this work. Tissue culture in mangroves is at an experimental stage and cannot reasonably be used for reforestation-scale purposes.
3. Mangrove reforestation success monitoring requires several years due to mangroves' slow maturation time. It would, therefore, be preferable for the project to continue for a longer period (e.g. at least three years). A longer observation period would be more likely to represent accurately the relative success of the different techniques and the effects, if any, of local oil pollution on reforestation success. This could be accomplished within the proposed budget by monitoring the reforested mangroves every three months over a period of three years instead of every month over a period of one year.
4. In the selection of control sites, the inclusion of four 100-square-metre plots (replicates) of all three reforestation methodologies at each intertidal level should be considered. This would produce a total of 36 reference plots per site.
5. An appropriate sediment sampling plan would include the analysis of triplicate sediment samples from all 36 plots at both sites, plus triplicate samples from the three reference plots from each of the two sites, for a total of 234 samples.
6. The level of effort for the researcher and assistant researcher positions can be reduced by 25 per cent and 70 per cent, respectively, to take account of the elimination of the tissue culture part of the project. The level of effort of technical staff should be increased from 40 months

to 47 months, due to the increase in the number of plants to be re-forested.

Annex X

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000344 (IRAN)
(paragraphs 145-151)

1. In selecting numbers and locations of study sites, careful thought should be given to the requirements of statistical validity, having regard especially to the goal of the project which is to characterize community recovery in the estimated 10,000 hectare area, and to the numerous microhabitat and oil exposure variations common in wetland areas that have been affected by oil spills.
2. Additional measures of recovery to those proposed include measuring the above-ground biomass (a measure of production) and systematic observations of marsh fauna in order to understand recovery of this important element of a marsh ecosystem. Although not essential, these additional measures of marsh recovery would help the study to gain a broader understanding of the actual recovery of Shadegan Wetland.
3. The project should identify and use suitable control plots and conduct additional fingerprinting of soil samples in the study and control areas. These actions might improve the project's ability to link any pollutants to Iraq's invasion and occupation of Kuwait and would reduce the probability that other confounding factors were responsible for any observed impacts.
4. The level of effort for the researcher can be reduced by 40 per cent. In addition, as indicated by the claimant, the level of effort for the assistant researchers and technical staff can be reduced by approximately 20 per cent since only 60-65 of the original 100 plots have been studied during the greater part of the period of this project. The level of effort for secretaries can be reduced by 40 per cent.
5. The proposed petroleum hydrocarbon analysis can be eliminated altogether and replaced by one set of sediment samples (i.e., one sample composited from each of 65 plots) for petroleum fingerprinting analysis using gas chromatography/mass spectrometry to obtain information that may help ascertain the source of oil pollution.

Annex XI

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000346 (IRAN)
(paragraphs 156-162)

1. Species diversity and abundance analyses should be performed on the planktonic, benthic fauna, and demersal fish samples. (For benthic communities, abundance and species diversity metrics, including the absence or presence of vulnerable species, can be indicative of sediment contamination, since these organisms are in direct contact with the sediment.)
2. In addition, heavy metal and petroleum hydrocarbon fingerprinting analyses should be performed on the benthic faunal samples. Approximately ten specimens of a selected benthic faunal species should be pooled for analyses from each sampling station for each sampling period.
3. A more explicit identification of baseline data, in terms of the actual data sets, sampling locations, seasons/times, and methodologies used to evaluate the comparability of this data with the proposed data collection effort should be undertaken. In addition, the project should consider the known and predicted behaviour of the oil from the oil spill in Kuwait, taking into account water circulation patterns and other factors (e.g. oil residence times) influencing the transport and fate of oil. While it is acknowledged that less baseline and post-1991 environmental data are available for Iran than other Gulf States, some published data are available and should be consulted (e.g. Regional Report of the State of the Marine Environment, ROPME/GC-9/002 (1999)).
4. Sampling in unaffected (control) areas should also be considered, as sites that have not been affected by oil can be important for determining the impacts of confounding factors.
5. The duration of the project should be increased to address the question of the regeneration rate of the fishery resources. To adequately study the regeneration of a population, the organism or system must be evaluated over a sufficient time frame. Substantial inter-annual variability in fish stocks and benthic faunal populations is a common occurrence. In addition, zooplankton and phytoplankton abundance may vary daily. An alternative to the proposed approach that would provide more information on regeneration rates is to spread the sampling over two and a half years. Under such a plan, sampling would occur only twice a year for a total of five sampling periods. While providing some seasonal variability data, this approach may also provide a better understanding of inter-year regeneration of selected species.

6. The level of effort for the assistant researcher staff can be reduced by approximately 50 per cent.

Annex XII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000348 (IRAN)
(paragraphs 163-168)

1. A statistically valid number of unaffected (control) sites should be established to minimize potential confounding factors that may have affected the marine ecosystem. These control sites might also help to define natural variability. For example, other Iranian monitoring and assessment marine projects propose to use the Strait of Hormuz as a reference site, as oil pollution from Iraq's invasion and occupation of Kuwait did not significantly penetrate that area.
2. Co-location of the sediment sampling sites, the fish specimen collection sites, the invertebrate collection sites, and the tarball collection sites would provide useful data for the interpretation of pollution sources, pathways, and potential contamination of food sources.
3. The proposed sediment sampling should be adjusted to include collection of at least two additional reference samples, thus increasing the number of sampling sites from 18 to 20.
4. Due to the physical and biological mixing that occurs in the marine environments proposed for sampling, using three centimetres core subsamples may not make it possible to attribute pollution to time periods and/or may lead to erroneous conclusions about the age of the sediment layers. For these reasons, the size of sediment subsamples should be increased (to five centimetres).
5. The number of tissues (per fish) to be analysed should be considerably reduced. Specifically, the fish liver, skin, and muscle are commonly analysed. The liver of fish species is a primary site for detoxification of hydrocarbons and other pollutants such as heavy metals. Ideally, collection of extracts of bile from the liver at the time of species collection would provide insight into the presence of petroleum metabolites, indicating exposure to petroleum compounds. In addition, pollutants can potentially accumulate in the skin of fish, making this tissue a good indicator of pollutant exposure. Also, the muscle tissue of the fish should be examined because consumption by humans and piscivorous wildlife may lead to health risks. The analysis of gills, gonads, kidney, gastrointestinal tract, and eye tissue should be eliminated because it may only provide a minimal increase in information on exposure of fish to pollutants.
6. Samples of oil collected at the time of Iraq's invasion and occupation of Kuwait were not stored properly. The oil may have undergone

biodegradation or other abiotic changes that could create a false fingerprint when compared to hydrocarbon concentrations detected in sediment and fish samples.

7. When conducting the laboratory bioassays, careful thought should be given to how best to simulate the field conditions present during Iraq's invasion and occupation of Kuwait. This process should include both devoting thought to the issue of determining exactly what those conditions were, and then taking care to ensure that the laboratory conditions (especially in flow-through experiments) approximate the relevant field conditions as closely as possible.
8. Appropriate quality assurance and quality control protocols for sample collection and processing should be established. Among other goals, these protocols should minimize the probability that collected samples are further contaminated in the field prior to proper storage and analysis.
9. Water samples should be collected and the dissolved constituents should be measured (for both hydrocarbons and trace metals) during execution of the laboratory toxicity studies. Previously conducted toxicity studies were flawed by the use of nominal concentrations (calculated based on the amount of oil added to a specific volume of water) rather than actual measured hydrocarbon concentrations. Understanding the limitations of the toxicity testing protocols and taking precautions against these limitations could increase the quality and application potential of resulting data.
10. The level of effort of the researcher, assistant researcher and technical staff should be increased because the level proposed is on the low end of the range likely to be necessary to complete a project of the complexity and scale proposed.

Annex XIII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000382 (IRAN)
(paragraphs 178-186)

1. A more extensive review of available literature should be undertaken because much can be learned from previous modelling efforts. The development of a new oil spill model without taking advantage of pre-existing computer code is a redundant exercise, given the availability of several models capable of performing the kind of analysis proposed.
2. While the proposed hydrodynamic modelling efforts are appropriate, the flow patterns in the intertidal areas are not addressed. Modelling of the land/water boundary flows will be critical to determining the coastal oiling resulting from invasion-related releases.
3. Experts in the field of marine oil transport and fate modelling generally use the Lagrangian (particle-based) approach, which allows masses of various oil constituents to be tracked and weathered as they move through the environment. Given the study objectives, the Lagrangian approach would be more appropriate for this effort than an Eulerian (grid-based) approach.
4. Because oil components have varying physical, chemical and toxicological properties, it is inappropriate to treat oil as a single constituent in the modelling effort. A model that treats oil as a single constituent is likely to produce over-simplified results that ignore the differential transport and fate of specific oil components. To the extent that a multi-component analysis is done, information about specific constituents and concentrations present in Kuwait oil (and other source oil that was released into the Persian Gulf) should be collected. Such information could be obtained through an analysis of current samples of Kuwait (or other source) oil.
5. While the project's focus is on modelling oil released during Iraq's invasion and occupation of Kuwait, it may also be useful to model oil inputs occurring after Iraq's invasion, to the extent such information is available. This type of exercise might help clarify the extent to which oil observed as part of post-invasion field efforts is from the invasion-related spill or more recent oil inputs into the system.
6. The primary purpose of data collection should be to supplement available data on currents, temperature, salinity, water height, and similar types of physical characteristics. This information is essential for the hydrodynamics modelling effort. To determine oceanographic conditions at the time of Iraq's invasion and occupation of Kuwait, assumptions will

have to be made about how these factors have changed over time, and will need to be considered carefully.

7. The level of effort for modelling can be reduced because as proposed it does not take full advantage of existing models that could be used as a starting point for this project, and does not use staff/consultants with more expertise and familiarity with oil transport modelling. The project could be undertaken with 24 person-months of effort: i.e. nine person-months on the part of a hydrodynamic modeller to develop, calibrate, and validate a three-dimensional hydrodynamic model for the Persian Gulf using previously-developed model code; six person-months for the oil fates modelling, assuming reliance on previously-developed model code and experience in this field; and nine person-months for the associated data processing and visualisation of model inputs and outputs. Of these, 15 person-months of effort would require senior modellers, and the remaining nine months of effort would require more junior help.
8. The level of effort for field data collection can be reduced by 75 per cent. This should be sufficient to conduct smaller scale cruises targeted at collection of project-specific data and/or proportionally contribute to data collection costs of a much larger oceanographic cruise.
9. The software and hardware budget can be reduced by 50 per cent, to better reflect current prices and software/hardware needs. The largest component of the proposed software and hardware budget is for the commercial software FLUENT/FIDAP. This package solves fluid mechanics problems, but is not designed for use in surface water modelling involving "free surfaces" (i.e., changing water height). Thus, additional effort would be required to adapt this package. Other freeware codes are better designed for hydrodynamics problems, for example the Princeton Ocean Model. There are also many commercial hydrodynamic models available that would be more suitable and cost-effective.

Annex XIV

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000389 (IRAN)
(paragraphs 192-198)

1. Performing a more comprehensive survey of the entire shoreline using the SCAT (Shoreline Clean-up Assessment Team) method developed by the Governments of Canada and the United States should be considered. These survey methods use standard terms and techniques to assess the oil along the entire shoreline, rather than in limited transects. The results of this type of survey can support the creation of computer-generated maps showing the extent of pollution of the shoreline.
2. The project should collect additional data about potentially affected ecological communities at the sampling sites. Such information might include the presence of sensitive species, such as migratory birds or fish species, that may be adversely affected by remediation operations.
3. Some additional work should be performed to identify the impacts of oil pollution that resulted from Iraq's invasion and occupation of Kuwait. Although the Claimant states that an investigation of the coastal zone suggests that the oil pollution is primarily a result of Iraq's invasion and occupation of Kuwait, the methodology proposed is to determine the age of the tarballs (and thereby the source) by measuring their weight, density, and volume. This methodology partly addresses source identification issues but is less accurate than appropriate chemical fingerprinting analyses (e.g. gas chromatography/mass spectrometry analyses). Due to the array of other potential sources of oil in the Persian Gulf, conducting a more precise fingerprinting analysis would be appropriate.
4. The second part of the project (evaluating remedial options) would benefit from further refinement. In particular, the study needs to define more explicitly the potential remediation goals for the polluted shoreline. While multiple remediation goals are often appropriate when chosen to reflect site-specific circumstances, identification of potential clean-up goals is needed to evaluate the success of the field demonstrations of remediation technologies.
5. While a variety of treatment technologies should be considered during the initial identification and evaluation phase of this project, additional emphasis should be placed on narrowing the set of technologies through literature review and laboratory-scale testing processes. There is an extensive body of published literature on shoreline clean-up that should be exhaustively reviewed before conducting any laboratory or field tests. In addition, performing laboratory scale testing on some remedial

options, such as bioremediation, will allow the researchers to evaluate the technologies in a more cost-effective manner, and will facilitate the design of the field tests.

6. Additional remedial options should be explored. For example in situ treatment may be a more cost-effective and feasible option for some oil residues. Other remedial technology options to be considered include:

(a) Beach cleaning machines for the removal of viscous oil on sand beaches;

(b) Rock washers or mobile washing machines for stained sands;

(c) Mobile incinerators or rotary kilns developed in Canada for oiled sediments; and

(d) Separation of weathered oil particles from unoiled sediments by sieving.

The treatment technology assessment should be based on a matrix of candidate treatment techniques arrayed against oil residue types or substrate types. Additional options available for treating the recovered waste, such as recycling should also be considered (e.g. viscous oil-sediment residues for asphalt production).

7. The transportation expenses can be reduced. The remaining portion of the transportation budget should be used to perform chemical analysis of tarball and/or sediment samples. Such analyses can help better characterize shoreline pollution, determine the source of observed pollution, and provide information about the effectiveness of alternative remediation technologies.

Annex XV

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000383 (IRAN)
(paragraphs 199-204)

1. Samples should be collected from additional locations within the Shadegan Wetland. Given the vast size of the wetland, the proposed 50 sampling locations would provide a very limited basis for extrapolation. Sampling a variety of hydrologic habitats within the Shadegan Wetland might improve the project's ability to determine which hydrologic factors may be working to remove or bury the oil.
2. Consideration should be given to a variety of approaches to help discern the source of the oil pollution. The project indicates that nickel and vanadium ratios would be used to identify specific sources of the observed oil pollution. While this method can be used to discriminate between sources of oil, the project's ability to discriminate between oil sources may be enhanced by chemical fingerprinting analyses (e.g. gas chromatography/mass spectrometry analyses).
3. With respect to the identification and evaluation of potential remediation technologies, there is limited practical experience in remediating wetlands. Wetlands are sensitive habitats, and remediation is difficult and risky. Nevertheless, if oil pollution is found in the Shadegan Wetland, it would be appropriate to investigate the use of remediation technologies. However, the project should focus on investigating non-intrusive or biological processes for remediation.
4. Researchers working on this project should co-ordinate closely and share data and data collection efforts with those working on the Shadegan Wetland plant communities project (claim No. 5000344). At a minimum, co-ordination of soil sampling will improve the robustness of the proposed root-zone study. Sampling areas and information collected should be co-ordinated to maximize coverage within the Shadegan Wetland.
5. The reallocation of 10 to 15 per cent of the labour budget to fund the additional chemical analyses would improve the project's ability to meet the objectives. In addition, it may be possible to use one or two "Masters level" soil scientists, instead of one or two of the three "Ph.D. level" soil scientists proposed for the project.

Annex XVI

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000427 (IRAN)
(paragraphs 243-251)

1. To isolate growth-related trends from the natural variability in plant specific growth rates, the sample size should be expanded to approximately 30 to 40 samples per species per plot. The sample sizes proposed (i.e., four trees of each target species from each of 40 sample plots) are very small given the natural variation among different plants of the same species, and may not provide sufficient data to perform a robust statistical analysis. As a result, the amount of labour required for enzymatic analysis will need to be increased, perhaps by as much as a factor of two.
2. The project team should include an expert in dendrochronology when assessing the growth of forest trees. Such an individual should be well-versed in techniques inclusive of proper increment core collection and preparation and cross dating of increment cores. The award as recommended includes provision of a dendrochronograph, which is necessary for a temporal analysis of tree ring growth and scaling up to tree and stand growth determinations.
3. The proposed DNA analysis should be eliminated. A sample size of four individuals is far too small to determine whether any genetic differences among the individuals constitute mutational events or merely represent natural variation. In addition, single events (even if cataclysmic) seldom cause genetic losses in mixed forests – and even assuming that such a genetic loss had occurred, the affected individuals would likely have been so adversely affected that they would not be present today. As a result the amount of labour required can be reduced. This reduction is offset by the increase in the amount of labour for enzymatic analysis.
4. A number of other projects proposed by Iran involve work in soil chemistry and biology. To the extent possible, researchers should attempt to co-ordinate data collection and analysis among the various projects examining soil in affected and unaffected regions.
5. The project "Determining Natural Revegetation Potential of Affected Mangrove Forests of Iran Consequent to the Persian Gulf War" (claim No. 5000347) may offer particularly relevant opportunities for co-ordination in data collection and analysis. While the two projects generally focus on evaluating different types of damage to mangroves, co-ordination and integration would improve the robustness of conclusions regarding impacts on mangroves.

Annex XVII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000428 (IRAN)
(paragraphs 252-260)

Additional steps are needed to correlate pollution from the oil fires with adverse health effects on livestock.

1. The data collection in the first project phase should be expanded to include a control group from provinces not affected by pollution from the oil fires in Kuwait.
2. Similarly, additional historical data from the eight affected provinces should be sought to set appropriate baseline levels.
3. Any sampling for bioaccumulation should focus on animals from age groups older than ten years, and on organic pollutants found in crude oil and combustion products such as dioxins and polycyclic aromatic hydrocarbons.

Annex XVIII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000374 (KUWAIT)
(paragraphs 385-389)

1. A thorough characterization of pollutant source areas and pathways should be conducted prior to finalizing the treatment system. This should be followed by pollutant fate and transport modelling.
2. Information from unaffected control areas, or pre-invasion groundwater quality data, should be used as an aid in attempting to quantify any incremental degradation caused by Iraq's invasion and occupation of Kuwait.
3. Monitoring should include an evaluation of casing leaks from oil wells. Oil well logging would locate leaks and permit a more efficient design of a monitoring programme for the aquifers. The monitoring should take into account the monitoring of oil well casings undertaken in connection with claim No. 5000376.
4. Polyvinyl chloride ("PVC") piping should be substituted for stainless steel piping in the installation of wells. The use of PVC piping is more cost-effective than stainless steel. Further, the use of stainless steel in the monitoring wells could affect the integrity of samples recovered for heavy metal analysis (e.g. vanadium and nickel).

Annex XIX

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000376 (KUWAIT)
(paragraphs 396-401)

1. The programme proposes to recover soil samples from the deeper wells beneath the water table. However, because many of the hydrocarbon contaminants are probably situated at or near the zone of water table fluctuation, samples recovered from the saturated zone should not be analysed.
2. Well casing studies should be considered in addition to monitoring well studies. Individual oil well logging to detect casing failures is cost-effective and feasible in the course of oil production. It is common practice in oil fields to shut down wells for short periods of time to allow for inspections. Well logging could take place as part of this routine procedure. When performed in the vicinity of aquifers used for water supply, selected oil well logging is likely to yield immediate information about the integrity of the well casings which could provide enough information to conduct a scoping level investigation.
3. The programme proposes to install shallow depth wells next to deeper wells. Having a deep and a shallow well at the same location is a reasonable approach; however, it is not necessary to drill two separate wells as proposed. Instead, it is common practice to drill one well hole and to install two monitoring wells at the same location.
4. The level of soil and groundwater sampling and analysis should be reduced by 50 per cent, which would be sufficient to provide a geographic and temporal characterization of the potential area of impact.
5. It would be sufficient to conduct two sampling events per year instead of four, because of the general geology of the areas and the limited annual rainfall in Kuwait.

Annex XX

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000378 (KUWAIT)
(paragraphs 411-416)

1. It would be inappropriate to analyse subtidal sediment and water samples for volatile organic compounds ("VOCs"). Analysis of VOCs in these environmental media can be useful immediately after a spill; however, such analyses are unlikely to provide useful information ten years after the oil spill resulting from Iraq's invasion and occupation of Kuwait. By now VOCs resulting from the spills will have been stripped from water and from the seafloor by physical and biological processes.
2. It is appropriate to conduct fish bioassays to determine the effects of the oil spill on fish as on representative marine organisms. However, the number of proposed fish bioassays is excessive. Repeated annual analyses are unnecessary to account for impacts on different life stages of the target species. It would be appropriate to conduct this analysis twice in the first year of the project, as proposed, but not in subsequent years.
3. It is unnecessary to conduct fish VOC bioassays, as it is unlikely that fish are still being exposed to VOCs from the oil spill that occurred in 1991.
4. The current meter placement and retrieval cruises, including both vessel rental costs and the associated labour effort, should be eliminated. While it is reasonable to have current records that coincide with the other proposed sampling events, the sampling cruises should afford sufficient vessel time and manpower to deploy and retrieve the current meters at the proposed locations without requiring separate cruises for this purpose. However, the weekly current meter data retrieval effort is separate from the cruise, as proposed, and should be maintained as proposed.

Annex XXI

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000397 (KUWAIT)
(paragraphs 417-425)

1. The number and type of chemical analyses proposed should be reduced substantially. All samples should be analysed for total petroleum hydrocarbon, to permit the identification of areas of high, moderate and low contamination. However, a full set of chemical and physical analyses should be conducted only where there are questions about the source of contamination or where detailed knowledge of the nature and amount of the chemical constituents in the sediment might influence remediation approaches. Detailed chemical/physical analysis of 20 per cent of collected samples should thus be sufficient to meet study objectives.
2. The level of proposed labour (1,490 person-months for 3,456 transects) should be reduced accordingly. A three-person field team could collect 27 samples per day and perform the proposed qualitative biological inventory. This would only require a total of 189 person-months of effort and involve seven field teams, assuming a study of nine months duration. Each field team should be composed of one professional, two technicians and one researcher. The administration component should be reduced from 33.5 person-months to 18 person-months.
3. The biological assessment of shoreline habitat is an appropriate component of the project. This evaluation would provide qualitative information on habitat quality and species abundance and diversity that may be useful in conjunction with the results of the contamination analyses. However, experience from scientific surveys conducted by the Mt. Mitchell and other cruises indicates that no additional field time is necessary specifically to complete this task.
4. The survey mobilization component of the proposal would require 30 person-months for completion, rather than the approximately 101 person-months proposed. The 30 person-months should include one month per researcher for survey team planning (seven researcher months), two months per professional for technical preparation for the survey (14 professional months), one half month per technician for field training (seven technician months) and two months of administrative support.
5. The field transport component should be reduced to 14 vehicles (two per survey team) for nine months rather than the proposed 68 vehicles for eight months.
6. The number of Global Positioning System units should be reduced from 102 eight-channel units and four 12-channel units to fourteen 12-channel

units (two per field team). The number of rigid frame backpacks should be reduced from 102 to 32 (two per field person plus contingencies). The number of cellular phones should be reduced from 80 to 16 (two per field team and two at research headquarters).

Annex XXII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000398 (KUWAIT)
(paragraphs 426-433)

1. There is an extensive body of published literature on shoreline clean-ups that should be exhaustively reviewed before conducting any laboratory or field tests. Upon review of the literature and using the results of the oiled shoreline survey (claim No. 5000397), a small number of candidate technologies could be identified for each type of contaminated substrate.
2. Remediation goals should be more explicitly defined. Among other considerations, treatment technologies should be evaluated for their ability to remove sufficient contamination to meet clean-up targets. To the extent the pre-invasion baseline can be identified, this is one potentially useful clean-up target. Remediation goals can also be based on residual risks to ecological or human receptors, or on planned future uses of the injured resource. Multiple targets are often appropriate to reflect site-specific circumstances. Evaluating technology performance relative to multiple remediation standards would maximize the amount of information available for the remediation decision-making process.
3. The risks of remediation should be carefully considered. Intrusive remediation techniques, especially those involving soil excavation, will cause additional disturbance to sensitive soils. In some areas, the nature of residual contamination may be such that remediation poses a greater environmental risk than natural recovery.
4. The technology review should begin with a scoping effort, during which the relevant data from the oiled shoreline survey (claim No. 5000397) are reviewed in order to ascertain the locations and characteristics of remaining contamination. Using this information, a set of oil residue categories should be defined (e.g. weathered asphaltic oil on coarse sand beach, buried liquid oil in soft marshland soils, etc.) and the volume of oil and sediment in each category estimated. For most oil spills, the oiled shoreline can be described in four or five categories. However, because of the unprecedented scale of pollution caused by Iraq's invasion and occupation of Kuwait, ten distinct categories may be necessary.
5. The scientific literature should be reviewed to identify candidate treatment techniques for each oil residue category. Shoreline cleaning, oil residue treatment, and waste disposal have been studied extensively over the past several decades; a wealth of knowledge exists in the oil spill response community. The outcome of this review should be a matrix of candidate treatment technologies and the categories of oil residues

and substrate types, which could then form the basis of the technology assessment study design.

6. Recovery goals should be identified for each oil residue category, both in terms of effectiveness and efficiency. These goals will provide the yardstick for evaluating the success of alternative treatment technologies. The study design should include at least two technologies for each oil residue category, preferably one in situ and one ex situ.
7. Based on the results of the technology review, investigators should test selected technologies in the laboratory to better determine costs, feasibility, optimum operating parameters, etc. Total labour required for this Laboratory Bench Test phase is estimated at 24 person-months. This estimate provides for six trial tests of ten individual technologies, or 60 trials. Each trial will require two chemical analyses, one before the trial and one after. The total number of samples should be increased by ten per cent to account for analysis of replicate samples for quality control purposes.
8. Field testing should be performed only on technology/oil residue combinations that are reasonable candidates for remediation, given project feasibility, clean-up targets, costs, remediation risks and similar considerations. The Panel's cost estimate allows for tests of 1,000 cubic metres of contaminated materials for each technology/oil residue combination.

Annex XXIII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000432 (KUWAIT)
(paragraphs 451-464)

1. Although remote sensing is an appropriate and effective method for mapping the oil lake contamination, there is evidence that Kuwait has previously collected a considerable amount of remote sensing data on the oil lakes. Thus, it is likely that only one additional set of remote sensing data, including Landsat, SPOT-4, and microwave radar images is needed for the analysis. Additional remote sensing images should not be collected if the currently available data are sufficient for the task of mapping the current extent of the oil lakes.
2. "Ground-truthing" the results of the remote sensing evaluation is estimated to require 17 person-months. Assuming a five-person team, this corresponds to a rate of between three and four lakes surveyed per day. This should be sufficient to determine the area of the oil lakes, their boundaries, and the volume of contaminated soils to a reasonable degree of certainty and resolution.
3. The necessary data to estimate volumes of contaminated soil and risks to ecological receptors can be obtained with a reduced number of sample sites. A tiered sampling strategy should be considered, in which samples are initially collected at a relatively less intensive rate than that proposed. Subsequent sampling should focus on areas where the contamination exhibits the greatest spatial variability. Such a strategy would accomplish the objectives of the sampling task while minimizing costs.
4. The number and type of chemical analyses proposed should be reduced substantially, making use of the information gathered during the analysis of remote sensing data and field survey. Many lakes and pools will require only one or two sample locations to characterize the contamination, while others may require as many as ten. Assuming that one third of the lakes requires one sample, one third requires five samples and one third requires ten samples, approximately 1,300 sample locations for the 246 lakes would be required. Based on rates achieved during previous investigations of the oil lakes, two 5-person teams working for four months should be sufficient to collect this number of samples.
5. A full suite of analyses should be performed on only 25 per cent of the soil samples collected, with the remaining 75 per cent analysed for a proxy analyte such as total petroleum hydrocarbon ("TPH"). By performing TPH analysis on all samples, areas of high, moderate and low

contamination could be identified. Analysis of a full suite of parameters should be reserved for a much smaller subset of samples, where there are real questions about the source of identified contamination and/or where risk assessments or remediation decisions might be influenced by detailed knowledge of specific chemical concentrations in the soil.

6. Of the approximately 3,900 samples, one-third should be surface oil samples, while the remaining two-thirds should be soil samples (as originally proposed by Kuwait). Only 25 percent of surface oil samples require a full analysis of metal and petroleum qualities, while a TPH analysis is appropriate on the remaining 75 per cent of the samples. Every lake should receive at least one full analysis; the largest third of the lakes should receive two full analyses.
7. Kuwait has already developed a Geographic Information System ("GIS") for management of satellite imagery and mapping of the oil lakes; thus only the incremental costs of incorporating the additional information gathered by the studies in this claim into the existing system should be funded. Two professionals working full-time during the survey phase of the project and quarter-time during the two years of the technology assessment studies should be sufficient for both the oil lakes survey and the survey work carried out under Kuwait's other terrestrial monitoring and assessment claims. This labour effort can be divided evenly between this project and the tarcrete project (claim No. 5000434).
8. The scale of the treatment technology assessment is excessive. There is an extensive body of published literature on oil spill clean-up that should be exhaustively reviewed before conducting any laboratory or field tests. Upon review of the literature, and using the results of the monitoring programme, a small number of candidate technologies for each type of contaminated soil can be identified.
9. Much of the information generated during the treatment technology assessment for Kuwait's oiled shoreline (claim No. 5000398), will be directly applicable to the remediation of the oil lakes. Many of the oil residue and soil types present in the oil lakes and on the shoreline will be similar. Therefore, these two projects should be co-ordinated in order to avoid duplication of effort. Nevertheless, because additional types of soil and oil contamination probably exist in the upland desert environment of the oil lakes, additional work would probably be needed in all phases of the treatment technology assessment, from literature review and technology screening to full-scale field demonstrations. Conducting four additional full-scale field demonstrations, each processing 1,000 cubic metres of contaminated materials, should be sufficient for this purpose. These field demonstrations would require approximately 220 chemical analyses. This represents analysis of one sample for every 20

cubic metres of treated sediments, based on a total of 4,000 cubic metres of treated sediments, plus ten per cent for quality control.

10. For laboratory-scale testing, a limited number of trials (i.e., eight trials each of three treatment technologies) should be sufficient to support the selection and design of technologies for the field tests. Each trial would require two chemical analyses, one before the trial and one after.
11. Remediation goals should be more explicitly defined. Among other considerations, treatment technologies should be evaluated for their ability to remove sufficient contamination to meet clean-up targets. Although treating to achieve pre-invasion conditions is one potential goal, this may not be possible or necessary.
12. It is important to recognize that there was surface contamination in the oil field areas prior to Iraq's invasion and occupation of Kuwait. Thus, accurate baseline data would be necessary to characterize pre-invasion conditions. As an alternative, remediation goals could be chosen based on residual risks to ecological or human receptors, or on the planned future uses of the areas. Evaluating technology performance relative to multiple remediation standards would maximize the amount of information available for the remediation decision-making process.
13. The risks of remediation should be carefully considered. Intrusive remediation techniques, especially those involving soil excavation, will cause additional disturbance to sensitive desert soils. In most oil lake areas, the degree of contamination will probably make soil excavation unavoidable. However, in less contaminated areas, excavation may pose a greater environmental risk than natural recovery.
14. Overall, Kuwait should be able to complete the analysis, modified as described above, with a labour effort of approximately 370 person-months. This reflects 48 person-months for remote sensing and ground-truthing; 84 person-months for monitoring and chemical analysis; 18 person-months for GIS data management; 34 person-months for ecological risk assessment; and 186 person-months for the treatment technology assessment.

Annex XXIV

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000434 (KUWAIT)
(paragraphs 472-488)

1. Remote sensing is an appropriate and effective method for mapping tarcrete pollution over a large area. However, the collection of additional remote sensing images is unlikely to be needed for this project. In past studies, Kuwait has collected a considerable body of remote sensing data covering the affected areas; in addition, this project could make use of new images collected for other projects such as the oil lakes monitoring and assessment project. These images should be sufficient for the task of mapping the current extent of tarcrete pollution.
2. Because the tarcrete layer is distributed over a very large area, a tiered sampling strategy should be considered, in which samples are initially collected at a relatively less intensive rate. Subsequent sampling should focus on areas where the pollution exhibits the greatest spatial variability. Such a strategy would accomplish the objective of characterizing the physical and chemical characteristics of the tarcrete layer and risks to ecological receptors while minimizing costs.
3. The likely homogeneity of the tarcrete over large areas reduces the need for extensive sampling. Given the size of the contaminated area, approximately 500 locations should be sampled, with two samples collected at each.
4. A targeted approach to the design of the chemical sampling and analysis programme would provide a cost-effective strategy for accomplishing the environmental testing requirements of the proposed study. A full suite of analyses should be performed on only 20 per cent of the soil samples collected, with the remaining 80 percent of samples analysed for a proxy analyte such as total petroleum hydrocarbon ("TPH"). By performing TPH analysis on all samples, areas of high, moderate and low contamination could be identified. Analysis for all of the parameters listed in the Monitoring and Assessment Report filed as part of the claim should be reserved for a much smaller subset of samples, where there are real questions about the source of identified contamination and/or where risk assessments or remediation decisions might be influenced by detailed knowledge of specific chemical concentrations in the soil.
5. It is not necessary to conduct a technology assessment on the scale proposed because the technology assessments for the oiled shoreline and oil lakes will generate information relevant to tarcrete remediation. Conducting a full-scale treatment technology assessment for tarcrete is

likely to duplicate at least some of the work of those studies. A more limited evaluation of remediation technologies should be performed, taking into consideration the results of the "oiled shoreline" and oil lakes assessments (claim Nos. 5000398 and 5000432). Revegetation studies should be a major component of this effort.

6. Much of the information generated during the treatment technology assessment for Kuwait's "oiled shoreline" (claim No. 5000398) will be directly applicable to the remediation of the oil lakes. Many of the oil residue and soil types present in the oil lakes and on the shoreline will be similar. Therefore, these two projects should be co-ordinated in order to avoid duplication of effort. Nevertheless, because additional combinations of substrate and oil contamination likely exist in the tarcrete areas, additional work would be needed in all phases of the treatment technology assessment, from literature review and technology screening to full-scale field demonstrations. For this reason, two additional full-scale field demonstrations and a revegetation study are recommended.
7. For laboratory-scale testing, a limited number of trials (e.g. six trials each of three treatment technologies) should be sufficient to support the selection and design of technologies for the field tests. Each trial would require two chemical analyses, one before the trial and one after.
8. Remediation goals should be more explicitly defined. Among other considerations, treatment technologies should be evaluated for their ability to remove sufficient contamination to meet clean-up targets. Although treating to achieve pre-invasion conditions is one potential goal, this may not be possible or necessary.
9. It is important to recognize that there was surface contamination in the oil field areas prior to Iraq's invasion and occupation of Kuwait. Thus, accurate baseline data will be necessary to characterize pre-invasion conditions. As an alternative, remediation goals could be based on residual risks to ecological or human receptors, or on the planned future uses of the areas. Evaluating technology performance relative to multiple remediation standards would maximize the amount of information available for the remediation decision-making process.
10. The risks of remediation should be carefully considered. Intrusive remediation techniques, especially those involving soil excavation, will cause additional disturbance to sensitive desert soils. In some areas of tarcrete, the degree of contamination will likely make soil excavation unavoidable. However, in less contaminated areas, excavation may pose a greater environmental risk than natural recovery.
11. It should be possible to complete the study, modified as described above, with approximately 491.5 person-months of labour effort. This reflects

42 person-months for remote sensing and ground-truthing; 38.5 person-months for monitoring, sampling, and chemical analysis; 18 person-months for Geographic Information System data management; 22 person-months for ecological risk assessment; and 371 person-months for the treatment technology assessment.

Annex XXV

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000406 (KUWAIT)
(paragraphs 523-528)

1. It is not necessary to examine each subject every two years. The usefulness of the information developed would not be diminished if subjects were examined once every four years.
2. Consistency of clinical measurements across clinical locations will be critical if useful public health data are to be generated. Such consistency is difficult to achieve for key activities such as pulmonary function tests. Steps should be taken to ensure that consistency and quality control are a significant focus of the clinical monitoring programme.
3. Chest X-rays are not needed every four years (i.e., every second visit). Chest X-rays carry some incremental risk to subjects due to the radiation involved. The diagnostic value of relatively frequent X-rays does not outweigh this risk. Chest X-rays should therefore be taken less frequently than every four years as proposed.
4. Given that one of the stated objectives of the programme is to support the ongoing work of the Al-Riga Centre in Kuwait City on post-traumatic stress disorders ("PTSD") related to Iraq's invasion and occupation of Kuwait, adequate resources from the programme should be allocated to clinical monitoring of psychological and mental health effects, including PTSD. These can be identified relatively easily by a number of screening questionnaires that have been developed and used across different cultural settings.

Annex XXVI

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000361 (SAUDI ARABIA)
(paragraphs 561-568)

1. A statistically valid number of unpolluted (control) sites should be used to eliminate potential confounding factors (e.g. elevated water temperatures, other oil spills) that may have affected the reefs, and to identify impacts on the coral reefs that may have resulted from Iraq's invasion and occupation of Kuwait. Review of studies published after 1991, which indicate that certain Saudi Arabian reefs suffered virtually no damage from invasion-related pollution, would facilitate the selection of reference sites for the proposed coral reef surveys.
2. Data collected with pneumatic coring devices should be correlated with data on other parameters in order to identify and assess the importance of possible confounding factors. These other factors, which also tend to bleach coral, may include elevated water temperatures, sewage, variable weather patterns, and other oil spills.
3. Chemical fingerprinting of coral samples should be done using polynuclear aromatic hydrocarbon and n-alkane analysis. In conjunction with effects analyses, these chemical analyses may provide evidence of whether the invasion-related oil spill reached the coral reefs. Reference should be made to studies previously carried out in the Persian Gulf for additional details of appropriate technologies and analytical protocols for isolating this type of effect.
4. The number of transects should be reduced from 1,000 to a total of 600 over five years, which can provide adequate data to evaluate coral reef impacts. The number of coral core samples should be reduced by 40 per cent, because taking additional samples is unlikely to significantly increase the value of the information to be obtained and because the coring technique itself has the potential to excessively damage the corals during the sampling process. Due to the reduction in the number of transects, the total amount of labour envisaged for certain personnel on the project (coral reef specialist, coral reef geologist, phycologist, ichthyologist, Geographic Information System/Global Positioning System field technician, marine technician/boat operator, and divers) can be reduced by about one third.

References:

J.W., Readman, J.W., and others, "Discrete bands of petroleum hydrocarbons and molecular organic markers identified within massive coral skeletons", Marine Pollution Bulletin, vol. 32, No. 5, pp. 437-443 (1996).

N. Downing, and C. Roberts, "Has the Gulf War affected coral reefs of the northwestern Gulf", Marine Pollution Bulletin, vol. 27, pp. 149-156 (1993).

C.M. Roberts, N. Downing, and A.R.G. Price, "Oil on troubled waters: impacts of the Gulf War on coral reefs", Global Aspects of Coral Reefs: Health, Hazards and History, Conference proceedings, pp. 132-136 (Miami, Rosenstiel School of Marine and Atmospheric Sciences, 7-11 June, 1993).

Annex XXVII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000363 (SAUDI ARABIA)
(paragraphs 574-579)

1. The sampling analysis should be reduced by analysing 1,750 samples from each of the two initial cruises and 500 samples from each of the eight subsequent cruises. This would allow later analysis to be focused on species or geographic areas of concern that would be identified from analysis of initial sampling data.
2. Methods to isolate impacts related to Iraq's invasion and occupation of Kuwait should include the following: First, in at least one study, an increased concentration of pollutants along a gradient towards the known source of the oil spill resulting from Iraq's invasion and occupation of Kuwait has been clearly demonstrated (J. W. Readman and others, "Oil and combustion product contamination of the Gulf marine environment following the war", Nature, vol. 358, pp. 662-665 (1992)). The occurrence of the same trend, and a corresponding increase in impacts on biological communities a decade after Iraq's invasion and occupation of Kuwait would be at least indicative of persistence of invasion-related effects. Second, to the degree possible, background levels of oil in the Persian Gulf, which are known to be high, should be subtracted from total oil levels to obtain an approximation of oil levels originating from Iraq's invasion and occupation of Kuwait. Also if possible, information on background petroleum hydrocarbon levels for the sites to be assessed should be compiled for pre-invasion and post-invasion periods. Projections could then be made to obtain estimates of current background levels of petroleum hydrocarbons.
3. Inclusion of fishing grounds commonly used by commercial fishermen should be considered during sampling site selection, as this would enhance the usefulness of the data for evaluating risks from seafood consumption.

Annex XXVIII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000409 (SAUDI ARABIA)
(paragraphs 592-599)

1. The results of the visual shoreline survey referred to in claim No. 5000359 should be used to guide the distribution of transects and chemical analyses. The SCAT (Shoreline Clean-up Assessment Team) method, developed by the Governments of Canada and the United States, uses standard terms and techniques to assess the oil along the entire shoreline, rather than in limited transects. The results of this type of survey can support the creation of computer-generated maps showing the extent of pollution of the shoreline.
2. Control sites unaffected by pollution related to Iraq's invasion and occupation of Kuwait, such as areas south of Abu Ali, should be used to address the question of confounding sources of pollution.
3. A tiered sampling programme should be implemented. Total petroleum hydrocarbon analyses should be performed on all samples, to identify areas of high, moderate and low contamination. More complete chemical and physical analysis should be reserved for a few samples, where there is uncertainty about the source of contamination or where remediation decisions would be influenced by knowledge of constituent concentrations and their relative proportions in the sediment.
4. Field teams should be able to collect at least 27 samples per day, on average. Therefore, 12 three-person teams should be sufficient to collect the modified number of sediment samples, rather than the 23 teams proposed by the Claimant. The total work time for the field biologist and the technician, and related administrative support, can be reduced by half.

Annex XXIX

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000411 (SAUDI ARABIA)
(paragraphs 606-619)

1. The scale of the project should be reduced by selecting a small number of candidate technologies for testing on relevant combinations of oil residue and substrate identified in the oiled shoreline survey (claim No. 5000409). It will not be necessary to conduct a large-scale technology assessment in order to determine the most cost-effective remediation techniques for the "oiled shoreline". An extensive body of published literature exists on shoreline clean-up that should be exhaustively reviewed before conducting any laboratory or field tests. Having reviewed the literature, and using the results of the oiled shoreline survey, a small number of treatment technologies can be identified.
2. Evaluating technology performance relative to multiple remediation standards would maximize the amount of information available for the decision-making process.

Annex XXX

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000441 (SAUDI ARABIA)
(paragraphs 656-661)

1. Fifteen hundred plant tissue samples should be analysed in addition to the proposed analysis of 1,500 soil samples. Two indicator species of plants should be sampled at each of 750 sampling locations.
2. Plant and soil samples should be taken from the same locations to enhance comparability. Soil should be sampled at two depths.
3. Total petroleum-related hydrocarbon analyses should be performed on all soil and plant tissue samples to identify areas of high, moderate, and low contamination. Analysis for all of the parameters proposed could be reserved for a much smaller subset of samples, where there are real questions about the source of identified pollution or where risk assessment or remediation approaches might be influenced by detailed knowledge of chemical constituents and their relative proportions in the environment. For planning purposes, budgeting for detailed chemical/physical analysis of 300 samples each of soil and plant tissue is sufficient to meet study objectives.
4. One hundred groundwater samples should be collected for analysis, unless groundwater monitoring wells are already present in the affected area or it is confirmed that there are no likely exposure pathways. The full suite of proposed analyses on groundwater samples should be conducted due to the limited number of groundwater samples collected.
5. If any pre-invasion sampling data are available, such data should be used to establish an appropriate baseline against which currently observed conditions could be compared.
6. Staff time can be reduced substantially. The positions of deputy project manager, data management specialist, field biologist and technician are not necessary and can be eliminated. It should be sufficient to provide a half-time project manager for the duration of the study. The labour effort for the risk assessment specialist should be split between an arid lands ecologist/soil scientist and a plant physiologist/toxicologist. Each of these individuals is estimated to need a month of mobilization time, 25 per cent effort for the four-month field survey, four person-months of data analysis effort, and 100 per cent effort for two person-months of report writing. Three person-months each (two for data analysis and one for report writing) for an environmental chemist and a Geographic Information System ("GIS") specialist will allow for analysis of groundwater data and integration of study results with a centralized

GIS database. Six additional person-months of effort for the GIS specialist will allow for a remote sensing specialist to analyse remote sensing imagery in order to assess baseline conditions in the study area. Five person-months should be included for a Geographic Information System/Global Positioning System field technician, including mobilization and field survey time. The labour estimate also includes 26 person-months of effort for researchers, including one person-month of mobilization, four person-months of field survey effort, and eight person-months of data analysis for each of two individuals at 100 per cent effort. Three person-months of editor/report production continue for the entire project.

Annex XXXI

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000414 (SAUDI ARABIA)
(paragraphs 677-683)

1. The exposure registry, as proposed, would include only a small percentage of the persons who might have been exposed to the environmental and other health risks. A much larger number of households should be surveyed for inclusion in the exposure registry. In addition, an attempt should be made to refine the estimate of the number and locations of households that might have been affected. This could be done by the use of either ground-level air quality monitoring data or estimates of ground ambient concentrations.
2. Estimation of population exposures before, during, and immediately after Iraq's invasion and occupation of Kuwait will require estimates of outdoor air pollution concentrations in each household surveyed during the relevant periods. Analysis and interpolation of historic air quality monitoring data should be used to estimate pollution concentrations. To the extent that such data are incomplete or unavailable, air quality modelling or review of satellite images or other data should be used. Care should be taken in the analysis of satellite images, as the smoke plume often remained well above ground level.
3. A two-tier strategy should be employed for conducting the national survey. In the first tier, the population of specific areas of Saudi Arabia should be sampled more or less intensively depending on the number of days of ground level pollution exposure. Areas that experienced higher levels of pollution should be sampled more intensively than areas with lower pollution levels. All individuals with potential exposure greater than or equal to 50 days should be included in the national survey. (See table below for estimates of the number of people exposed to different numbers of days with smoke overhead). Areas with 25 to 50 days of smoke coverage should be sampled on a 25 per cent basis, that is one out of four households should be selected to participate in the initial national survey. Areas with less than 25 days of smoke coverage should be sampled on a ten per cent basis, that is one out of every ten households should be selected to participate in the initial national survey. As shown below, this calculation results in a total of 398,323 households to participate in the initial national survey.

<u>Number of days with smoke overhead</u>	<u>Number of people</u>	<u>Number of households</u>	<u>Proportion sampled</u>	<u>Number of households sampled</u>
> 100 days	1,251,391	171,423	100%	171,423
50 - 100 days	808,957	110,816	100%	110,816
25 - 50 days	3,055,403	418,548	25%	104,637
10 - 25 days	144,787	19,834	10%	1,983
< 10 days	690,835	94,635	10%	9,464
<u>Total</u>	5,951,373	815,256		398,323

4. In the second tier, a hierarchical interview strategy should be used, where each sampled household completes a simple screening questionnaire and only a subset of homes are asked to complete a more extensive questionnaire. Homes selected for detailed questions should be those with persons who were in exposed locations during the period of the oil fires.
5. Follow-up interviews should be conducted to ensure that exposures continue to be tracked over time and that health outcomes can be re-evaluated at intervals. This may be done as part of the proposed activities in claim No. 5000416 and claim No. 5000417.
6. Experts in clinical medicine, epidemiology, biostatistics, medical records systems, and survey research should be included.

Annex XXXII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000417 (SAUDI ARABIA)
(paragraphs 694-701)

1. The proposed sample size is derived in part from a desire to detect a disease with a mortality rate of one per 10,000. A disease such as chronic obstructive pulmonary disease, which has a mortality rate of two per 10,000, should be used instead. Therefore, the sample size should be reduced from 34,880 to 17,006 subjects.
2. The frequency of clinical examinations should be reduced from every two years to every four years.
3. The diagnostic value of relatively frequent chest X-rays should be evaluated, taking into account the incremental risk to subjects due to the radiation involved and the possibility that the risk may outweigh the diagnostic value.
4. Consistency of clinical measurements across clinical locations is critical to generate useful public health data. Therefore, consistency and quality control should be a significant focus of the clinical monitoring programme, particularly for key activities such as pulmonary function tests.
5. Screening questionnaires that have been developed and used across different cultural settings should be used to identify psychological and mental health effects of Iraq's invasion and occupation of Kuwait.
6. More experts in clinical medicine, epidemiology and bio-statistics should be included.

Annex XXXIII

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000418 (SAUDI ARABIA)
(paragraphs 702-706)

1. The survey instruments should be field tested to evaluate their effectiveness and to enable necessary refinements to be made to both the instruments and the proposed field survey procedures. One or more pre-tests should be performed, and this may require an extension of the duration of the study from 18 months to 24 or 36 months.
2. A formal statistical analysis should be conducted to refine the sample size. In choosing sample size, note should be taken of the fact that a substantial portion of the household samples may comprise children under age 11, who should not form part of the pre-invasion/post-invasion analysis.
3. The external control approach would require data for a comparable population using the same or similar type of survey instrument as that proposed in the project. The comparison population should be selected from within Saudi Arabia itself, specifically from areas of the country that were less affected, or unaffected, by Iraq's invasion and occupation of Kuwait. Post-invasion disease rates in this population should be compared with post-invasion disease rates in the exposed Saudi populations. Increased disease rates in the exposed population in comparison with the unaffected population could, in properly controlled statistical analyses, be attributed with reasonable confidence to the effects of Iraq's invasion and occupation of Kuwait.

Annex XXXIV

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000371 (SYRIA)
(paragraphs 737-741)

1. The project should be refocused as a screening-level assessment of damage in the areas where cultural artefacts are suspected to have been most directly affected by the oil fires in Kuwait. This assessment would use approximately 130 person-months of effort.
2. The assessment should focus on one or two areas that are identified as most likely to have been exposed to pollution from the fires, and on a single outdoor material, such as limestone or marble, that is sensitive to pollution.
3. Analyses should be conducted to determine the feasibility of using before-and-after comparison studies and fingerprinting studies to determine whether there is evidence suggesting that pollution from the oil fires caused damage to outdoor artefacts.

Annex XXXV

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000372 (SYRIA)
(paragraphs 742-747)

1. The project should be refocused as a screening-level assessment that could provide information for making an initial judgement on the possibility of groundwater pollution. This assessment would use approximately 100 person-months of effort.
2. Available scientific literature on air quality should be reviewed to identify potential areas of impact in Syria, and to locate studies or data that identify pollution from the oil fires in Kuwait, based on the presence of key marker pollutants.
3. A map should be constructed in order to show, first, land areas that are identified in the scientific literature on air quality as likely to have been affected by the oil fires and, second, aquifer characteristics that determine vulnerability to surface contamination, such as depth to the water table, soil type and thickness, and covering vegetation.
4. The map should be used to identify areas with a high probability of impact from the oil fires. "Control" locations that are outside this area should be identified. Control locations should have similar aquifer and other characteristics. Groundwater measurements should be used in these control areas, in combination with available pre-1991 groundwater data, if any. This would provide insights into possible incremental impacts resulting from the oil fires.
5. A sampling programme, using soil samples and groundwater samples from existing wells within the areas identified as high risk and within the control areas, should be conducted. These samples should be analysed for pollutants that could have resulted from the oil fires in Kuwait, including hydrocarbons and key markers, in order to determine whether pollution from the oil fires in Kuwait affected groundwater in Syria.

Annex XXXVI

SUGGESTED MODIFICATIONS TO CLAIM NO. 5000419 (SYRIA)
(paragraphs 762-768)

1. The project should be refocused as a screening-level assessment that would make it possible to detect, in time and at least cost, any increases in adverse health effects that could be linked to the oil fires in Kuwait. This assessment would use approximately 260 person-months of effort.
2. The project should focus on two or three areas of the country where exposure to air pollutants from the oil fires is known to have been severe, with two or three similar but less exposed areas to serve as control locations. Within these areas, data could be developed from a random sample of health centres (perhaps 10 to 20) and from hospitals. Data should be collected for the health effects that are most likely to have been caused by air pollutants, that have relatively short latency periods, and that are relatively easy to classify. This would help to minimize the effects that differences in record keeping at the various health centres could have on the results of the screening.
3. If adequate data on rates of respiratory and other related diseases are developed, an analysis should be undertaken to determine whether any significant increase in disease rates identified resulted from the oil fires and whether differences exist between the findings in the affected areas and those in unaffected control areas.
