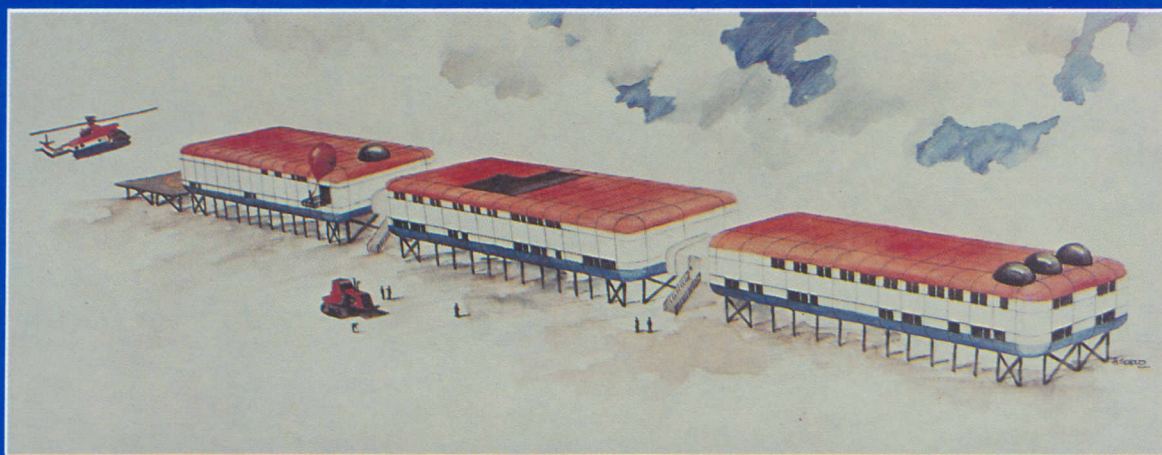


SANAE IV

FINAL REPORT: COMMENTS AND RESPONSES ON THE DRAFT COMPREHENSIVE ENVIRONMENTAL EVALUATION (CEE) of the proposed new SANAE IV facility at Vesleskarvet, Queen Maud Land, Antarctica



OCTOBER 1993

DEPARTMENT OF ENVIRONMENT AFFAIRS
PRIVATE BAG X447 • PRETORIA • 0001
REPUBLIC OF SOUTH AFRICA

FINAL REPORT:
COMMENTS AND RESPONSES on the
DRAFT COMPREHENSIVE ENVIRONMENTAL EVALUATION (CEE)
of the proposed new SANAE IV facility at Vesleskarvet, Queen Maud Land,
Antarctica

COMPILED BY:

P Claassen

PA Sharp

JC Agenbach

REVIEWED BY:

WDM Fourie

DJ van Schalkwyk

OCTOBER 1993

Department of Environment Affairs
Private Bag X447
PRETORIA
0001

REPUBLIC OF SOUTH AFRICA

ISBN 0-621-15909-3

TABLE OF CONTENTS

TABLE OF CONTENTS	i
INTRODUCTION	v

CHAPTER 1 COMMENTS AND RESPONSES

1.1	Dr JR Krynauw, University of Natal, SOUTH AFRICA	1-1
1.2	Dr C Frick, Geological Survey, SOUTH AFRICA	1-4
1.3	Major J Kriegler, 22 Squadron, SAAF, SOUTH AFRICA	1-4
1.4	Dr CA Rinaldi, Instituto Antartico Argentino, ARGENTINA	1-4
1.5	Dr R Moncur, Australian Antarctic Division, AUSTRALIA	1-6
1.6	Dr DWH Walton, GOSEAC, SCAR	1-17
1.7	The Percy FitzPatrick Institute, UCT, SOUTH AFRICA	1-24

CHAPTER 2 PRELIMINARY ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT SYSTEM (EHSMS).

2.1	INTRODUCTION	2-1
2.2	MISSION STATEMENT	2-2

2.3	POLICY STATEMENT	2-2
-----	----------------------------	-----

CHAPTER 3
PRELIMINARY ENVIRONMENTAL, HEALTH AND SAFETY
MANAGEMENT PROGRAMME

3.1	MANAGEMENT OBJECTIVES AND TARGETS	3-1
	3.1.1 Permanent Environmental Impacts	3-1
	3.1.2 Cumulative Environmental Impacts	3-1
	3.1.3 Environmental Education	3-1
	3.1.4 Waste Management	3-2
	3.1.5 Programme Management	3-2
3.2	MANAGEMENT RESPONSIBILITIES	3-2
3.3	EHS MANAGEMENT STRUCTURE ON SITE	3-3
3.4	WASTE MANAGEMENT PLAN	3-4
	3.4.1 Waste Removal	3-4
	3.4.2 Waste Classification	3-4
	3.4.3 Facilities	3-4
	3.4.4 General Provisions	3-4
3.5	CONTINGENCY PLANS	3-4
3.6	EHS IMPACTS REGISTER	3-5
3.7	ANTARCTIC TREATY REQUIREMENTS REGISTER . . .	3-6
3.8	EHS AUDIT PLAN	3-6
	3.8.1 Audit Objectives	3-6
	3.8.2 Audit Criteria	3-7
	3.8.3 Pre-Audit Activities	3-8
	3.8.4 On-site Audit Activities	3-10
	3.8.5 Post-Audit Activities	3-10
	3.8.6 Performance Parameters	3-11
3.9	EHS MANAGEMENT REVIEW	3-12

CHAPTER 4 CODE OF CONDUCT

4.1	SHIP OFF-LOADING	4-1
4.1.1	Responsibility	4-1
4.1.2	EHS Incidents	4-1
4.2	AIR TRANSPORT PROCEDURES	4-1
4.2.1	Procedures	4-1
4.2.2	Flight Paths	4-1
4.3	VEHICLE & TRANSPORT PROCEDURES	4-1
4.3.1	From ship over bay ice to depot at top of ramp	4-1
4.3.2	Depot at ramp	4-1
4.4	BASE CONSTRUCTION ACTIVITIES	4-2
4.4.1	Construction material depot at Vesleskarvet ..	4-2
4.4.2	Waste Depot	4-2
4.4.3	Decommissioning of waste depot	4-2
4.4.4	Clearing	4-3
4.4.5	Dumping of cleared material	4-3
4.4.6	Footpath from the base to the scientific huts ..	4-3
4.4.7	Drilling	4-3
4.4.8	Welding/Cutting/Grinding	4-3
4.4.9	Packaging	4-3
4.4.10	Fuel handling and transport	4-4
4.4.11	Fuel storage	4-4
4.4.12	Refuelling of vehicles	4-4
4.4.13	Vehicular movement on site	4-4
4.5	GENERAL PROVISIONS	4-4
4.5.1	Pedestrian movement	4-4
4.5.2	Waste handling, storage and transport	4-4
4.5.3	Fresh water production	4-5
4.5.4	Conservation of fauna and flora	4-5

APPENDIX 1 TERMS OF REFERENCE: ASSESSMENT TEAM

INTRODUCTION.

This report represents the final section of the SANAE IV Comprehensive Environmental Evaluation (CEE) as required by Article 3 of Annex 1 to the Madrid Protocol under the Antarctic Treaty.

Certain elements of the SANAE (South African National Antarctic Expedition) operations and design elements relating to the new facility changed since the Draft CEE was published, and not all this data was available to the assessment team by the time the report was produced. Comments relating to the previous specifications still hold relevance, however, and have therefore been responded to. Each comment received has been answered individually.

Comments that were received after 15 October 1993 have not, for technical reasons, been included in this report. We do, however, take note thereof, and will endeavour to incorporate important issues in the further development of the Environmental, Health and Safety Management System (EHSMS).

The co-ordinators gratefully acknowledge those individuals and organisations who delivered comments in the short time available.

It has been decided to include the Preliminary EHSMS in this report. The Preliminary EHSMS contains a Mission Statement regarding the environment, Environmental, Health and Safety (EHS) Policy statement, Management Objectives and Targets for the construction phase, a code of conduct and an EHS Audit Plan. This is to give an indication of how the results of the Draft CEE are being applied.

CHAPTER 1

COMMENTS AND RESPONSES on the Draft CEE.

1. Dr JR Krynauw,
University of Natal, SOUTH AFRICA
2. Dr C Frick,
Geological Survey, SOUTH AFRICA
3. Major J Kriegler,
22 Squadron, SAAF, SOUTH AFRICA
4. Dr CA Rinaldi,
Instituto Antartico Argentino, ARGENTINA
5. Dr R Moncur,
Australian Antarctic Division, AUSTRALIA
6. Dr DWH Walton,
GOSEAC, SCAR
7. The Percy FitzPatrick Institute,
University of Cape Town, SOUTH AFRICA

CHAPTER 1

COMMENTS AND RESPONSES**1.1 Dr JR Krynauw
University of Natal****COMMENT 1.1:**

My first impression of the EIA is that SANAP is going to great lengths to ensure that SANAE IV will be as environmentally friendly as is possible for a research base of this nature in the Antarctic environment. This is laudable and something of which I hope we will be proud of once it has been completed and operating.

I have, however, one serious reservation. It is recommended that a well defined EHSMS be established and that the accountable officers of DEA and DPW should make up the first tier of the management structure. The second tier of the management structure should consist of participants in the various Antarctic research programmes, and the role of this second tier should only be advisory. The impression is created that DEA and DPW will manage the system and police themselves at the same time. For the EHSMS to have credibility, some of its members must include participants from the Antarctic research programmes and independent experts not involved in SANAP.

RESPONSE 1.1:

Why the DEA needs policing is not clear. The DEA funds all SANAP activities and is held responsible for any incidents which occur under SANAP. For this reason, DEA should have the final say as to how the limited funds and logistic services available are distributed. The aim is not to be autocratic, but to produce a well-defined line of authority and responsibility. All constructive advice and criticism from any level of the SANAP should be considered by the DEA, but the safety of personnel and the conservation of Antarctic systems will take precedence over programme needs if the choice has to be made. Similarly, the DPW has the responsibility to provide expensive facilities and maintenance, and must ensure therefore that their funds are spent fruitfully.

It should also be noted that one particular section (Antarctica and Islands Management) within the DEA is responsible for the general administration and management of the SANAP. This section falls under the Chief Directorate: Administration. Another section (Environmental Impact Management) under the Chief Directorate: Environmental Management is responsible for environmental matters.

The latter section is responsible for national policy on environmental impact assessment and related matters, and is therefore closely monitored by many public and private individuals and organisations.

COMMENT 1.2:

Return of solid waste (p4-3): It is stated that summer field teams will return their solid waste (including excrement) to the base. In the past solid waste has been returned as a matter of course (and principle). However, discussions with colleagues locally and in the SCAR Working Group on Geology have shown that returning excrement to base is highly impracticable. How is this to be achieved by a person travelling up to 1 000 km on a skidoo and sledge? This aspect should be reconsidered and practicalities ascertained before a commitment is made to remove excrement from the field as well.

RESPONSE 1.2:

While it is true certain of the programmes have returned their waste in the past, not all have, and no specific provision has been made for this action. The purpose of the EHSMS is to ensure that the Expedition as a whole returns its waste.

Regarding excrement, the new base will have a sewage processing plant which could also process field team sewage. If suitable procedures and equipment are introduced into the expedition equipment, tested with the co-operation of the various programme members and modified after each season, then we believe it could be possible. Programmes should not only conduct certain activities in environmentally responsible ways if it is convenient, and reject the idea before it has been tested. The ideal should be striven for.

COMMENT 1.3:

Lack of weather information: Have you been in contact with people who have overwintered in the Borga (Huldreslotet) and old Grunehogna bases during the late 1960's and 1970's? Surely they can provide some information. A good person to speak to will be Leon Wolmarans from the Geological Survey in Pretoria.

RESPONSE 1.3:

Unfortunately time constraints make further research for purposes of the report impossible. Your suggestion has been noted, however.

A weather station was in fact installed on the site during the 1991/1992 Assessment Team visit. It unfortunately proved inadequate.

The South African Weather Bureau has unfortunately ended its involvement in the SANAP, and no facilities were available to the assessment team. The assessment team member for climate also assured the project co-ordinator that no further data was necessary for the purpose of the assessment.

COMMENT 1.4:

There are still a number of typing and grammatical errors which should be addressed for the final report. Some of these include the following:

pvi The words "geophysics" and "geophysicist" are consistently misspelt as

"geo-physics" and "geo-physicist throughout the document (e.g. 2-5, 3rd par).

pxxiv The nunatak "Schumacherfjellet" is misspelt "Schumachersfjellet" throughout the document, including the caption of Plate F.

p1-1 GPS: Is the term not "Global Positioning System"? Please check and correct throughout the document, if necessary.

p1-4"d":lin 4: change "it's" to "its". When you write "it's", the meaning is "it is". This occurs elsewhere in the document (e.g. p6-6 f, 3rd par) and should be corrected.

p1-6 1.3.2, a (ii): "affect" not "effect".

p1-13 1.6.1: The statement reads 80 and 18 people, whereas on pxxv it is 60 and 20. Which is correct?

On the same page and elsewhere in the document the terms "overwinter" and "winter-over" are used. Which is correct or do they have different meanings?

p2-1 2nd last par and 2nd par on p2-2: The names should read "Båkenesdokka" and "Båken". Furthermore, is should either read "Båkenesdokka" or Båkenes Valley". As it stands it is like talking about the "Drakensberg Mountains".

p2-4 2nd par: change "ultra-mafic" to "ultramafic".

p2-11 b), 2nd par: change to "quadrant" in two places.

p3-1 last par: change to: "the effect of the oncoming.."

p6-17 Key issue 8: change to "fuel spill"

p7-1 First par: change to "logistics".

App 8-vi Chapter 1 d: change to "good".

I have not checked the document rigorously for grammatical and spelling errors and suggest that detailed editing is still required.

RESPONSE 1.4:

The grammatical errors are noted.

With regard to the number of personnel, the correct figures are 18 over-wintering and up to 62 during the summer take-over period. This gives a total of 80.

There is no difference in meaning between "over-wintering" or wintering-over".

**2. Dr C Frick
Geological Survey**

COMMENT 2.1:

Thank you very much for the draft report on the Environmental Impact of the SANAE IV base. I think this was an excellent job well done. I have no serious comments regarding any aspect of the report.

RESPONSE 2.1:

Comment noted, thank you.

**3. Major JC Kriegler
SAAF**

COMMENT 3.1:

Bogenoemde verslag is deur my bestudeer en alles is in orde gevind.

RESPONSE 3.1:

Comment noted, thank you.

**4. Dr CA Rinaldi
Director del Instituto Antartico**

COMMENT 4.1:

We found that it is a very complete work which includes nearly all the aspects needed for such a CEE.

Nevertheless, we want to suggest you some general comments about this document.

In our opinion the CEE should include, as part of the considered activities, the transport of personnel and materials from the coast to SANAE IV. This includes a more detailed description of the transport system and the affected environment. We can not found elements to justify the exclusion of this matter in the document.

RESPONSE 4.1:

The description of the transportation system, and the figures given under Chapter 3 section 3.6 were based on information available to the assessment team. It is not clear what would entail a more detailed description, if figures were

to be given on number of trips, time per trip, tonnage per sledge, etc, these figures would be largely estimates and their value questionable.

The environment to be affected by the route described in paragraphs 3 and 4 of section 2.1.2 of the draft CEE consists of a relatively sterile ice-shelf and snow-fields. There are no vegetated or ice-free areas en route, and the nearest animal breeding colony is a snow petrel colony at the Robertskollen group of nunataks, approximately 7 to 10 kilometres west of the route and 25 kilometres north-west of Vesleskarvet.

COMMENT 4.2:

Respect to the planning process described in chapter 1 and analyzed in chapter 6 (table 1) some activities appear to be commenced or done on dates previous to this CEE. In consequence it is impossible to do comments and/or propose modifications for those activities as it is suggested by the Madrid Protocol.

RESPONSE 4.2:

The site selection process was one which was out of the hands of the CEE team. Certain of the construction activities did commence before the CEE process had been completed (the building of the ice-road and the construction base, and the setting up of the safety handrail), but only after the matter had been discussed with and agreed to on site by the assessment team Project Leader, Mr P Claassen. While this is certainly not ideal, it was unfortunately the only option open to us at the time.

The elements were designed and constructed in a responsible manner, and no adverse impacts are deemed to have occurred because of these activities.

COMMENT 4.3:

In table 1 (chapter 6) we noted that some possible mitigation measures are planned to be carried out after the end of the activity (for example impacts number 1, 2, 3, 4, 6, 7, 9 and 10). We think that mitigation measures should be applied with the activity or its effects are in course in order to really mitigate them.

RESPONSE 4.3:

Of the mitigation called for on the above impacts, only mitigation with respect to impacts 2 and 7 could possibly be implemented during the construction phase. As snow deposition would continue to occur immediately after levelling of the area and from experience stabilises quickly, it is only considered necessary to level the area after the construction base has been removed, after which no more snow deposition will occur.

Latest information appears to indicate that one section of the construction base might be used for skidoo storage. The impact of this will be of similar nature as the entire construction phase, but the effect should be less. The potential impacts will be fully investigated before the decision is taken.

With regard to impact 5, the road has been constructed using the minimum space necessary, and does not obstruct any visible drainage patterns. See also response 4.2.

COMMENT 4.4:

Some activities and their potential impacts are not considered in the document:

- safety and environmental aspects related with helicopter flights;
- environmental hazard related with the introduction of poultry and other fresh food;
- safety aspects related with the transport of personnel from the coast to SANAE IV.

RESPONSE 4.4:

The EHS aspects relating to helicopter flights are still under development for the new base, but the standard South African Air Force and the Antarctic Flight Information Manual procedures will apply. These procedures have been used in the SANAP for many years, and are considered internationally to be of a high standard. They have not been included in the Preliminary EHSMS, but will be included in the final EHSMS.

With the implementation of the waste management plan and the code of conduct, it is not anticipated that any indigenous Antarctic bird species shall gain access to any of the food waste. See Chapter 4 of this report.

The safety of personnel between the coast and SANAE IV has been addressed in Chapter 3 and Chapter 4 of this report.

**5. R Moncur
Australian Antarctic Division**

Thank you for your letter of 18 August 1993 seeking comments on the draft Comprehensive Environmental Evaluation for the proposed new SANAE IV facility in Antarctica.

The attached comments represent the views of some government departments as well as non-government organisations and are therefore not necessarily the views of the Australian Antarctic Division. However, these are included in the event that you may find them of interest. Unfortunately, the limited time available has precluded wider circulation of the draft CEE and more detailed comments, however, I would be pleased to provide further information if required.

I hope our response is useful and thank you for the opportunity to comment.

COMMENT 5.1:

There are several positive aspects of this draft CEE including the level of detail generally, the intention to exceed some requirements of the Madrid Protocol and the functional, compact design of the proposed station.

The draft CEE gives the impression that the commencement of construction and other operational events has paralleled or preceded development of CEE. If construction and other site preparations have not commenced, then references to timing of events, such as those in chapters six and seven, should be revised. If operations have commenced, then there may be value in acknowledging or commenting on the apparent inconsistency with Article 3(6) of Annex I of the Protocol.

RESPONSE 5.1:

Certain of the construction activities did commence before the CEE process had been completed ie: The building of the ice-road and the construction base, and the setting up of the safety handrail. These activities took place after the matter had been discussed with and agreed to on site by the assessment team Project Leader, Mr P Claassen. While this is certainly not ideal, it was unfortunately the only option open to us at the time.

COMMENT 5.2:

The document structure is sometimes confusing and related information is not always closely grouped. While recognising that no method is perfect, use of the structure developed by COMNAP would improve this aspect. The report would benefit from further editorial work to improve the grammar and accuracy of the contents. There are a number of typographical or factual inconsistencies that need rectification.

RESPONSE 5.2:

Comment noted.

COMMENT 5.3:

The biological survey work has improved significantly from the IEE. However, some other references in the draft CEE appear similar to those in the IEE despite the greater level of attention they deserve in a CEE; for example, some data on aspects such as meteorology and waste generation. Alternatively, an explanation of the omission of such data would improve the CEE.

RESPONSE 5.3:

The South African Weather Bureau has unfortunately ended its involvement in the SANAP, and no facilities were available to the assessment team. The assessment team member for climate also assured the project co-ordinator that no further data was necessary for the purpose of the assessment.

No definite figures are available for the waste generation of SANAE III, and the

systems used at the new facility are to be quite different, so it is not believed that any figures obtained from it will be of use in determining waste loads for the new facility.

While we believe that waste generated at the new facility will be less than at SANAE III, all systems have nonetheless been designed with generous safety margins.

COMMENT 5.4:

The draft CEE would be a more valuable document if it could be read in conjunction with other operational documents, such as contingency plans for environmental emergencies (for example, oil spills), a waste management plan and procedural statements (for fuel transfers and other activities with high potential environmental risks), as these are critical for understanding the proposed management of environmental impacts. While recognising that these documents may still be under development, many of the recommendations in Chapter 7 (such as those relating to management structures and responsibility; environmental, health and safety management system and audits, etc) should make a clear commitment to what will be done. In particular, the proposed Environmental, Health and Safety Management system should form part of the final CEE.

RESPONSE 5.4:

The Preliminary EHSMS is included in this document under Chapter 3, and includes the preliminary contingency plans available. Procedures used at SANAE III to date will apply in the absence of any other plans. The commitment to what should be done must be made by the SANAP management, not by the assessment team, who acted merely as consultants to them.

COMMENT 5.5:

Given the implied scale of the transport operations required to support the construction and operation of SANAE IV, more attention should be given to the extent and likely impacts of these operations. More information about the proposed level of usage and impacts of helicopters and other vehicles should be included.

RESPONSE 5.5:

Detailed figures are not available at this stage. See response 4.1.

COMMENT 5.6:

Executive summary - greater consideration of alternatives, including the need for the station and an explanation of why this particular size and style of station was chosen, would be valuable.

RESPONSE 5.6:

Comment Noted.

COMMENT 5.7:

Chapter 1, 1.3.1 b) - the argument about the value of maintaining the integrity of the 30 year old data set should be applied consistently to all alternatives rather than only as a reason for excluding a coastal location. A site 220 kilometres inland would also lose the value of maintaining continuous data.

RESPONSE 5.7:

Comment noted.

COMMENT 5.8:

1.3.1 c) - The observation about the likely considerable snow deposition that would be caused by erection of a surface structure on the existing SANAE III site requires more explanation of the actual impact associated with such deposition in relation to the value of the area covered. The mitigation proposed in 1.3.2 b) would seem relevant here also. It may need to be made clear that the impact of high snow accumulation is that the removal of the station will become impossible.

RESPONSE 5.8:

The impact relating to the snow deposition is, as stated in your comment, related to the removal of the facility at decommissioning. The conservation value of the land which would be covered, in the case of this option a bare ice-shelf, is not considered to be high and is by nature a dynamic landscape in which snow deposition and erosion occur as a matter of course.

Access and ventilation shafts must be lengthened each year, and above-ground scientific instruments become more remote and more difficult to maintain.

COMMENT 5.9:

1.3.3 b) - the "greater scientific advantages" referred to should be explained in more detail.

RESPONSE 5.9:

The advantages referred to include better earthing of instruments, visual access to scientific facilities and the possibility of making atmospheric observations from within the main base, quicker and easier access to facilities outside, and more area available for scientific purposes inside the base eg. laboratories at the same cost.

COMMENT 5.10:

1.4.1 - the area of Vesleskarvet is given as 250,000m² while the executive summary mentions 40,000m².

RESPONSE 5.10:

The area given in the Executive Summary is incorrect. The correct area is

between 240 000 m² and 250 000 m², depending on the amount of rock exposed at any specific time..

COMMENT 5.11:

Chapter 2, 2.2.4 - is there nil precipitation or is it carried away by wind?

RESPONSE 5.11:

The effect is that of nil precipitation. A lot of the snow arriving at the site is also wind driven snow.

COMMENT 5.12:

2.2.7 a) - the section on ozone trends appears dated and could be revised in the light of more recent research.

RESPONSE 5.12:

Comment noted. For safety reasons a conservative approach was adopted.

COMMENT 5.13:

Chapter 3 - The descriptions of the structure necessary to support various science programs are useful and could be usefully preceded by a statement of the size and type of scientific research programs likely to be conducted. This would make it easier to place other aspects of the proposal and the need for various facilities into context. More information should be provided on the impacts of the proposed transport operations to and from the coast and research sites.

RESPONSE 5.13:

The impacts of research stations etc, are under evaluation for purposes of upgrading the operations in two years when the base becomes operational, and the summer scientific programme begins again. The SANAP is almost at the end of a five year research cycle. When the new facility becomes operational, new research proposals will be evaluated, presumably taking EHS considerations into account.

Only the transport activities relating specifically to the construction phase were considered for the draft CEE.

COMMENT 5.14:

3.2.4 a) - should the last line refer to "ozone" rather than "oxygen"?

RESPONSE 5.14:

No, oxygen is correct as the sentence refers to the oxygen depletion potential of combusting material.

COMMENT 5.15:

3.6 - While the existing information on the construction phase is useful; more information on the impacts generated by this phase would be helpful in this section; perhaps some of the information on the analyses of impacts contained in chapter 6 could be commented on in 3.6. This is an important aspect as previous Antarctic experience, and the significance as assessed in the draft CEE, suggest that construction impacts are often greater than ongoing operational impacts. More information on decommissioning of the construction camp would be helpful if this is available.

RESPONSE 5.15:

The impacts generated by the construction phase, apart from those mentioned on page xxvii of the executive summary of the draft CEE, will mostly be cumulative impacts stemming from repetitive actions such as hauling construction materials from the depot to the site, welding, grinding, etc.

An attempt has been made in the code of conduct in the Preliminary EHSMS to address these impacts by managing these activities. It must be remembered that while construction activities do hold potential for significant cumulative impacts by their nature, the relatively short time span again limits their significance. Small operational impacts, however, if repeated for the entire operational phase of the base, hold the potential for more significant impacts, which might not be as easy to detect.

The construction base consists of insulated containers placed on a tubular steel framework. The containers are approximately 2 metres above grade. The base is founded on wooden planks placed flat in trenches dug into the snow. Decommissioning would entail removal of all components to the RSA.

COMMENT 5.16:

Chapter 4 - While the intention to retrograde hazardous wastes and management of liquid wastes are mentioned elsewhere in the CEE, it would be useful to state them in this chapter.

RESPONSE 5.16:

Comment noted.

COMMENT 5.17:

4.2.2 - our experience suggests that the level of waste generated in a "municipal situation" are significantly less than those generated on an Antarctic station because of packaging differences. Are there any estimates available from the operation of SANAE III? This section might also mention any waste minimisation practises to be employed.

RESPONSE 5.17:

Unfortunately no figures are available from SANAE III. The entire provisions

supply system has been re-designed, however, and from the 1993/1994 take-over all packaging has been reduced to the minimum. This has been done through the use of bulk containers with no smaller "commercial" packaging on the individual articles.

COMMENT 5.18:

4.3.4 c) ii) - the discharge rate of 3.3 l/sec referred to appears incorrect if this rate is continuous.

RESPONSE 5.18:

Comment noted.

COMMENT 5.19:

4.3.5 - the discharge of treated effluent over the edge of the nunatak is potentially inconsistent with Annex III, Article 4 (2) of the Protocol; an explanation of why a deep ice pit is not the most practicable option is required. Such an explanation should also include more detail on the purity of the effluent (perhaps, by attaching the standard referred to in 4.3.1) and the likely cumulative and other impacts of the chosen disposal method, especially given the flora of the area, and whether this discharge will land on an ice-free area. The location of the discharge pipe should be marked on the site plan (figure 7).

RESPONSE 5.19:

The standard of the effluent is such that it could be re-used for certain purposes, but this was not done for safety reasons.

The effluent will be discharged into the wind scoop. Only a small section of the cliff face will be affected. The effluent will effectively therefore be discharged onto snow and blue ice. Due to the inaccessible nature of the discharge area, no EHS risks are anticipated.

COMMENT 5.20:

4.4.4 - while the diesel emissions may be minor and hard to avoid, there should be some calculations to support this assessment, such as volume of fuel consumed, volume of exhaust gases, etc.

RESPONSE 5.20:

These were requested, but no figures could be made available to the assessment team yet.

COMMENT 5.21:

4.4.5 - the use of alternative energy sources deserves more attention. If these alternatives have been evaluated or there is a plan to evaluate them at some future stage, this could be included here. Has the station been designed to facilitate the later use of such alternatives ?

RESPONSE 5.21:

The use of alternative energy sources was evaluated by SANAP members, but the cost of supplying the technology and its relatively unproven qualities in the specific environment led to the base being supplied with proven systems.

The technology development programme recommended in Chapter 7 of the draft CEE however, should include energy systems and materials, so that such items can be tested and then be applied if feasible. It is also hoped that the specifications for the SANA V facility will grow out of this programme.

The design of the station is such that alternatives could well be incorporated.

COMMENT 5.22:

Chapter 5, 5.2.2 - Fuel transfer and storage have undoubtedly been considered in detail. Some other questions, which have probably been considered but may warrant some explanation in the final CEE, are:

- Why not reduce the number of fuel transfers by pumping fuel directly from the ship to sled bladders?
- Will the bladders leak if a sled overturns?
- Will dry-break disconnect fittings be used in the fuel lines?
- What precautions will be taken to prevent overfilling of bladders?
- What weight of snow will bladders support?

RESPONSE 5.22:

The time available for pumping from the ship, the equipment used, and the distance which diesel must be pumped from the ship preclude this option. Once the large bladders are full, a separate team continues to pump diesel into the smaller bladders and transport them to the base. The ship can then be off-loaded. If this procedure were not followed, many more sledges would also be required.

Due to the nature of their design it is unlikely that the bladders will leak if overturned.

New dry-break couplings have been purchased for all fuel lines.

Training of personnel and not filling from the ship into small bladders (see beginning of this response) and metered pumps will reduce the risk of overfilling.

The weight of snow which a bladder can support is not known.

COMMENT 5.23:

5.3.3 - Although the chosen alternative seems best, this section prompted some other questions:

- What is the operational lifetime of the bladders?
 - Will the pumps be located inside a sealable container?
 - Is top draw-off being used?
 - Does the steel casing have the same or higher pressure rating as the bladders?
- Presumably, there are pressure vacuum vents on the bladders and casings.

RESPONSE 5.23:

Approximately 10 years, but bladders are visually inspected before each filling.

The pumps are mounted on sealable containers.

Top draw-off is being used.

Pressure ratings are not known.

COMMENT 5.24:

Chapter 6 - In table 1 on page 6-7, the duration of the erection and operation of the construction base is described as commencing in December 1991; is this correct? The assessment of the erection and operation of a construction base as being of "low" significance (first line of this table) does not appear consistent with the definition of "low" given on page 6-5, should it be "medium" given that it seems unlikely that natural process or functions can remain unaffected by such a temporary facility? More explanation of this aspect is required.

RESPONSE 5.24:

Yes, December 1991 is correct. See response 5.1.

It is the intensity of the impact which is defined on page 6-5; the assessment of which was high. The significance though, was considered low in the light of the definition on page 6-6, for the following reasons:

The only natural process to be modified was the maintenance of the original snow grade to the west of the construction base. The modification is an increase in height of approximately up to 4 metres for a distance of not more than 100 metres.

This snow deposition does not affect the nunatak surface, and no biotic or seasonal elements are affected.

The base will only operate for two more summer seasons (up to 1995/1996 takeover).

COMMENT 5.25:

Table 1, page 6-9, "Activities of construction personnel, 15" - Education and environmental awareness training could also be included under mitigation.

RESPONSE 5.25:

An awareness programme has been started. The construction team leaders have been informed of the recommendations in Chapter 7 of the draft CEE. Further discussions will take place at a later stage.

The Directors-General of both the DEA and the DPW are to address the construction team and show their support for the EHSMS.

COMMENT 5.26:

Table 1, page 6-10, "Activities of construction personnel, 20" - How will grey water be treated and where will it be released?

RESPONSE 5.26:

The decision has been taken by SANAP not to treat grey water emanating from the construction base in Antarctica. It will be pumped into specially allocated polyethylene drums and removed with all other waste to the RSA.

COMMENT 5.27:

Table 1, page 6-13, fuel storage, number 36 & 38 - mention could be made of bunding and other containments proposed under "possible mitigation" or a cross reference made to section 5.3.3.

RESPONSE 5.27:

Comment noted.

COMMENT 5.28:

6.4, - combining the discussion of key issues in this section and section 6.2 would assist the reader.

RESPONSE 5.28:

Comment noted. The intention of the layout was to take the reader through the elements in the process in chronological order, ie: key issue identification, assessment of potential impacts and then addressing of key issues.

COMMENT 5.29:

6.4, key issue 1 - the position of the safety handrail closer to the station would naturally define a smaller "station limits" area, may offer improved aesthetic appeal by being closer to buildings, and is a shorter distance of railing; a small "viewing platform" could be constructed nearer to the edge if necessary.

RESPONSE 5.29:

A smaller station limits area would be advantageous but would entail moving the handrail in the case of possible future expansion or placement of new scientific or communications instruments. Due to the nature of the facility and its operations, it is also not considered necessary to curtail pedestrian movement on the nunatak surface to such an extent.

If the handrail is too close to the base, personnel will be forced to climb over it to walk on the nunatak. They would then be outside of the safety area.

COMMENT 5.30:

6.4, key issue 2 - the area on the southern buttress mentioned in paragraph 2

may not be unique but would still appear worthy of protection by demarcation as previously intended.

RESPONSE 5.30:

Due to the fact that the area will fall partly inside the construction area, it is not feasible to maintain it. See also Response 7.6 and Response 7.12.

COMMENT 5.31:

6.5 - While cumulative impacts are difficult to define, this section is inadequate for a CEE. Some mention should be included of impacts generated by highly repetitive tasks such as transport operations and waste management. Aspects of the environment most vulnerable to cumulative impact should be identified, if possible, as well as monitoring procedures that will be used to quantify the impacts.

RESPONSE 5.31:

The Preliminary EHSMS included in this report attempts to identify, monitor and manage these tasks through the management objectives and targets, the code of conduct and annual EHS audits.

COMMENT 5.32:

Chapter 7 - it is unclear why this chapter contains "recommendations" rather than stating the reasons for adopting particular strategies; is this section to be revised before presentation in the final CEE? While this chapter discusses intentions in a range of important areas, it would be more appropriate to present the strategies to be employed and justify their choice. This is especially so for a key area such as monitoring. In this respect, it is unclear whether the EHSMS is intended to satisfy the Protocol's requirements for monitoring. The purpose and status of recommendations about new management structures is unclear.

RESPONSE 5.32:

The Draft CEE was produced for the SANAP management by a different section of the Department of Environment Affairs. The assessment co-ordinators can only therefore make recommendations to SANAP management on what course of action would be most desirable from an environmental management point of view. The strategies laid out in the recommendations of this report must thus be accepted by SANAP management.

The monitoring will be executed by members of the section responsible for the CEE, which is a separate section from the Antarctica and Islands Management section. This is important to maintain objectivity and impartiality. See response 1.1.

The purpose of the recommendations regarding new management structures is to ensure a better definition of responsibilities, especially regarding EHS aspects, and efficient environmental management.

The status of the recommendations is exactly that: they are recommendations to the SANAP management at DEA, for their consideration and implementation.

**6. Dr DWH WALTON
GOSEAC, SCAR**

Thank you for sending copies of this to SCAR for comments. We are pleased to be able to provide an assessment of such an important document. SCAR considers that it is only by a process of critical evaluation and informed comment that the intentions of the Environment Protocol will be turned into acceptable activities and management. Considerations of each CEE is a significant part of this process.

I regret to say that since insufficient were supplied for all members of GOSEAC and the time allowed for comment after receipt was only six weeks I have not been able to canvass opinions widely. You will appreciate that with a membership spread over 12 countries (including those like Argentina, Chile and Brazil with very poor postal systems) there was no possibility of being as thorough as I would have liked.

Given those logistic caveats I have some comments to make on behalf of SCAR.

COMMENT 6.1:

p.xxiii para 2. This states that it was decided to adhere as closely as possible to Articles 1 & 2 of Annex I. These articles only cover Initial Environmental Evaluation. You state "This report represents a Comprehensive Environmental Evaluation as described in Article 2 of the Annex." It is Article 3 that covers CEE.

RESPONSE 6.1:

The error is noted.

COMMENT 6.2:

There is still no indication of how the summer and winter numbers for base personnel were derived. Nor is there an indication that temporary accommodation was considered as a possibility for at least some of the summer bulge, which might have led to a significant down-sizing of the station.

RESPONSE 6.2:

The numbers were derived from the maximum possible number of participants in the summer and winter programmes, based on present and possible future projects. The figures were derived in consultation with all participating organisations.

Temporary accommodation for the summer contingent is not considered to be an option as it would mean an increase in temporary logistic components, which in turn leads to an untidy and difficult to control base site. These facilities require

storage, or must be removed at the end of each summer season. The inherent lower quality of temporary facilities could also adversely affect the summer programmes.

COMMENT 6.3:

p.3-13. The only reference to the impacts of the construction activities is not in this section but in the impact tables on p.6-12.

RESPONSE 6.3:

Chapter 3 of the draft CEE deals ostensibly with the project proposal, not with environmental impacts. That is why they are dealt with separately.

COMMENT 6.4:

Whilst the construction camp position is shown on Fig 7 there is no indication of the expected size of the impact zone.

RESPONSE 6.4:

The size of the area taken up by the construction material depot, the waste depot, fuel storage sites, vehicle parking areas, etc cannot be accurately determined. What can be stated is that the area between the construction base and the nunatak, and extending approximately fifty metres to the east of the construction base will be affected. This does not include the transportation routes. All of the above area is snow. The areas of the nunatak surface to be affected are given in the executive summary on page number xxvii. No further exposed rock areas should be affected.

The area to be cleared for the actual base structure shall be limited to a strip approximately 165 metres long and 20 metres wide.

COMMENT 6.5:

p.3-13. The statement in para 3.5.3a on the HF radar implies that both the British radar at Halley and the US radar at Goose Bay have been subjected to rigorous assessment of environmental impact. Since the Goose Bay radar was installed in the early 1980's on a military base it is unlikely that any form of environmental assessment was made. The planning and installation of the British radar at Halley predated the present environmental legislation and was not subjected to the current environmental impact assessment legislation. Your radar is the first to be installed under the Protocol legislation and could therefore provide a lead on the extent of any impact which would be of value to the British and the Japanese. I would suggest that your statement about output power is a little disingenuous. Since the radar uses a narrow focused beam the power of the transmitter is not the same as the power in the output field; thus the beam power will be much higher than most commercial transmitters although the transmitter power will be much lower. Whilst it seems unlikely that this will have any environmental impacts your present description of the experimental array does not allow the reader to assess this. Why is the beam direction not shown on Fig 7?

RESPONSE 6.5:

The statement regarding the HF radar facility and environmental standards has been discussed with the specialists concerned. It would appear that your comment is correct, and no environmental assessment of the system has been done before.

There are now three similar radars operating in Canada which have been through the Canadian civilian licensing procedure. It is not known, however, if this procedure contains aspects of environmental testing.

The HF radar has an array of 16 antennae (see 3.5.2(a)(v)) each of width 15 m lying approximately East-West. Each antennae is driven by a 600 W transmitter. The radar scans through 16 beam directions with a 6 second integration time for each beam. Each of the beams has a width of about 4 degrees horizontally. The beams are directed southwards away from the base; the nearest inhabited base in their direction is at South Pole. They are directed at angles of approximately 20-25 degrees (depending on frequency, which is in the range of 8-20 MHz) above the horizon. The average effective radiated power in any one beam direction is 3 kW. Before transmitting, the radar scans in frequency and avoids frequencies that are in use or restricted.

COMMENT 6.6:

p.4-5 to 4-7. Clearly the discharge or treated effluent over the cliff is the simplest way of managing the output from the sewage plant. What checks will be made to assess that the effluent meets the Water Institute standards?

Will the discharge of all chemicals be banned from the sewage system (eg photochemicals, lab chemicals etc) and this material be removed as toxic waste?

Presumably there will be a management requirement under EHS to provide only "environmentally friendly" cleaners etc for the station?

Since all waste is to be returned at every stage and no incineration is provided for in the base construction it follows that there should be no open burning at the site. However the statement in para 4.4.2 that "air pollution is not regarded as a potential significant environmental impact" is unfortunate. The environment in which the base is being built is virtually pristine and whilst the emissions are unlikely to measurably pollute the air they almost certainly will pollute the snow with heavy metals. Minimisation of this by washing waste gases will be a challenge.

RESPONSE 6.6:

Samples of the discharge effluent will be taken weekly. In the event of any component failure within the treatment system, the pumping of effluent will immediately be stopped until that component is repaired or replaced. All checks and procedures will be subject to the yearly EHS audit.

All photo and lab chemicals will be stored in specially designed drums and returned to the RSA. None will be allowed into the system.

The use of environmentally less damaging cleaners shall be an integral part of the technology development programme recommended in Chapter 7 of the draft CEE.

No open burning of waste will be allowed on the site. Allowance will, however, have to be made for the South African tradition of "Braaivleis" (not unlike a barbecue), where food, (especially meat) is cooked over an open wood or charcoal fire. A proper facility shall be provided for this activity.

All generating equipment shall be strictly maintained to ensure optimum burning of diesel fuel. The development of scrubbing and washing techniques will be promoted under the technology development programme.

Negotiations have been started with a leading South African waste handling company regarding the management of all South African waste brought back from the Antarctic. This will possibly entail the supply and retrieval in Cape Town of specialised containers and compacters, and the handling of all types of waste.

COMMENT 6.7:

The fuel handling problem is clearly not easy to solve. It appears that the multiple handling required using the bladder tanks on sledges will certainly not significantly reduce the possibilities of spills. The key danger area would appear to be pumping the fuel ashore in an inadequate anchorage.

RESPONSE 6.7:

The key to reducing the risks lies in the effective implementation of procedures. Problems in the past have originated from faulty couplings, split bladders and broken hoses. For the 1993/1994 take-over, all couplings, hoses, tanks and bladders have been replaced with new items, all of which conform to international specifications. All couplings used will also be of the dry-break type.

COMMENT 6.8:

No mention is made of helicopter fuel. Is this to be brought in bladders or drums? How is it to be stored? I note that any future use of fixed wing aircraft via the skiway will be the subject of a separate assessment (p.6-16).

RESPONSE 6.8:

Helicopter fuel will be transported and stored in 200 litre drums. Approximately 300 drums will be brought in per take-over, ie: 600 drums for the construction phase. Refuelling will take place directly from the drums, and all drums will be returned to the RSA.

COMMENT 6.9:

There is no discussion of the decommissioning of SANAE III. Will this be the subject of a separate assessment?

RESPONSE 6.9:

During the Assessment team visits of 1991/1992 and 1992/1993, SANAE III was also inspected and various options for removal considered. It was decided that, due to the scope of the project, a separate study should be undertaken once SANAE IV was operational. An evaluation of the removal of SANAE III will be conducted in accordance with either Article 2 or 3 of Annex 1 to the Madrid Protocol on environmental protection.

COMMENT 6.10:

p.7-12. Monitoring is mentioned but only in passing. How do you intend to apply Article 5 of Annex I? Why is there no mention of monitoring in the executive summary? Do you intend to publish an assessment of the value of any monitoring data at the conclusion of the project?

RESPONSE 6.10:

Baseline monitoring began with the initial biological samples removed during the 1991/1992 season. Environmental officers will be the first on site at the start of the construction phase (1993/1994), and present for the full duration of construction activities. They will be based at Vesleskarvet, but will also monitor the off-loading at the ship and the transport routes. The records which are produced will be kept by the assessment team for inclusion into the audit plan. A full audit report will be presented to SANAP management at the end of each take-over (1993/1994 and 1994/1995), and at the end of the construction phase. This will include the audit sheets and evaluation of all aspects of the preliminary EHSMS.

COMMENT 6.11:

Will there be any independent assessment of the accuracy of your predictions of the extend, duration and significance of impacts or of the effectiveness of your proposed mitigation procedures?

RESPONSE 6.11:

The Assessment Team shall perform an internal assessment of the accuracy of the predictions and effectiveness of the mitigation. This process is outlined in the Preliminary EHSMS. Comments from independent observers will be welcomed.

COMMENT 6.12:

Despite the statement that South Africa will follow the Environmental Protocol even though it has yet to be ratified, there is no indication in the document that the circulation of the CEE meets the requirements of Annex I Article 3. This requires a public period of 90 days for comment on the draft by all parties. The requirement for providing it to the CEP at least 120 days before the next ATCM is clearly not possible at present. Article 3 goes on to say that "no final decision shall be taken to proceed... unless there has been an opportunity for consideration of the draft CEE by the ATCM on the advice of the Committee". By the time of the next ATCM you will have installed the base structure. Indeed, it

seems unlikely that any comments made now can influence in any way the activities for this next season.

RESPONSE 6.12:

While it was hoped that the treaty stipulations could have been fully adhered to, certain factors in the base design and report production process made it impossible.

The most important factor necessitating departure from the stipulated timetable was the relatively sudden deterioration and structural collapse of SANAE III. All activities relating to the replacement facility were then forced to occur in a compressed time scale.

While it certainly would have been ideal to postpone the project for one more year and conduct the evaluation process according to the Protocol, this was not practicable for the SANAP, given the advanced state of the project and the state of SANAE III..

Another problem encountered was that the design process, not only for the base structure, but equipment too, resulted in many changes being made. Some significant changes in the fuel transport sledge, for instance, were decided on. These changes are out of the hands of the assessment team.

Besides the problems experienced with the SANAE IV project, the stipulated timing does not really allow for as accurate an assessment of an operation as would be ideal.

COMMENT 6.13:

Whilst utilising SANAE III meteorological data gives a general indication of the likely climate at the site why was it not possible for the advance party in 1991 to leave an automatic weather station at the site to gather another year's on site data?

RESPONSE 6.13:

A weather station was in fact installed on the site during the 1991/1992 Assessment Team visit. It proved inadequate.

The South African Weather Bureau has unfortunately also ended its involvement in the SANAP, and no further facilities were available to the assessment team. The assessment team member for climate also assured the project co-ordinator that no further data was necessary for the purpose of the assessment.

COMMENT 6.14:

Might it not be useful to have stated in chapter 2 that a report providing a complete biological inventory and community distribution would be available as a statement of baseline conditions? This would then allow any future change possibly caused by the station itself to be accurately measured?

RESPONSE 6.14:

While the DEA is not planning to produce such a report, the Percy FitzPatrick Institute at the University of Cape Town has started compiling a brochure on the nunataks of Western Queen Maud Land, and the initial biological studies conducted for the draft CEE are to be published in the SA Journal of Antarctic Research.

COMMENT 6.15:

In more general terms I find much to commend in the draft CEE which provide very detailed information about the proposed building activities and the outline of an environmental management system (EHS) which has fundamental implications for all the South African activities. The tables in Chapter 6 summarising potential impacts are clear and easy to use, but with no indication of monitoring activities how will the success of your mitigation activities be assessed by you?

RESPONSE 6.15:

The procedure for assessing mitigation is included in the audit plan in Chapter 3 of this report.

COMMENT 6.16:

The lack of indication that any outside observer is to be invited to take part in the project is regrettable.

RESPONSE 6.16:

The participation of international observers would be welcomed. Provision could be made at any time for such observers. Anyone wishing to observe should contact the SANAP Managers.

COMMENT 6.17:

We applaud your decision to publish the comments received on the IEE. A commentary on how you dealt with these would have been a useful addition to Appendix 8, since it appears that several important points raised there have not been addressed in the CEE. Whilst SCAR appreciates the difficulties faced by national operators in providing new facilities in the Antarctic, it is not possible to include this as a mitigating factor in our scientific assessment of a CEE. In the case of SANAE IV there was clearly some urgency in progressing the project once the extent of deterioration in SANAE III had been recognised.

I hope that these comments and questions prove useful to you in progressing the project.

RESPONSE 6.17:

Unfortunately many of the comments and suggestions could not be worked into the process. One of the most important problems is the timing of the assessment

with regard to the design process.

Many factors also had to be considered as given or fixed by the assessment team, and many external changes were made in the design process, unfortunately even after the draft CEE had been finalised.

**7. DA Balfour, J Cooper, JM Harris and WK Steele
Percy FitzPatrick Institute of African Ornithology
University of Cape Town**

In reply to your letter of 18 August to Professor WR Siegfried, please find enclosed the combined comments of the SANAP researchers at this Institute on the SANAE IV CEE. My letter to you of 30 August on the mailing list and your reply of 17 September, for which thanks, also refer. Dr Will Steele has already sent you a copy of our draft manuscript describing Vesleskarvet and its biology. As he will have told you, this ms is not yet ready for submission to a journal, needing further input of data from samples currently being analyzed. However, the draft ms as sent, although incomplete, may still contain information of significance for a revision of the draft CEE.

Our most substantive comment is that the scientific exclusion area established last summer on the southern lobe close to the base site should be maintained and not omitted from the site plan. Reasons for this recommendation are that it is an area which supports high densities of tardigrades and contains the highest diversity of tardigrades found at Vesleskarvet, as well as containing meltwater pools and relatively large soil patches.

Other substantive points refer to the existence of climatic data from nearby Robertskollen for two summers and one winter, and additional details of the microbial communities found at Vesleskarvet. Please note that the Table referred to in our attached comments will be faxed to you as soon as Jean Harris returns from leave this Wednesday: apologies for missing your deadline with this.

We at the FitzPatrick Institute would like to congratulate you and your office for producing a thorough and detailed report under severe time constraints.

Note: comments are given in text order and are references to the text by page and/or section numbers where appropriate.

COMMENT 7.1:

vi. Dr JM Harris is the correct form. Describe Dr WK Steele as an Ornithologist, Mr DA Balfour as a Botanist, Dr JM Harris as a Microbial ecologist, and not as "Researcher". Add "FitzPatrick Institute" to their affiliations prior to "University of Cape Town".

RESPONSE 7.1:

Comments noted.

COMMENT 7.2:

xxv. "Lobes", rather than "buttresses" should be used, see Section 1.4 page 1.9, and 2.3.2b, page 21.12. Otherwise, the specific meanings of these two terms should be defined, if they are considered not to be synonymous.

RESPONSE 7.2:

"Lobes" was originally used, but changed to buttresses. The two words are taken to be synonymous.

COMMENT 7.3:

1.1.3 The 1991/92 inspection also included a search for the presence of breeding birds.

RESPONSE 7.3:

Comment noted. Reference on the research with regard to breeding birds is contained in 2.3.2.

COMMENT 7.4:

2.2.1: An Automatic Weather Station (AWS) was erected by the FitzPatrick Institute at View Rocks, Robertskollen, approximately 35 km northwest of Vesleskarvet, during the summer season of 1991/92 and 1992/93. The AWS was left in position at the end of the 1992/93 to gather data during the 1993 winter. It will be visited during the 1993/94 summer and the winter data downloaded for analysis. Data recorded include wind speed and direction, air temperature, humidity and UVb radiation. Data for the two summers are currently available in the form of daily averages, maxima and minima and hourly averages. It is considered that these data will provide information closer to the Vesleskarvet situation, than will data collected at SANAE III.

The statement in 2.2.1a of "very little data from similar inland sites" should thus be amended to give specific reference to the FitzPatrick Institute's Robertskollen AWS data. If requested, the 1991/92 summers can be supplied for use in the CEE.

RESPONSE 7.4:

Such data could have been valuable. It is unfortunate that it has only been made known at this stage.

COMMENT 7.5:

2.3.1 The first Robertskollen survey (Ryan *et al.* 1989) was carried out in 1987/88, not given, which suggests two separate visits.

RESPONSE 7.5:

Comment noted.

COMMENT 7.6:

2.3.2b Results of the 1991/92 survey of microbial communities are now available. 1992/93 samples are currently being analyzed. Tardigrades, nematodes, protozoa, fungi and bacteria were all found to be present in soils at Vesleskarvet. Table 1 enclosed provides a summary of the densities of soil microbiota and corresponding soil nutrients parameters for four quadrats sampled on the southern and northern lobes of Vesleskarvet.

The correct spelling is Dr Hieronym Dastych, not "Hieronim".

Second paragraph, page 2.12. The statement that "the proposed base will therefore not constitute a threat to their survival" should be altered to read: "the proposed base is unlikely to constitute a threat to their survival". The sites very near to the proposed base site on the southern lobe where both new tardigrade species were found appear to support the highest densities of tardigrades and also contain the highest diversity of tardigrade species. It is therefore strongly recommended that the 1992/93 exclusion site established on this lobe be maintained. This will serve two purposes: to protect the relatively biotic-rich patch of habitat, and to act as a control site (one sampled prior to base building) to monitor the impact of human activity close to the base. The site sampled and marked as an exclusion area includes large meltwater pools and relatively big soil patches. These meltwater pools have drainage streams (mostly under rocks which may be vital to the continued existence of the meltwater pools and soil patches, both during base building and thereafter, needs to be carefully considered.

RESPONSE 7.6:

Comments noted. The maintenance of the exclusion plot on the southern buttress has been discussed with the SANAP Managers. It will fall partly into the area required for the placement of the base structure. Unfortunately its retention is not feasible. A construction area is to be demarcated, however, outside of which no construction activities or vehicular movement may take place. This will ensure that the area not actually needed for construction purposes should remain undisturbed.

COMMENT 7.7:

1.3.3 The first paragraph refers to the setting up of quadrats and transects which were also used to obtain the microbial information. It should therefore be given in Section 2.3.2b, to avoid results coming before methods.

Following the list of lichen names a note should be added saying that nomenclature follows Ryan *et al.* 1989.

Last line, second last paragraph, page 2.12. Should be 60 mm², not 60 mm.

RESPONSE 7.7:

Comments noted.

COMMENT 7.8:

Key issue 2, pages 6.2 and 6.12 second paragraph. The meltwater pools on the southern lobe, site of the 1992/93 exclusion area, should be regarded as of "special value" and therefore covered by this section. The pools should be protected from destruction or blockage of their drainage streams, and construction material and rocks should not be dumped onto the meltwater pool area.

Table 1, pages 6,7-15. This table does not seem to address the impact of levelling ground or moving rocks and soil during base construction. If rocks are moved and dumped in piles, important biotic habitats (meltwater pools and soil patches) on the southern lobe may be affected, both directly by covering them with displaced soil and rocks, and indirectly by blocking drainage streams.

RESPONSE 7.8:

All rock which has to be dumped will be levelled as much as possible without covering too great an area. The areas to be covered will have to include some drainage area, but as the rocks will be of identical shape and size of the in situ material, no problems with drainage are envisaged. The covering of soil in certain areas can unfortunately not be avoided, and should be considered in the context of the entire nunatak and all the facilities.

The nature of the cleared material will be such that it will not be possible to move it as easily as sand, nor spread it as evenly. These factors will largely determine the placement and nature of the rock dump. Monitoring of, and if necessary direction of, the dump construction activities will be the responsibility of the environmental officers.

COMMENT 7.9:

Table 1, pages 6.9. The 1992/93 EIA visit removed biological samples as well. Two of the plots mentioned were larger than the size given, one very much so (see Figure 7).

RESPONSE 7.9:

Correct. The final size of the plot on the southern buttress was approximately 27 X 32 metres. The minimum size of the plots was to be 25 X 25 metres.

COMMENT 7.10:

7.9.2 It is recommended that a booklet informing visitors (scientists, base personnel), construction/maintenance teams, helicopter and logistic support teams, etc.) about the natural environment (biology, geology, climatology, etc.) of Vesleskarvet and other nunataks, as well as a code of conduct, be produced and issued.

RESPONSE 7.10:

The Preliminary EHSMS is the start of a system of which such a booklet would

be a part. Posters, videos and other media could also be used. A code of conduct has already been set up for the construction phase, and is to be refined as the project progresses. It is envisaged that the EHSMS for the operation of the base will include a section on the environmental components.

COMMENT 7.11:

7.17.2 The "on-going monitoring project" mentioned should include the southern exclusion area, for the reason given above, and to provide a control site near the base which has been sampled prior to commencement of base construction. This comment also has relevance to 7.18.3, 7.18.5 and 7.18.7.

RESPONSE 7.11:

As this area is not be retained, this will not be possible. However, the environmental monitoring which will take place as part of the audit plan includes transects of the entire nunatak and the area around the construction base and the depots.

COMMENT 7.12:

7.19.1.a,b: Conditions for the construction phase and demarcation of work areas should include and consider prevention of destruction or degradation of the meltwater pools on the southern lobe, and the maintenance of the 1992/93 exclusion area for this purpose.

RESPONSE 7.12:

All construction activities will be allowed within a demarcated area. The delimitation of the construction area will be done on site before construction starts, by DEA and DPW officials and the consulting engineer. Certain of the meltwater pools may well be affected by construction activities. These will be limited to the minimum practicable by the environmental officers in consultation with the construction team leader.

COMMENT 7.13:

7.19.c Sampling of biological (and geological?) material for purely scientific purposes should not be specifically banned during the construction phase. Any collection must, however, be done under the necessary permit and after consultation with the Environmental Officer.

RESPONSE 7.13:

As no biologists or geologists will be present on the site for the construction phase, there will not be anyone present who should be taking samples during that time.

COMMENT 7.14:

Appendix 2, Figure 7. The southern lobe 1992/93 exclusion area should be reinstated on the site plan, for reasons as given above. To protect this site

further, an area at which dumping is not allowed should be demarcated just south of the proposed base to protect the drainage area. It would be informative to include the positions of the meltwater pools and drainage streams on the figure, because they represent important habitats for biota.

RESPONSE 7.14:

See Response 7.6.

CHAPTER 2

PRELIMINARY ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT SYSTEM

2.1 INTRODUCTION

2.2 MISSION STATEMENT

2.3 POLICY STATEMENT

CHAPTER 2**PRELIMINARY ENVIRONMENTAL, HEALTH AND SAFETY
MANAGEMENT SYSTEM****2.1 INTRODUCTION**

This Preliminary Environmental, Health and Safety Management System (EHSMS) contains the following elements: Mission statement regarding the environment, Environmental, Health and Safety (EHS) Policy statement, EHS Management Programme, Waste Management Plan, Contingency Plans, EHS Impacts Register, Antarctic Treaty Requirements Register, EHS Audit Plan and EHS Management Review.

Most of those elements which are not complete are scheduled for completion before 12 November 1993. The others will be completed by the environmental officers while at Vesleskarvet during the 1993/1994 summer take over period.

It must be stressed that, with the exception of the Mission and Policy, the entire EHSMS is preliminary, and shall be refined over the entire construction phase period. This Preliminary EHSMS shall thus serve as a basis on which the EHSMS for the operational phase of SANAE IV will be drawn up.

All the elements of the plan are designed to satisfy the EHS Mission.

The Policy statement falls directly under, and in support of, the Mission.

The Management Objectives in the EHS Management Programme in Chapter 3 are ideals which are designed to satisfy the Policy.

Each Management Objective has a number of Targets which must be carried out in order to ensure that it is accomplished.

The Code of Conduct in Chapter 4 is that part of the plan which places responsibility for care of the environment on individuals. Each participant must take responsibility for his or her individual actions, just as the Department of Environment Affairs (DEA) must take responsibility for the entire South African National Antarctic Programme (SANAP) and its actions.

A post-construction environmental audit shall be carried out. The overall audit plan includes a compliance audit and a management audit. This forms part of the EHS Management Programme in Chapter 3. The overall purpose of this environmental audit will be to ascertain whether appropriate care had been exercised throughout this phase to prevent environmental pollution and damage, and whether existing controls are sufficient.

2.2 MISSION FOR THE ENVIRONMENT

The mission which the South African National Antarctic Programme endeavours to achieve in all its activities is as follows:

"It is our mission to protect the Antarctic Environment, its dependant and associated ecosystems, its intrinsic and aesthetic value as a wilderness, and its value as an area for conducting scientific research, in particular research with respect to the global environment."

(Adapted from the Madrid Protocol of October 1991)

2.3 ENVIRONMENTAL, HEALTH AND SAFETY POLICY

The Environmental, Health and Safety Policy which the South African National Antarctic Programme has adopted and shall strive to achieve in all its activities reads as follows:

"It is our policy that the maintenance of a South African presence in Antarctica shall have no permanent negative consequence on the Antarctic environment, that every participant in the SANAP shall, as far as possible, have safe and healthy working conditions in a clean environment and that safety considerations shall take preference over all other activities."

CHAPTER 3

PRELIMINARY ENVIRONMENTAL, HEALTH AND SAFETY MANAGEMENT PROGRAMME

1. MANAGEMENT OBJECTIVES AND TARGETS
2. MANAGEMENT RESPONSIBILITIES
3. EHS MANAGEMENT STRUCTURE ON SITE
4. WASTE MANAGEMENT PLAN
5. CONTINGENCY PLANS
6. EHS IMPACTS REGISTER
7. ANTARCTIC TREATY REQUIREMENTS
8. EHS AUDIT PLAN
9. EHS MANAGEMENT REVIEW

CHAPTER 3**PRELIMINARY ENVIRONMENTAL, HEALTH AND SAFETY
MANAGEMENT PROGRAMME****3.1 MANAGEMENT OBJECTIVES AND TARGETS****3.1.1 PERMANENT ENVIRONMENTAL IMPACTS**

To ensure that South African facilities and activities do not result in any permanent negative environmental impact.

- a) All activities on the construction site shall be executed in terms of this EHSMS.
- b) The site shall be cleaned before and after each building season, and all waste removed to the RSA.

3.1.2 CUMULATIVE ENVIRONMENTAL IMPACTS

To ensure minimum effects of cumulative and synergistic impacts.

- a) Implement the environmental monitoring programme during the construction phase.
- b) Ensure the maintenance of complete records for the entire construction phase.
- c) Implement the environmental auditing plan which shall include audits of the following:
 - i) Organizational structures for the construction phase.
 - ii) Administrative and operational procedures.
 - iii) Work areas, operations and processes.
 - iv) The Preliminary EHSMS, its implementation and operation.
 - v) Compliance to the code of conduct.

3.1.3 ENVIRONMENTAL EDUCATION

To ensure that all personnel and visitors are made aware of the nature and sensitivity of the Antarctic environment.

- a) Ensure distribution of copies of the code of conduct to all participants of the 1993/1994 and 1994/1995 take-overs at the start of the voyages to SANAE:
- b) Implement an environmental education curriculum into all summer and winter SANAE teams' training programmes.
- c) Make all personnel aware of the Agreed Measures under the Antarctic treaty.

3.1.4 WASTE MANAGEMENT

To ensure that all waste is handled in such a way as to have minimum environmental, health and safety risks.

- a) Implement the preliminary waste management programme. This shall cover:
 - i) Construction waste.
 - ii) Human waste.
 - iii) Domestic & kitchen waste.
 - iv) Emissions to the atmosphere.
 - v) Safe areas for fresh water production.
 - vi) The quality of the personnel environment with regards to aesthetic values and health.
 - vii) The safe handling of waste.

3.1.5 PROGRAMME MANAGEMENT

To ensure efficient management of all SANAP activities.

- a) Full commitment must be given overtly to the EHSMS at all levels of SANAP management, and especially at the top level.
- b) Each programme leader shall be held responsible for any EHS impacts resulting from any activity undertaken under his programme, this responsibility is not limited to his own personnel's activities.
- c) All EHS management activities shall be reviewed after each season for efficiency and continued relevance. Any necessary changes shall be drawn up, circulated for comment amongst affected parties and implemented before the next season.

3.2 MANAGEMENT RESPONSIBILITIES

The **Director General** of the DEA is ultimately responsible for the environmental consequences of any actions undertaken under the SANAP. He is also responsible for the health and safety of all participants in the SANAP.

The **SANAP management** are responsible for the execution of the mission, policy and code of conduct in the programme as a whole.

The **DEA Co-ordinator** is responsible for ensuring compliance to the code of conduct by all personnel while on expedition. All leaders, DEA personnel and construction leaders are under the direct authority of the co-ordinator.

The **Consulting Engineer** together with the **Construction Leaders** are in charge of all matters pertaining to the construction activities, and is responsible for ensuring that the code of conduct is adhered to on site by all construction personnel.

The **Environmental Officers** are responsible for monitoring the construction and related activities in terms of the code of conduct and general environmental

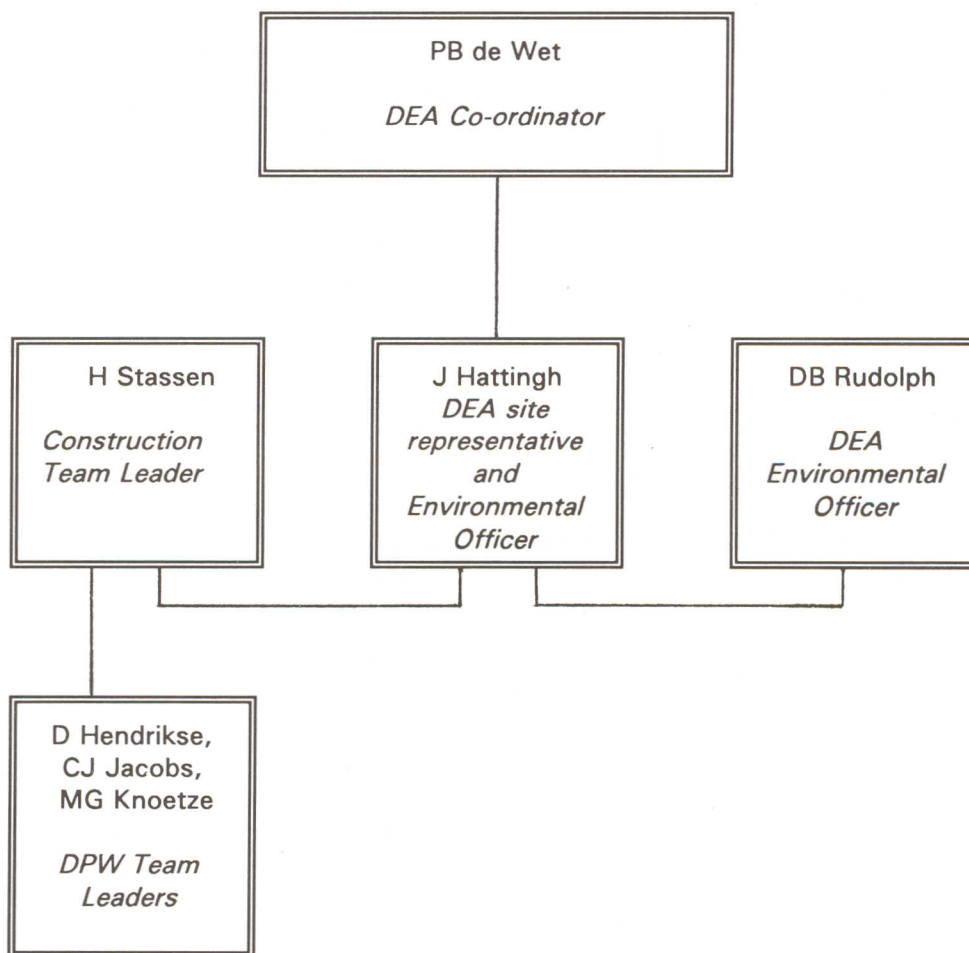
related activities in terms of the code of conduct and general environmental effects. Any formal requests, disputes or non-compliance shall be addressed through the consulting engineer. The DEA co-ordinator shall also be informed of any such matters and shall act as arbitrator if necessary.

A detailed audit report is to be handed to SANAP management by the audit team on return to the RSA. This report shall include the following:

- a list of the original objectives for the audit;
- copies of the original audit sheets filled in on the construction site;
- findings (deficiencies) if any;
- a motivated assessment by the audit team of the degree in which the audit objectives were met; and
- a set of recommendations stemming from the audit.

3.3 EHS MANAGEMENT STRUCTURE ON SITE

Note: This structure will only apply for EHS matters.



3.4 WASTE MANAGEMENT PLAN

3.4.1 WASTE REMOVAL

All waste is to be returned to the ship for removal to the RSA.

Adequate provision for the safe and environmentally responsible handling of waste in the RSA shall be made before the waste arrives in Cape Town.

3.4.2 WASTE CLASSIFICATION

All waste from the construction site and the transport teams shall be sorted, placed in the correct containers and removed to the ship. This shall be supervised by the Household Group Leader.

All waste shall be classified as follows:

- | | |
|----------|---|
| Group 1: | Sewage and domestic liquid wastes. |
| Group 2: | Other liquid wastes, chemicals, fuels and lubricants. |
| Group 3: | Non-metal waste. |
| Group 4: | Metal waste. |
| Group 5: | Radioactive materials. |

Group 3 and Group 4 may be placed in the same containers, as no incineration is to take place.

3.4.3 FACILITIES

Suitable containers shall be placed at strategic points on the construction site in order to facilitate the collection of construction waste.

All human waste shall be sealed in the drums provided.

Site ablutions shall be provided on site.

3.4.4 GENERAL PROVISIONS

All waste which was buried to the north and east of the present construction base during the 1991/1992 take-over period shall be removed and placed in waste containers before any construction activities may commence.

All construction personnel shall be provided with specially constructed belt-type waste bags for use on site, to place all small items such as offcuts, rods, food & sweet wrappers and cigarette butts in.

3.5 CONTINGENCY PLANS

3.5.1 OIL SPILL CONTINGENCY PLAN

This plan has not been completed, and will be distributed at a later stage.

3.5.2 VEHICLE ACCIDENT CONTINGENCY PLAN

- a) All SANAE field trip vehicles working the interior routes shall be equipped with emergency survival gear as described in the field manual. All field trips shall have an appointed leader who shall be responsible for vehicle safety.
- b) In the case of a vehicle accident, the trip leader shall firstly secure the safety of his field party and then send an SOS message to the main base for assistance.
- c) The duty radio operator at main base, on receiving the SOS message, shall immediately inform the DEA Co-ordinator, and shall maintain radio contact with the stranded field party. The DEA in Pretoria must also be notified at this stage.
- d) The DEA Co-ordinator's first priority shall be to return the field party back to the main base, by air or overland .
- e) The rescue party shall be accompanied by a medical doctor if necessary, an experienced technical recovery person and an environmental officer, to make an assessment of the situation.
- f) The rescue party shall be suitably equipped with climbing gear to execute a safe rescue.
- g) As soon as the field party is safe, a technical committee under the leadership of the DEA Co-ordinator shall meet to plan the vehicle recovery.
- h) A suitably equipped recovery team shall be sent out to probe the area if necessary and mark a safe route for the recovery vehicles.
- i) If crevasse fields cannot be safely negotiated, then use must be made of air transport.
- j) The method of retrieval must be decided on by the specific circumstances, and must take environmental, health and safety considerations into account.
- k) At the end of the operation, the DEA Co-ordinator will lead an investigation into the incident, based on reports and evidence submitted by all personnel involved. The findings of this investigation shall be reviewed by the EHS audit team and SANAP management to assess whether changes in the EHSMS are necessary.

3.5.3 PERSONNEL ACCIDENT CONTINGENCY PLAN

This plan has not been completed, and will be distributed at a later stage.

3.6 EHS IMPACTS REGISTER

The EHS Register shall be drawn up on site by the environmental officers during

the 1993/1994 take-over period.

The Register shall be based on the list of possible impacts contained in Tables 1-3 in Chapter 6 of the SANAE IV Draft CEE.

3.7 ANTARCTIC TREATY REQUIREMENTS REGISTER

The Antarctic Treaty Requirements Register shall be drawn up by the environmental officers during the 1993/1994 take-over period.

3.8 ENVIRONMENTAL, HEALTH AND SAFETY AUDIT PLAN

3.8.1 AUDIT OBJECTIVES

The overall purpose of the Environmental, Health and Safety environmental audit is to ascertain whether appropriate care had been exercised throughout the construction phase to prevent environmental impacts. The main objectives of the audit can be described as follows:

- a) Determine and verify whether all environmental requirements, criteria and constraints (prescribed in the EHS Management Plan) have been adhered to during the construction phase.
- b) Determine and verify whether environmental control programmes (for example the code of conduct) have been successful to prevent environmental impacts.
- c) Determine and verify whether remedial and contingency plans have been appropriate and successful to avoid future environmental impacts.
- d) Determine and verify the existence and appropriateness of environmental policies, guidelines and procedures.
- e) Ensure that environmental monitoring and control programmes exist to follow up on remedial and rehabilitation works completed during the construction phase.
- f) Determine whether appropriate departmental environmental policies, guidelines and procedures are in place, understood and adhered to by all relevant personnel, and implemented satisfactorily.
- g) Determine and verify the degree of understanding and implementation of the policies, guidelines and procedures at all appropriate management and operational levels.
- h) Determine whether appropriate and adequate resources (manpower, finances, equipment, etc.) have been allocated to ensure satisfactory environmental management performance.
- i) Establish whether systems for communications, information flow, accident prevention, monitoring and contingency measures are

implemented fully and applied successfully to ensure compliance with the required environmental standards.

- j) Establish whether departmental and treaty standards are achieved in line with compliance requirements.
- k) Determine the quality of operational and maintenance systems for equipment as well as data obtained from monitoring and surveillance programmes for air quality, water quality, waste and land management.
- l) Determine whether appropriate and adequate supporting services are provided and functioning to the required standards of performance.
- m) Determine and verify the degree of integration between environmental management and other operational functions of management such as human resources, finance, safety, technical services and advisory and supporting services.
- n) Determine whether equipment is suitably designed to achieve departmental and treaty environmental standards.
- o) Identify existing and potential environmental risks and liabilities exposed in the investigations, evaluations and verifications, and strengths and weaknesses in all the above.

3.8.2 AUDIT CRITERIA.

The following criteria must be adhered to:

a) Management

- i) Management at all levels must be fully committed to the audit system. They must overtly support a purposeful and systematic environmental audit programme. For example the adoption of high performance standards, the allocation of appropriate resources and actively following up identified weaknesses in areas of performance and recommendations from the audit team.
- ii) The environmental audit must involve a critical examination (investigation, evaluation and verification) of all management, technical and operational issues and, if necessary, identify areas of concern and make recommendations for improvements in performance in order to assist management to meet requirements.
- iii) The information obtained during the audit must be treated as confidential at all times.
- iv) The audit system must not be seen as a policing system, but rather as a self-regulatory tool to improve environmental management performance at all levels. The responsible employees must be assured of the correct intentions of the audit so that the results will be a combined search for solutions to environmental management problems rather than an exercise in apportioning

blame for poor or inadequate performance.

- v) The environmental audit examination must be based on pre-determined, well defined and clearly understood performance standards as contained in the Preliminary EHSMS. These standards must be known to all parties involved in the audit and should be realistically based on what is ecologically and legally required, technically feasible and financially affordable.
- vi) The environmental audit must not come as a surprise to the personnel. The latter should be informed ahead of time in order to enable the base to prepare for the audit, to compile relevant information and documentation, which the audit team may need.
- vii) The audit team must employ well-defined and systematic audit procedures to ensure comprehensive and efficient coverage of all relevant matters.
- viii) All reporting on the audit examinations and findings must be comprehensive and in written form. A clear report, concentrating on factual and objective investigations, evaluations and observations must be presented to the Department.
- ix) The audit is not complete without appropriate follow-up measures. The full value of the audit can only be obtained if comprehensive action plans, which address all the unsatisfactory performance issues, are actively followed up and implemented.

b) Audit team

- i) The audit team must be objective in all its approaches and activities. Members of the team must be sufficiently detached to ensure an objective examination of all relevant issues and facts. Management should continuously monitor the behaviour and actions of the audit team to maintain objectivity in the audit process.
- ii) The audit team members must be professionally competent to ensure a successful audit. They should be well versed in the theory and practise of environmental auditing and they should also be appropriately qualified.

3.8.3 PRE-AUDIT ACTIVITIES

a) Audit team

The audit team consists of:

Mr JL Benadé (Assistant Director, Environmental Impact Management, DEA),
Mrs E Swart (Environmental Officer, Environmental Impact Management, DEA),
Mr JC Agenbach (Assistant Environmental Officer, Environmental Impact Management DEA).

The on-site monitoring team consists of:

Mr DB Rudolph (Landscape Architect: Environmental Rehabilitation, DEA) and
Mr J Hattingh (Engineer, Antarctica and Islands Management, DEA).

b) Audit scope

i) Time

The first information gathering and monitoring phase will last from November 1993 to April 1994. Auditing will take place after the 1993/1994 summer take-over period.

This process will be repeated the following summer take-over period (November 1994 to April 1995).

ii) Technical

The audit process shall begin with a monitoring of compliance to the Mission, Policy and Code of Conduct. The environmental audit shall involve a critical investigation, evaluation and verification of all management, technical and operational issues and, if necessary, identify areas of concern and make recommendations for improvements in performance in order to assist management to meet requirements.

The information obtained during the audit must be treated as confidential at all times.

iii) Geographic

This monitoring exercise and audit shall be confined to the activities involved in constructing SANAE IV. This includes the ship off-loading area, the transport routes to Vesleskarvet, depots on the route if any, and all activities taking place on the entire nunatak. If any extra-ordinary construction related activities occur out of the given areas, then they shall also be included in the process.

The present SANAE III facility will not be included in the process, neither will any logistic or maintenance activities relating to it.

All preparatory work must be completed before the start of the summer take-over period so that the audit team can operate at maximum productivity.

c) Information

The team shall have access to all the information, such as copies of monitoring, maintenance and operational programmes, the results of such programmes and all other physical documents, records, data reports, etc., which could be used to substantiate or verify the status of performance.

3.8.4 ON SITE AUDIT ACTIVITIES.

The audit activities on the site comprises the following five steps:

a) Identify and understand management control systems

Internal controls are incorporated in the EHSMS. They include monitoring and record-keeping procedures, formal planning documents such as plans for prevention and control of oil spills and internal inspection programmes. The audit team should gain information on all significant control system elements from numerous sources through observations and interviews.

b) Assessing management control systems

This involves the evaluation of the effectiveness of management control systems in achieving their objectives. Statutory consents specify the design of the control systems. For example the consent may list specific elements to be included in plans for responding to an oil spill. More commonly, the audit team must rely on their own professional judgement to assess the adequacy of control.

c) Gathering audit evidence

The audit team shall gather evidence to support statements made in interviews and questionnaires and that which is required to verify that the controls do in practise provide the results intended. Team members shall follow testing sequences outlined in the audit plan, which have been modified, if necessary, to consider special conditions at the site. Investigations on site will also assist in giving the audit team an impression of the condition of equipment, protective and containment works, and adherence of personnel to the code of conduct. All of the information thus gathered shall be recorded for ease of analysis, evaluation and verification and as a record of conditions at the time of the audit. Where a control element is found to be deficient in some way, the condition shall be recorded as a "finding".

3.8.5 POST-AUDIT ACTIVITIES.

a) Evaluating audit results

After individual controls have been tested and verified, the team shall meet to integrate and evaluate the results and to assess the significance of each deficiency (finding) in the overall functioning of the control system. In evaluating the findings, which are of primary importance for future action, the team shall confirm that there is sufficient evidence to support the findings and summarise related findings in a way that most clearly communicates their significance.

b) Reporting the audit results

The results of the audit shall be discussed individually with the responsible personnel in the course of the audit. At the conclusion of the

audit, a meeting shall be held with the management to report fully on all results, with particular emphasis on findings, and their significance in the operation of the control systems. The team shall provide management with a written summary of the results, which will serve as an interim report prior to the preparation of a final report.

c) Final audit report

All reporting on the audit examinations and findings shall be comprehensive and in written form. A clear report, concentrating on factual and objective investigations, evaluations and observations shall be presented to the DEA.

The Environmental Officer will prepare a draft final audit report. After the draft has been reviewed by all those in a position to evaluate its accuracy, the final report is prepared and provided to the Director-General.

d) Follow-up: action plan preparation and implementation

The DEA assisted by specialists, if necessary, shall develop an action plan to address all audit findings. This follow-up activity shall take place as soon as possible after the completion of the audit.

e) Audit results report

A concise document summarising the monitoring and audit procedure and the findings should be made publically available.

3.8.6 PARAMETERS THAT WILL BE USED TO MEASURE PERFORMANCE OF THE CONSTRUCTION PHASE.

- a) Organisational Structures
- b) Resources
- c) Policy
- d) Code of conduct
- e) Treaty requirements
- f) Communication
- g) Design
- h) Environmental monitoring
- i) Source monitoring
- j) Incident reporting and rectifying
- k) Contingency plans
- l) Legal requirements
- m) Training
- n) Contractors & personnel
- o) Administrative and operational procedures
- p) Work areas, operations and processes
- q) The EHSMS, its implementation and operation
- r) Compliance to the EHSMS

CHAPTER 4

CODE OF CONDUCT

1. SHIP OFF-LOADING
2. AIR TRANSPORT PROCEDURES
3. VEHICLE TRANSPORT PROCEDURES
4. BASE CONSTRUCTION ACTIVITIES
5. GENERAL PROVISIONS

CHAPTER 4**CODE OF CONDUCT****4.1 SHIP OFF-LOADING.****4.1.1 RESPONSIBILITY**

Overseeing the ship off-loading is the joint responsibility of the ship's Captain and the DEA Co-ordinator, who shall both take cognisance of Marpol 73/78 and the Antarctic Treaty as well as Annex 4 to the Protocol on Environmental Protection under the Antarctic Treaty.

4.1.2 EHS INCIDENTS

In the event of an oil spill or any other environmental, health or safety incident, the Environmental Officer and the Co-ordinator or the most senior DEAI official shall be notified immediately and the appropriate contingency plan implemented.

4.2 AIR TRANSPORT PROCEDURES**4.2.1 PROCEDURES**

Air transport shall be handled according to South African Air Force (SAAF) and Antarctic Flight Information Manual (AFIM) procedures by the DEA Co-ordinator and the Air Force team leader.

4.2.2 FLIGHT PATHS

No helicopter flight paths shall pass directly over Robertskollen, and no landings shall be made at Robertskollen during the construction phase.

4.3 VEHICLE TRANSPORT PROCEDURES (CAT TRAIN)**4.3.1 FROM SHIP OVER THE BAY ICE TO DEPOT AT THE TOP OF THE RAMP**

- a) Only the driver and his assistant may be in the vehicle.
- b) Passengers shall only be transported by open sledge on the bay ice.
- c) No passengers shall travel on the sledges while the vehicles are negotiating the ramp.
- d) No personnel shall be on the ramp at the same time as any vehicle.

4.3.2 DEPOT AT RAMP

- a) A temporary ablution facility shall be set up at the depot. All human

waste shall be stored in a depot and later removed to the ship.

- b) All waste is to be taken to the ship for removal to the RSA.
- c) No materials or packaging of any sort whatsoever shall be buried at the depot or anywhere else.

4.3.3 FROM DEPOT AT RAMP TO VESLESKARVET

- a) Standard driver procedures as per the Barlows training course for SANAE vehicle operators shall be followed.
- b) Only suitably qualified personnel appointed as drivers may operate vehicles.
- c) All waste shall be sent to SANAE III or Vesles for inclusion into the waste management system.

4.4 BASE-CONSTRUCTION ACTIVITIES

4.4.1 CONSTRUCTION MATERIALS DEPOT AT VESLESKARVET

- a) An area shall be demarcated at the present construction material storage site for storage of all construction materials. This shall be done by the Environmental Officers in consultation with the Construction Team Leader.
- b) No materials shall be stored outside of the demarcated area.
- c) The depot shall be removed in its entirety at the end of the construction phase.

4.4.2 WASTE DEPOT

- a) The waste depot shall be placed close to the construction materials depot.
- b) The waste depot is to cater for storage of all waste from construction activities and base operations, including kitchen waste and human waste.
- c) The Household Group Leader shall, in consultation with the Environmental Officers, ensure that all waste is handled according to the waste management plan.

4.4.3 DECOMMISSIONING OF WASTE DEPOT

All items which have been stored in the waste depot and all those that constitute its structure are to be removed for disposal in the RSA in accordance to the Waste Management Plan.

4.4.4 CLEARING

- a) A work area shall be demarcated and all the construction activities are to take place within the demarcated area.
- b) The area to be cleared for base foundation purposes is to be limited to that necessary for the foundation structure and essential vehicular access and manoeuvring for construction purposes.

4.4.5 DUMPING OF CLEARED MATERIAL

- a) All rock material which is cleared shall be dumped in pre-designated areas only, and must be levelled to ensure no snow deposition takes place. This shall be done to the satisfaction of the Environmental Officers.
- b) Vehicular access to the dumping areas must be strictly controlled and only be allowed via pre-designated routes.
- c) The dumping area may only be used for rock, ice and snow cleared from the base foundation area. No materials such as packaging, steel of any description, damaged base components or any other introduced materials may be dumped at these areas.

4.4.6 FOOTPATH FROM THE BASE TO THE SCIENTIFIC HUTS

The smallest area necessary for the construction of the ice-path shall be disturbed. The path shall be less than 1.5 metres wide, and constructed in such a way as to prohibit vehicular traffic.

4.4.7 DRILLING

- a) Health and safety shall be the responsibility of the DPW shift leader.
- b) All drilling components such as broken drill bits, jigs, etc shall be placed in the waste containers provided.

4.4.8 WELDING / CUTTING / GRINDING

- a) All offcuts, waste, used blades, cutting disks and welding rods shall be placed in the containers provided. No introduced materials shall be left on site.
- b) Operators shall ensure that their areas are free of waste after each shift.

4.4.9 PACKAGING

- a) Cognisance shall be taken of Recommendation XV 3, Human Impact on the Antarctic Environment: Waste Disposal, of the Antarctic Treaty and the submission A15/1/2/1/1 dated 1993-09-29 issued by the DEA in the above regard, in the packaging of all materials.
- b) All packaging shall be placed in designated waste containers immediately

after the packaged item has been removed.

- c) Special care shall be taken with packaging such as plastic bags and plastic packaging which can be carried away by wind.
- d) Small items such as strapping and labels shall also be placed in the waste containers.

4.4.10 FUEL HANDLING AND TRANSPORT

All personnel involved with the handling and transport of fuel shall be aware of the procedures laid down in the oil spill contingency plan, and shall possess the necessary level of competence to implement the plan.

4.4.11 FUEL STORAGE

The fuel storage facility shall be placed off all vehicle routes, and shall be afforded vehicle impact protection. The necessary equipment to implement the fuel spill contingency plan shall be in place.

4.4.12 REFUELLING OF VEHICLES

- a) Vehicles shall only be refuelled in pre-designated areas. All spills shall be reported to an Environmental Officer and the DPW Team Leader.
- b) The personnel concerned shall all be in a position to respond to any spill, and implement the oil/fuel spill contingency plan.

4.4.13 VEHICULAR MOVEMENT ON THE SITE

No vehicles shall enter into areas which have been designated as "out-of-bound" areas on the approved site map, unless in an emergency.

4.5 GENERAL PROVISIONS

4.5.1 PEDESTRIAN MOVEMENT

- a) All persons walking on the nunatak shall make themselves aware of the sensitive nature of the area, and shall ensure that no intentional action of theirs shall damage the habitat in any way.
- a) No person shall move outside of the safety handrail, except persons physically conducting extension or maintenance of the safety handrail, provided they are wearing a safety harness at the time.
- a) No person shall enter any of the scientific exclusion areas.

4.5.2 WASTE HANDLING, STORAGE AND TRANSPORT

- a) All waste is to be considered as non-biodegradable. All the waste generated from the base shall be placed in the waste containers provided.

This includes apple cores, cigarette butts, sweet wrappers, etc.

- b) No objects whatsoever shall be thrown over the cliff edge.
- c) All personnel in the ice-ramp and fuel pumping areas shall use the temporary ablution facilities provided. All the waste generated at the these areas shall be removed to the ship in accordance with the Waste Management Plan.
- d) All waste generated in the field shall be brought back to a point where it can be included in the waste handling process.

4.5.3 FRESH WATER PRODUCTION

No person shall enter the area where snow collection is to take place for fresh water production, except for purposes directly related to the production of water. The area shall be monitored daily for pollutants, especially carbon outfall from the electricity generators.

4.5.4 CONSERVATION OF FAUNA AND FLORA

- a) The Agreed Measures and Annex II of the Madrid Protocol under the Antarctic Treaty shall apply.
- b) No feeding whatsoever of birds shall take place.
- c) No collecting of rocks, lichen, algae or moss shall take place unless for bona fide scientific purposes as part of a SANAP approved research programme.
- d) No person shall disturb or damage any portion of the nunatak surface which is not inside a designated construction or dumping area.
- e) The turning over, breaking and throwing of rocks is strictly prohibited.

APPENDIX 1

TERMS OF REFERENCE: ASSESSMENT TEAM

APPENDIX 1

TERMS OF REFERENCE: ASSESSMENT TEAM**CO-ORDINATORS**

Ensure the production and distribution of a draft Comprehensive Environmental Evaluation report regarding the proposed new SANAE IV facility at Vesleskarvet, Queen Maud Land, Antarctica according to the requirements of the Madrid Protocol on environmental protection under the Antarctic Treaty.

Make use of the necessary specialists to draw up specialist reports in this regard.

Assess (evaluate) the potential environmental, health and safety impacts and risks associated with the proposed facility.

Draw up recommendations to SANAP management regarding findings of the CEE.

Receive comments on the draft CEE and produce and distribute a comments and response report.

Fulfil, as far as possible, all the requirements for such a report in the Madrid Protocol under the Antarctic Treaty.

LOGISTICS

Indicate the personnel and equipment needed for each phase of the project.

NEED AND DESIRABILITY

Compile a report explaining the following:

- An historical account of the RSA's involvement in Antarctica.
- Motivation for the RSA's presence and scientific involvement in Antarctica.
- Motivation for the replacement of the present facility, with special reference to environmental, health and safety aspects.
- Indication and motivation for accommodation, workshop, storage, scientific laboratory, and all other areas needed.
- Any other aspect you feel necessary.

SITE ALTERNATIVES

Indicate and explain all site alternatives considered.

Give a detailed account of environmental, health and safety considerations for each.

Indicate and motivate the preferred alternative.

ACCESS AND TRANSPORTATION

Indicate and explain alternative types of vehicles, aircraft and sledges that were considered for use.

Indicate all the access alternatives that were considered.

Indicate and explain the types and volumes of cargo that will be transported. Differentiate between the pre-construction phase, the construction phase, the operational phase and the decommissioning phase.

Give an indication of environmental, health and safety considerations and indicate and motivate the preferred alternative in each of the above cases where appropriate.

PROJECT PHASES

Give a detailed account of all activities which have already taken place, or which must still take place for the planning phase, pre-construction phase, construction phase, operational phase and decommissioning phase.

PROJECT PROPOSAL

Compile a report regarding the different options with regard to structural design philosophy and concepts for the main base (with emphasis on a surface structure versus a sub-surface structure). Give an indication of the environmental, health and safety limitations and/or opportunities of the options.

Give an indication of environmental, health and safety considerations. Indicate possible impacts and mitigation.

Indicate and explain alternative processes that were considered for:

- water supply;
- sewage management, treatment, storage and disposal;
- solid waste management, treatment, storage and disposal; and
- electricity generation.

Indicate and explain alternative materials which were considered for the various components of the facility.

Indicate and motivate the preferred alternatives for all of the above.

SCIENTIFIC PROGRAMMES

Give a detailed account of, and motivation for, all the scientific programmes that are likely to be run at or managed from the new facility, including a description of all permanent outdoor structures required.

Give an indication of environmental, health and safety considerations for each.

POLLUTION - FUEL

State legal and other requirements in terms of international and RSA law, and the Antarctic Treaty.

Indicate and explain fuel transportation and fuel storage options.

Indicate environmental, health and safety considerations.

Indicate and motivate the preferred alternatives.

POLLUTION - EFFLUENT, SOLID WASTES AND EMISSIONS

State legal and other requirements in terms of international and RSA law, and the Antarctic Treaty.

Indicate environmental, health and safety considerations.

Indicate and motivate the preferred alternatives.

GEOLOGY, PALAEOLOGY AND LANDFORMS

Give a general overview of landforms on a regional scale.

Give a detailed account of the landforms at Vesleskarvet.

Give a detailed account of landforms encountered on the route from SANAE III to Vesleskarvet.

Give a detailed geological account of Vesleskarvet, including the stability for construction and possibility of the presence of fossilized material.

GEOPHYSICS

Give an indication of the geophysical nature of Vesleskarvet.

Give an indication of environmental, health and safety considerations.

FAUNA

Indicate the possibility of faunal life on Vesleskarvet and on the route from SANAE III to Vesleskarvet, with specific reference to bird breeding sites.

Give an indication of environmental, health and safety considerations.

Give a value judgement on the conservation value of any finds.

FLORA

Indicate the possibility of plant life on Vesleskarvet and on the route from SANAE III to Vesleskarvet, with specific reference to bird breeding sites.

Give an indication of environmental, health and safety considerations.

Give a value judgement on the conservation value of any finds.

CLIMATE

Give a general assessment of the regional climate with special reference to wind conditions and temperature fluctuations.

Give a detailed assessment of expected weather conditions at Vesleskarvet with special reference to wind conditions.

Give an assessment of possible impacts of the proposed facility on wind flow patterns.

Give an indication of environmental, health and safety considerations.

MAPS PLANS AND SKETCHES

Prepare a location map which shows Vesleskarvet in relation to SANAE III and other bases in the vicinity.

Prepare a regional map which shows all alternative sites investigated and access routes.

Prepare a site plan of Vesleskarvet which shows contours, landforms and special features.

SITE SURVEY

Survey the surface of Vesleskarvet to enable a site plan to be drawn up.

Survey areas of scientific interest or importance if requested.