ANTARCTICA NEW ZEALAND

K001: CAPE ROBERTS PROJECT

1998/1999

K001
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LOGISTICS REPORT

K001:CAPE ROBERTS PROJECT (CRP2)
ANTARCTICA NEW ZEALAND 1998/1999

Event Personnel :

RIDGEN	Jeremy	NZ	Mechanic/Engineer
HOWAT	Brian	NZ	Engineer/Plant Operator
SINCLAIR	Peter	NZ	Carpenter
PYNE	Alex	NZ	Science Support Manager
REID	Brian	NZ	Electrician
KNOX	Murray	NZ	Plant Operator
CONAGLEN	Kevin	NZ	Carpenter/ Field Assistant
CLARKE	Colleen	NZ	Paramedic/ Camp Manager
COWIE	Jim	NZ	Project Manager
ALEXANDER	John	NZ	CRP Liaison Officer
SKINNER	Dennis	NZ	Chef
VARCOE	Kath	NZ	Camp Assistant
BRICE	David	NZ	Field Assistant
BROWN	Steve	NZ	Carpenter
COOPER	Pat	NZ	Drill Manager
HOLLOWAY	Leon	USA (NZ)	DV/Drill Engineer
TANSEY	Frank	NZ	Driller
MACDONALD	Malcolm	NZ	Driller
MARCUSSEN	John	NZ	Assistant Driller
AVEY	Michael	NZ	Assisstant Driller
WOODFORD	Sam	NZ	Assisstant Driller
SYMONS	Todd	NZ	Assisstant Driller
KINGAN	Tony	NZ	Assisstant Driller
COLLIE	Chris	NZ	Assisstant Driller
EATON	David	NZ	Assisstant Driller
ANDERSON	Joanna (Jo)	NZ	Science Technician*
BRYCE	Sonya	Australia	Science Technician*
JACKSON	Nick	NZ	Science Technician*
BUTLER	Edward	NZ	Science Technician*
PLANKELL	Eric	USA	Science Technician*
WILSON	Terry	USA	Scientist*
RAFAT	Nodi	USA (Germ)	Science Technician*
PAULSEN	Timothy	USA	Scientist*
NEISSEN	Frank	Germany	Scientist*
KOPSCH	Conrad	Germany	Science Technician*
POLOZEK	Kerstin	Germany	Science Technician*
BARRETT	Peter	NZ	Chief Scientist*
WEBB	Peter	USA	Science Leader, Crary Lab
POWELL	Ross	USA	Scientist*
WOOLFE	Ken	Australia	Scientist*

ATKINS	Cliff	NZ	Science Technician**
EHRMANN	Werner	Germany	Scientist**
NAISH	Tim	NZ	Scientist
JANACEK	Tom	USA	Core Curator
CURRAN	Matt	USA	Core Curator
SCHERER	Reed	USA	Scientist
BOHATY	Stephen	USA	Scientist
DEVINE	Rusty	USA	Scientist
TABECKI	Mike	UK	Science Technician
KRISSEK	Larry	USA	Scientist
FIELDING	Chris	Australia	Scientist
LAVELLE	Mark	UK	Scientist*
STRONG	Percy	NZ	Scientist
PASSCHIER	Sandra	USA	Scientist
HANNAH	Mike	NZ	Scientist
WILSON	Graeme	NZ	Scientist
ASKIN	Rosie	USA	Scientist
SIMES	John	NZ	Science Technician
MCLEOD	Barbara	USA	Science Technician
WATKINS	David	USA	Scientist
VILLA	Giuliana	Italy	Scientist
TAVIANI	Marco	Italy	Scientist
SMELLIE	John	UK	Scientist
TALARICO	Franco	Italy	Scientist
AGHIB	Fulvia	Italy	Scientist
WONIK	Thomas	Germany	Scientist**
BUECKER	Christian	Germany	Scientist**
BRINK	Jason	USA	Scientist*
SCHOLZ	Erich	USA	Science Technician**
WILSON	Gary	USA	Scientist
SAGNOTTI	Leo	Italy	Scientist
FLORINDO	Fabio	Italy	Scientist
CLAPS	Michele	Italy	Scientist**
SANDRONI	Sonia	Italy	Science Technician
ALBERTI	Mauro	Italy	Science Technician
KETTLER	Richard	USA	Scientist
ARMIENTI	Pietro	Italy	Scientist
MAGGS	Tom	Australia	DV/Enviro. Auditor AADiv
FOX	Jeff	USA (NZ)	CRP Distinguished Visitor (DV)
CARTER	Bob	Australia	CRP Distinguished Visitor
GROBE	Hannes	Ger.(USA)	DV/AWI Core Curator
RAINE	Ian	NZ	Scientist
VEROSUB	Ken	USA	Scientist
HENRYS	Stuart	NZ	Scientist
VAN DER MEER	Jaap	NZ (N/lands)	Scientist
CITA	Maria Bianca	Italy	ISC Member
DAVEY	Fred	NZ	Scientist/ISC Member
TESSENSOHN	Franz	Germany	ISC Member
HUCH	Monika	Germany	CRP DV/Science Journalist
ANDERSON	Ian	Australia	CRP DV/Science Journalist
FUETTERER	Dieter	Germany	CRP DV/OMG Member
THOMSON	Michael	UK	Scientist/ISC Member
ROBERTS	Andy	UK (NZ)	Scientist

Notes:

1. The breakdown of the 93 CRP personnel is:
Support Staff – 13
Drillers – 10
Scientists and Science Technicians - 58
Distinguished Visitors – 12

* Scientists and Science Technicians based at Cape Roberts.
** Scientists and Science Technicians who divided their time between Cape Roberts and Crary Laboratory, McMurdo Station.

CAPE ROBERTS PROJECT – CRP2
LOGISTICS REPORT 1998-1999

INTRODUCTION

1.1. 1998/1999 summer season was the second drill season for Cape Roberts Project and throughout this report will be referred to as CRP2 to distinguish it from the previous season: CRP1 1997/98.

1.2. CRP1 was terminated prematurely when a storm in late October broke up the sea ice near the Drill Site and threatened the safety of personnel and equipment. The drill site was located 15.25 kilometres east of Cape Roberts, over a water depth of 150 metres. A drill depth of 147.7 metres below sea floor (m bsf) was reached with a core recovery rate of 86%.

1.3. CRP1 exposed a number of inadequacies in the drilling system, the most serious involving the sea riser. Some parts of the sea riser (that part of the drill system suspended in the water) had design and manufacturing defects. Questions were also raised about the ability of the sea riser to withstand the strong currents in the drill site area. Another problem was the difficulty of embedding the sea riser in the sea floor. In the off-season significant and costly modifications were made to the sea riser.

AIMS OF CRP2

2.1. The aims of CRP2 were:

- To recover up to 700 meters of high quality rock core from a second drill hole east off Cape Roberts. The core from CRP2 would 'pick up' from where CRP1 core 'left off' (ie. optimally with an overlap of up to 30m) to maintain an unbroken time sequence in the core.
- To conduct drill and logistics operations in an efficient, timely and safe manner.
- To conduct all operations in accordance with the Comprehensive Environmental Evaluation report and thereby minimise impact on the environment.
- To successfully recover enough core to justify a third drill season.

PLANNING

3.1. CRP2 could not have proceeded had the sea riser not been upgraded. Planning for this had begun even before CRP1 had finished as time was short and additional funding had to be approved by the Project partners. The view of the Operations Management Group (OMG) was that CRP2 was the last chance to both prove the drill technology and achieve the operational goal of obtaining a reasonable amount of core. If neither of these goals were achieved then the Project would be terminated.

3.2. **Operational Planning**. The time-line for CRP2 operational planning was:

a. **Ship Resupply January 1998**. The main items of resupply were two 'new' CRP containers (plus rigid sledges) fitted out as extensions to the Rig's mud hut system and the Drill Site Laboratory. All went according to plan.

b. **Post-Season Review**. An International Steering Committee (ISC) meeting was held in Washington in early February 1998 at which sea riser options were discussed. It was agreed the best option was to refurbish the existing riser because of the limited time and funding available. A major study was then undertaken by a US company to determine the existing sea riser's capabilities. From the results of that study modifications followed.

c. **Sea ice Monitoring**. The first DMSP (infared) images were received from ASA by Science Support Manager (CRPSSM) and Cape Roberts Project Manager (CRPM) in early April 1998 and continued regularly from then. Dr Robert Onstott at ERIM also contributed regular interpretive reports on his website. CRPSSM predicted at the end of his April-May sea ice report that a 20 km strip of fast ice about 1m thick had formed off-shore of Cape Roberts. Although it was too early to make longer term predictions, ice formation had begun well. This proved to be the case, and the fast ice along the western coast remained stable for the remainder of the 1998 winter. Sea ice growth was also monitored at the American's ice runway and west of Arrival Heights, and these measurements confirmed what was found when the reconnaissance team travelled to Cape Roberts and then out to the Drill Site in early September.

d. **USAP Assistance**. At the annual Post Season-Pre Season planning meeting held in Denver by the US Program CRP requested US support for hauling the two 'new' containers from Scott Base to Marble Point. Three hundred helicopter hours were requested for the Project, to be equally shared between Antarctica New Zealand and USAP. The Project would also draw upwards of 30,000 litres of JP5 from Marble Point at a time or times to be arranged. All the above arrangements went according to plan.

e. **Staff Recruitment**. In early March 1998 CRPM initiated the CRP2 recruitment round with an 'expression-of-interest' letter and an employment questionnaire to all CRP1 employees. Most of the CRP1 support and drill staff wished to return for CRP2 and information obtained from the questionnaire responses proved useful in revising the contract. On the drill team, one driller from the previous season was not offered re-employment and one other was unavailable, necessitating two new drillers for CRP2. One member of the support team was not offered re-employment and one was unavailable. In addition to the two replacements, a new position was created – Camp Assistant – to take some of the workload off the Project Manager and Camp Manager. The Carpenter's length of employment was reduced to cover the period from September to mid-October. At the end of the drilling phase the Scott Base carpenter was seconded to Cape Roberts to help with the Drill Site and Camp decommissioning. This worked well. Movements Controller, Antarctica New Zealand (Ant NZ) was kept advised of all recruitment information such as addresses, individual contracts, salaries, travel arrangements, medical certificates, clothing forms and the like.

f. **Integration of CRP Scientists into Pre-Season Planning**. CRPM was advised of CRP2 scientists and their dates for flying to Antarctica in early June 1998. Minor changes were advised by the Chief Scientist as he was made aware of them. Movements Controller, Ant NZ was kept advised. The Movements section of Ant NZ was kept advised of all clothing and freight requirements of CRP2 scientists as advised to CRPM. The manifesting of scientists and their cargo went well from Ant NZ's point of view. There were, however, some misunderstandings again with the Italian science contingent who were the responsibility of the US Program.

CRP2 CARGO

4.1. **Winfly 98 Cargo**. A total of nearly 31,700 lbs (14,400kg) of cargo was air freighted at Winfly 98 for the Project. Cargo consisted mainly of drilling equipment (sea riser rigid flotation modules -15,000 lbs - and additional steelwork), food – fresh, no-freeze and short shelf-life items, and science cargo.

4.2. **Mainbody 98 Cargo**. A total of 16,300 lbs (7,400kg) of cargo was air freighted during the season for CRP2. Of this, 6,000lbs (2,700kg) was for specialist drill 'muds'. Another 7,000 lbs (3,200kg) was science cargo, the majority for the two German science teams.

4.3. **Resupply Items**. Nearly 70 orders were raised during the drilling phase for resupply items that individually would have numbered well over a thousand. In terms of prompt delivery, most were important and about a quarter were 'urgent', ie. to replace a used, defective, near-defective or broken part. Fortunately most arrived on time. Timely delivery of over 2.5 tonnes of drill muds was appreciated. Resupply of 'freshies' needs to be looked at - weather delays couldn't be blamed for all the delays.

CRP2 PERSONNEL

5.1. A total of 93 people were on CRP2 in the 1998/199 season made up of:
a. **Scientists and Science Technicians** – 53.

b. **Support Staff** – 13, which included the Project Manager and the Project Liaison Officer (CRPLO).

c. **Drillers** – 10, made up of a Drill Manager, two Drillers and seven Assistant Drillers

d. **Science Support Staff** – five, made up of the Science Support Manager and four Core Technicians.

e. **CRP3 Official Visitors and Media** – 12, made up of three from Australia, one from Britain, four from Germany, one from Italy and three from NZ/USA

f. **Maintenance/Clean-up Team January 2000** – four, made up of CRPM, Electrician, Engineer/mechanic and Engineer/Asst Plant Operator.

5.2. The 'permanent' population at Cape Roberts during drill operations (ie. October and November) was 35, made up of support staff (10), drillers (10), science support staff (5) and scientists (10). The Chief Scientist spent approximately a third of his time at Scott Base/McMurdo.

5.3. The Winfly team of nine was made up of CRPM, CRPSSM, Engineer, Mechanic, Plant Operator, Electrician, Paramedic/Camp Manager, Field Assistant/Carpenter, and Carpenter. CRPM remained at Scott Base until Mainbody, while the remaining eight people traversed to Cape Roberts in two Hagglunds all-terrain vehicles and began setting up the main camp and then the Drill Site camp.

5.4. **Personnel Deployment**. CRP2 personnel deployment to Antarctica was full of disruption. Winfly flights suffered extensive delays and turnarounds. Four flights were scheduled from 20 to 26 August. The first successful flight was on 22 August and the last on 05 September. Because members of the reconnaissance team were delayed CRPM and CRPSSM decided to combine the reconnaissance phase with the set-up phase to make up for lost time. The full support team of eight travelled to Cape Roberts on 02-03 September.

5.5. Mainbody flights from NZ were also heavily disrupted. After a four-day delay the first and second flights made it on 03 and 04 October respectively before another period of delays. Local bad weather then delayed helicopter deployment to Cape Roberts, the first of the drillers not getting there till 07 October, four days behind schedule. A further six day bad-weather delay followed before key Cape Roberts-based scientists and science technicians arrived at Scott Base/McMurdo from NZ. By this time delays in getting some key items of drilling equipment (under-reamer and an electric motor) from NZ were threatening progress on sea riser deployment. Bad-weather and unservicability of aircraft caused delays of up to seven days to the planned drill schedule. However, in reality this was not as serious as it appeared because difficulties in deploying and embedding the sea riser and in establishing a regular coring routine added about six days to the schedule anyway.

5.6. The Crary Laboratory-based scientists and technicians were accommodated at Scott Base and McMurdo Station. Scott Base hosted 17*, made up of one Australian, four British, three Germans, and nine New Zealanders. Every Crary Laboratory-based scientist was encouraged to visit Cape Roberts and overnight so as to gain a fuller appreciation of the field operation. Most availed themselves of the overnight option. (*It should be noted that four of these individuals spent in excess of 10 days each at Cape Roberts.)

5.7. **CRP Distinguished Visitors/Media**. Nominations received for CRP official visitors were:

a. **Australia**:

- Mr Ian Anderson, science journalist, New Scientist.
- Prof Bob Carter, James Cook University, Townsville.
- Mr Tom Maggs, Environment Manager, Australian Antarctic Division.

b. **Britain**:

- Dr Michael Thomson, BAS and ISC member.

c. **Germany**:

- Dr Dieter Fuetterer, AWI and OMG member.
- Ms Monica Huch, science journalist.
- Dr Hannes Grobe, AWI.
- Dr Franz Tessensohn, BGR Hannover and ISC member.

d. **Italy**:

- Prof Maria-Bianca Cita, University of Milan and ISC member.

e. **New Zealand/USA**:

- Dr Fred Davey, IGNS and ISC member.
- Dr Jeff Fox, Director Ocean Drilling Program (ODP).
- Mr Leon Holloway, Drilling Engineer ODP.

With the exception of Leon Holloway all the CRP Visitors came to Cape Roberts in November. An ISC meeting was held at Cape Roberts 10-12 November 1998. Tom Maggs conducted an independent environmental assessment of the Project from 02 –05 November 1998.

FIELD DEPLOYMENT AND FIELD EQUIPMENT

6.1. **WINFLY Deployment August-September**. CRPM was in regular contact with Winter-over Manager in the two months prior to WINFLY detailing the programme and support and resources required from Scott Base. CRP personnel were grateful for the use of the Scott Base garage and cold porch throughout the Winfly period. Scott Base personnel willingly assisted in the loading of sledges and containers. At Cape Roberts the first reconnaissance of the proposed CRP2 drill site was made on 07 September. The ice was 1.8m thick. Steady progress was made on erecting the CR Camp and the first hot showers were taken on the evening of 11 September and the Camp became fully habitable on the 13th.

6.2. Pyne, Howat and Conaglen returned to Scott Base in H1 on 15 September for five days to complete important engineering and scientific tasks before returning to Cape Roberts. Two sledges and two fully loaded containers (additions to the Mud Hut and Drill Site Lab) were loaded and hauled to Marble Point by the Americans on 26 September. They were met there by Pyne, Knox and Howat with the D6, who on-hauled the train to Cape Roberts the following day.

6.3. The normal sea ice route from Scott Base to Marble Point was blocked by a large active west-east crack that extended across McMurdo Sound from the Strand Moraines and finally swung north to near Tent Island where it petered out. The USAP sledge train had to head north almost to Tent Island before it could make westward progress. The route from Marble Point to Cape Roberts was reasonably straightforward but three cracks had to be bridged for safe travel by the D6. The preferred sea ice route to the Drill Site was to the north of Cape Roberts (5kms) before 'turning' the CR Crack and heading ESE. The route was 25kms long and passed through a couple of patches of rough ice which slowed progress (after a helicopter reconn in early October changes were made to the route to avoid the worst of the rough sections).

6.4. The support team at Cape Roberts spent the second half of September establishing the Drill Site camp. The two ice holes were drilled on 08 September to enable deployment of the under-ice flotation bags and then the start of the sea riser deployment.

6.5. **Mainbody Deployment/Redeployment October-December**. The first of the Mainbody crew - drillers and the remaining support staff - arrived at Scott Base on 03 October, and at Cape Roberts on 07 October, having done an Antarctic Field Training refresher course. Helicopter support remained 'patchy' for the next week or so, mainly due to unsettled weather. Regular shift change helicopter operations began on 16 October. The regular and smooth movement of personnel and cargo through Scott Base (and McMurdo) to Cape Roberts was the responsibility of the CRP Liaison Officer. His role was pivotal in the successful deployment and then ongoing movement of personnel and cargo between Christchurch, Scott Base/McMurdo and Cape Roberts.

6.6. Redeployment of personnel and science cargo to New Zealand went reasonably smoothly, in spite of an apparent lack of bed space at Scott Base and the threat of a lack of seats on aircraft returning to NZ, especially after the closure of the ice runway. Most of the drillers, the science technicians and some of the Cape Roberts-based scientists were able to return to Scott Base via a planned night-over at Vanda – a small reward for all their efforts.

6.7. **Field Equipment**. Relative to the size of the Project and the large number of personnel at Cape Roberts, only a small amount of field equipment was drawn from Scott Base stocks. In keeping with the Project's policy of 'self sufficiency' wherever possible, CRPM instituted CRP-owned light weight survival bags for people taking the shift change helicopters. Not only did these bags reduce weight and time for helicopter operations, they took considerable pressure off the limited supply of Scott Base survival bags. Scott Base-supplied field equipment was requisitioned in the normal manner and returned to store at the end of the season.

6.8. **Scott Base Equipment**. Throughout the drill season requests were made to Scott Base (and occasionally McMurdo) for the loan of specialist tools or the use of urgently required consumables such as plumbing and mechanical parts. These items were gratefully received and returned (and in some cases replaced) as soon as possible. The reality of the situation is that a Project the size of Cape Roberts, being conducted in a reasonably remote location, cannot hope to stock spares for every eventuality or have extensive repair facilities.

TRANSPORTATION

7.1. **Christchurch-McMurdo Air Operations**. The early part of the 1998/1999 season was disrupted by bad weather and CRP suffered delays in personnel and freight arrivals. Although frustrating and inconvenient at the time these early delays did not adversely affect the outcome of the drilling and science operation. At the end of the drill season there was concern expressed by Project management that unnecessary pressure was applied from Scott Base to finish early and have personnel 'off the Ice' before the ice runway closed. The threat of 'not getting home till after Christmas' was exaggerated and added to the already stressful task of making CRP2 a success. All Project personnel returned to NZ on or about the dates originally planned.

7.2. **Cargo**. Refer to CRP2 Cargo, Para 4 above, for cargo details. Overall the movement and delivery of cargo went well, especially so given the high amount air freighted (some 46,000 lbs ex Christchurch) and the often short notice to purchase and deliver. There is room for improvement in the way urgent cargo is tracked from NZ to Cape Roberts and better ways of doing this will be instituted for CRP3. CRPSSM was critical of the delay and damage done to science cargo that was returned to NZ after the drilling phase eneded. It seems the problem here is that when CRPLO departs Scott Base there is something of a vacuum created and 'loss of ownership' and CRP equipment can be overlooked. Hopefully CRP3 will plan for this.

7.3. Both German science groups (Niessen and Wonik) on the Project brought radioactive sources as part of their science cargo. Both scientists reported that this administratively sensitive cargo was moved smoothly through 'the system'. Niessen elected to leave his low grade source in storage at Cape Roberts until CRP3, thereby saving a good deal of paperwork.

7.4. **Helicopter Operations**. In CRP2 a total of 228.7 hours were flown of the 300 hours allocated. Of that, 217 hrs were flown in the drill operations phase, and the remainder in the January-February maintenance and winterisation phase. **Refer to Appendix 1 for a breakdown of helicopter hours by week**. The Project was well served by both the RNZAF and PHI. After some exuberant flying by RNZAF pilots on CRP1, the more measured approach by this season's RNZAF crews was appreciated by those who rode helicopters daily to work. CRPM was particularly appreciative of the effort by the RNZAF crews to back-load trash to Scott Base.

7.5. **CRP Vehicle Fleet**. The CRP2 vehicle fleet consisted of two Caterpillar bulldozers, - D5 and D6 models, a Kassbohrer PB 170 equipped with a Hiab crane, four Bombardier skidoos, a 4 x 4 Honda motorbike and two Haaglunds all-terrain vehicles. With the exception of the Haaglunds and the Honda motorbike all the other vehicles were wintered-over at Cape Roberts. The Honda motorbike arrived at Cape Roberts in late September on the sledge train to replace the unreliable ASV (all seasons vehicle) Track-Truck which was returned to Scott Base at the same time. Vehicle serviceability was generally good throughout the drill season. During the maintenance phase all vehicles were serviced. The skidoos are 'showing their age' and will require increased servicing to see out CRP3 and the clean-up year. A major job was undertaken at Cape Roberts in January when the right--side pivot shaft on the D6 was replaced. This involved the removal of the tracks, the blade and the track roller frame to access the worn shaft. It would not have been possible without the heavy lift capability of the Hiab crane on the Kassbohrer.

EVENT DIARY

8.1. **Refer to Appendix 2 for an outline event diary and Appendix 3 for the CRPSSM's report covering drilling and science events and issues pertaining mainly to the Drill Site operation.** The CRPM wrote daily situation reports (Sitreps) throughout the drill operation phase of CRP2. These recorded movement of personnel to and from Cape Roberts, daily weather, sea ice conditions, personnel welfare and drilling progress. The Sitreps are not reproduced in this report but can be accessed through Ant NZ records if required.

HEALTH AND SAFETY

9.1. No member of the CRP2 team suffered any serious illness or injury while in Antarctica. At Cape Roberts there were only minor injuries reported; eg. two strained backs, various muscle strains, a wrist injury and a welding burn. There were a couple of cases of cold/throat infections and a passing 24 hour-type flu, but fortunately that is where it ended.

9.2. **Paramedic/Camp Manager Position**. Colleen Clarke assumed the role of Paramedic/Camp Manager and immediately made her mark in both positions. First-aiders were identified and trained for emergencies at the Drill Site. First aid equipment was reorganised and new kits made up for each skidoo. Personnel feeling unwell or with a minor injury could approach Colleen with confidence. Colleen took an active role in the weekly staff safety meetings. She was also responsible for health and safety in the Camp, frequently making suggestions for improvements. And finally she tested the Camp's water supply daily for its pH level and weekly for bacteria count. The water was 'dosed' with sodium bicarbonate to maintain an optimal pH of between 7.8 and 8.2, as recommended by Ant NZ's water expert, Tim Donaldson of Ace Water Treatment Ltd. All bacteria counts were negative during the season. In mid-October a water sample was sent to Tim Donaldson in Christchurch for more specialised analysis of impurities such as copper and lead. Levels of these substances were either non-existent or well within acceptable levels.

9.3. A member of the Cape Roberts team who suffers from a potentially communicable disease was self administering injectable medication. Both CRPM and Paramedic were aware of this and suitable disposal arrangements for the used syringes were made. However, through an oversight the Scott Base medical office was not aware and became alarmed when used syringes were found in a rubbish bin at Scott Base. The individual concerned acknowledged a lack of forethought on his part but in his defence said there was no obvious 'sharps container' and he didn't know who to see about such a facility. This incident highlighted the need for better communication and access to medical files by all who should be 'in the loop' in such a case.

9.4. **Safety Meetings**. Weekly safety meetings were held throughout the drill operation phase. The pattern that worked best was the Drill Manager conducted a Drill Site meeting of all day shift personnel on a Friday. Notes from this meeting were given to the CRPM who then conducted a second meeting at CR Camp on the Saturday involving all night shift and support staff (not otherwise at the Drill Site meeting). Notes from both meetings were then posted on the noticeboard in the Warm Vestibule for everybody to read. Feedback from these meetings was positive, and the information useful. The key to the acceptance of the meeting format was the 'no blame' theme – people were there to learn, discuss and propose alternatives, and not to lay blame.

9.5. **Incident Reports**. CRPM filed three incident reports to Manager Scott Base during the drill season. All were classified 'near misses'.
a. The first occurred when a pillion passenger on a skidoo fell off when the skidoo went over an obstacle. Speed nor carelessness were not at issue, except that the passenger wasn't holding on well enough. The real danger was a sled was being towed behind the skidoo and the passenger was lucky not to be struck or run over by it. Thereafter no passengers were to travel on skidoos towing a sled.

b. The chef was very lucky to escape serious fat burns when there was an 'explosion' of boiling fat from the CR Camp's deep fat fryer. This was caused by a build up of water in the fat from repeated cooking of water-logged parboiled potatoes. The chef should have recognised the danger.

c. A party was caught out on the Wilson Piedmont in a white-out when returning to CR Camp from a climb of Mt England. They were travelling with two skidoos and trailers and had all necessary survival gear. The leader of the group of five was an experienced climber and had three seasons Antarctic experience. He elected to push on, got off the route and didn't stop until the party had become thoroughly disorientated. Camp was made but not before they discovered they had ventured into a crevassed area. The weather lifted about three hours later and they safely returned to Camp. This incident raised a number of important issues regarding field safety and leadership.

COMMUNICATIONS

10.1. Three communications facilities were available to CRP2. They were telephone links utilising 'Country' sets, HF radio and VHF radio. HF and VHF radio provided only voice communication, while the telephone system provided voice, data and facsimile transmission. There were three distinct communication phases during CRP2 – Winfly (September), drill operations (October-November), and close down/maintenance (December and January). The operational phase was the only one which had all communication facilities functioning. The total communications suit was only just adequate during the main operational-science phase of CRP2. At times, because of unserviceability, interference and overload the communication system was variously criticized as limited, cheap, ill-conceived, user-unfriendly and stress inducing.

10.2. HF radio, using 5400kHz, was only used on the Winfly traverses to and from Cape Roberts when the vehicles lost comms on VHF. Thereafter it was there as a radio of 'last resort' in an emergency.

10.3. VHF radio was the workhorse of the communications system, particularly between CR Camp and the Drill Site and between vehicles and the two camps and Scott Base. The majority of the VHF sets (some 15 including vehicle radios) were supplied from Scott Base stock. The base stations at both camp sites are CRP-owned. Performance during the Winfly period was excellent once the Piedmont VHF repeater (behind Cape Roberts) had been installed. However, it did deteriorate as the season progressed and at various times Channels 3 and 5 were being constantly interchanged in search of better performance.

10.4. The telephone system consisted of two lines – line 1 was set up once the Piedmont repeater was activated at Winfly and provided a reliable if static voice line to Scott Base and the world. The second line was transmitted through an intermediary repeater on Hoopers Shoulder, Mt Erebus. This could only be activated in early October once helicopter flying began. The quality of this line for most of the time was suitable for voice, data and facsimile transmission. It was, therefore, in high demand. Not only was the demand on it too much, data and facsimile transmission could easily and inadvertently be cut because of the way the system was configured at CR Camp.

10.5. As drilling progressed one of the most serious limitations of the communications system became increasingly apparent – there was no 'private' link, namely a telephone or scrambled radio link, between the Camp and the Drill Site. CRPSSM and the Drill Manager grew increasingly reluctant to discuss drilling issues and decisions on 'public' VHF radio and this adversely affected the working relationships in the on-site management team.

10.6. The CRP communications system had limitations and some criticism was justified, but in mitigation it should be remembered that:

- the system was conceived in 1994 with a negligible budget,
- in 1994 it was not appreciated how much all personnel on the Project would utililise phone, data and facsimile facilities if they were made available, and
- based on the mid-1980s CIROS experience nobody expected the drilling to be as difficult and demanding as it was on CRP1 and CRP2, necessitating good quality and private communications when frequent 'hard' and sometimes debatable decisions had to be made at short notice by the management team.

ENVIRONMENT REPORT

11.1. The CRP2 Environment Report is attached as Appendix 4. Note that this report is submitted to Ant NZ's Environmental Manager who in turn incorporates it in the annual environmental return to EARP. The Environment Report contains Appendices on person-days and visitors at Cape Roberts and a hazardous substances report.

Jim Cowie
Cape Roberts Project Manager

May 1999

Appendices;
1. CRP2 Helicopter Hours 1998/1999 Season.
2. CRP2 Event Diary.
3. CRP2 CRPSSM's Report dated Feb 99.
4. CRP2 EOS Environment Report dated Feb 99.

CRP2 HELICOPTER HOURS 1998/1999 SEASON

To Week End	10-Oct	17-Oct	24-Oct	31-Oct	7-Nov	14-Nov	21-Nov	28-Nov	5-Dec	12-Dec	16-Jan	23-Jan	30-Jan	TOTAL
Projected	35.0	35.0	25.0	25.0	25.0	25.0	30.0	30.0	30.0	30.0	5.0	2.5	2.5	**300.0**
Actual	7.8	24.1	26.7	25.4	31.8	22.9	28.5	29.5	24.0	4.1	1.2	1	1.7	**228.7**
Difference	-27.2	-10.9	1.7	0.4	6.8	-2.1	-1.5	-0.5	-6.0	-25.9	-3.8	-1.5	-0.8	**-71.3**
Accum. Diff.	-27.2	-38.1	-36.4	-36.0	-29.2	-31.3	-32.8	-33.3	-39.3	-65.2	-69.0	-70.5	**-71.3**	
TOTAL	7.8	31.9	58.6	84.0	115.8	138.7	167.2	196.7	220.7	224.8	226.0	227.0	**228.7**	

NOTE: CRP2 helo hours are shared equally between Ant NZ (K001) and USAP (S-049).

CRP2 1998/1999 EVENT DIARY

Appendix 2 to
CRP2 Log Report
dated May 1999

DATE	EVENT
22-Aug	Howat, Ridgen, Sinclair arrive Scott Base (SB) ex Chch. Begin preparations for reconn.
31-Aug	Clarke, Conaglen, Knox, Pyne, Reid arrive SB.
1-Sep	Cowie arrives SB.
2-Sep	Support team of eight depart SB in H1 and H2; overnight near Butter Point.
3-Sep	Support team arrive Cape Roberts (CR) 1500 hrs.
5-Sep	First containers/sledges hauled off CR.
7-Sep	Conaglen, Pyne reconn drill site area - ice 1.8m thick; water depth 178m; DS at S77.006 E163.719. Temperature at SB reaches -50C.
11-Sep	Utilities containers set up and first hot showers.
13-Sep	CR Camp fully operational; Conaglen, Howat, Pyne depart CR for SB overnighting MPt.
21-Sep	A heavy sledge route is finally determined SB to MPt via Tent Is.
22-Sep	Conaglen, Howat, Pyne depart SB for CR overnighting at MPt.
25-Sep	Conaglen resigns as Field Assistant/Carpenter.
26-Sep	Americans depart SB for MPt hauling 4 CRP sledges (2 Challengers & Delta). Howat, Knox, Pyne depart CR for MPt in D6 and H2 with crack-bridging sledge (ASV on board) to rendezvous. Overnight MPt and return CR following day. Three cracks to bridge.
29-Sep	First Mainbody flight cancelled.
3-4 Oct	All 10 drillers, Holloway and remaining support staff (3) arrive SB ex Chch.
5-Oct	Sea ice at Drill Site now 2m thick.
7-8 Oct	CRPM, all drillers plus Holloway, two support staff, three divers (ex McM) arrive CR. Two 1m diameter holes drilled in sea ice and two air bags positioned in water under rig. Conaglen departs CR for SB and NZ.
9-Sep	Sea riser deployment begins.
14-Oct	Core technicians arrive and Sinclair (CRP Carpenter) departs CR for SB and NZ.
15-Oct	Embedment of the sea riser into the sea floor begins. Brice arrives CR ex SB W/O to replace Conaglen as temporary Field Assistant.
16-Oct	First core recovered.
18-Oct	Cementing-in of sea riser a failure and repeated. All of CR 'permanent staff' now in residence.
20-Oct	Holloway departs CR for SB and NZ. Ackerly and Single (TVs Wild South programme) arrive to film Project.
24-Oct	50m bsf reached in CRP2 hole. James Barker USAP photographer arrives to photograph Project.
25-Oct	While attempting to further embed the sea riser the under-reamer is temporarily 'lost' in the hole.
26-28 Oct	Brice, Cowie, Howat, Knox depart CR for MPt fuel run, returning with 164 full drums.
28-Oct	Sea riser further advanced to 12.2m bsf and again cemented-in. New hole now CRP2A.
30-Oct	50m bsf reached in new CRP2A hole. Growing concern at high rate of mud fluid loss. New mud ordered, in all 2,625 kg (1,000 kg each of XCD Poly and PAC-R and 625 kg Guar Gum).
31-Oct	Icetrek Expedition visits CR Camp and DS with TVNZ film crew.
2-Nov	100m bsf reached, core recovery rate improving and reduced loss of fluid. Independent environmental monitor, Tom Maggs, arrives with Ant NZ Enviromental Manager.
3-Nov	150m bsf reached. CRP DVs Carter and Fox arrive at CR with CEO Ant NZ.
5-6 Nov	A successful 20 hour down-hole log conducted to depth of 172m bsf.
6-Nov	Brice departs CR for SB and NZ.
7-Nov	HQ coring stopped at 199m bsf and HQ rod cemented-in.
10-Nov	200m bsf reached. Coring recommenced using NQ rod.
12-Nov	250m bsf reached.
13-Nov	Cita, Davey, Tessensohn, Thomson, Webb (all ISC members) and Fuetterer (OMG member) arrive.
14-Nov	300m bsf reached. Borg (NSF), Anderson and Huch, CRP visiting journalists arrived.
16-Nov	350m bsf reached. Cowie, Pyne depart CR for SB to attend combined ISC/OMG meeting.
17-Nov	400m bsf reached.
18-20 Nov	Howat, Knox, Reid depart CR for second MPt fuel run; returning with 158 full drums. A fourth crack had to be bridged en route.
20-Nov	450m bsf reached. Horizontal drift of ice from over hole 9m - margin remains acceptable.
21-Nov	500m bsf reached. Italian TV film crew (3) arrive ex TNB for overnight filming.
22-Nov	Hydraulic chuck replaced with mechanic chuck due to failed bearings.
23-Nov	550m bsf reached. Noticeable ice melt occurring at drill site and at CR transistion.
24-Nov	600m bsf reached. Decision taken to end coring 25 Nov to allow down-hole logging.
25-Nov	Drilling stopped at 1420 hrs at depth of 624.15m bsf. Steve Brown, carpenter, arrives CR from SB.
26-29 Nov	Down-hole log conducted to bottom of hole. Tool stuck in hole at 441m bsf on 27th. Tool abandoned on 28th and final log done of upper hole. Party time at CR for 42 pers.
30-Nov	HQ rod cut and recovered and CRP2 hole cemented. Scientists and drillers begin to depart CR, some via an overnight at Lake Vanda.
1-2 Dec	Sea riser recovered. Outer casing successfully cut with CDC charge. Divers assisted.
1-4 Dec	Drill Site decommissioned; all elements returned to CR, except one stuck under-ice 5t air bag.

CRP2 1998/1999 EVENT DIARY

5-10 Dec	CR Camp decommissioned by team of 7 support staff.
11-12 Dec	Support team return to SB in H1 and H2 overnighting MPt.
13-Jan-99	Howat, Reid, Ridgen arrive CR for maintenance/winterisation work. The 5t air bag, abandoned at DS in December is recovered.
22-Jan	Cowie arrives CR.
25-27 Jan	Ant NZ's Environmental Mngr at CR for monitoring work. Soil and water samples 'clean' of hydrocarbon contaminants.
29-Jan	Maintenance team depart CR for SB and NZ.

Appendix 3 to
CRP2 Log. Report
Dated May 1999

CAPE ROBERTS PROJECT : Report on CRP-2 drill hole (1998), with comments on plans for CRP-3

by
A R Pyne, Science Support Manager
February 1999

Introduction.

This document is primarily a report on the CRP-2 drill site operation and the science support manager's responsibilities during October - December 1998, but includes comments that may be useful for drilling CRP-3 in 1999.

Section 1 of this report is structured to provide a brief background on previous relevant drilling experience in the area, and to show how preparations for the Cape Roberts Project drilling have evolved. Notes on drilling aspects of CRP-1 and CRP-2 are presented to show the lessons that have been learned and how these have been developed to achieve the scientific drilling goals. Notes on scientific support for the drilling operation, including the winter sea ice remote sensing, are also presented, with comments on CRP-3 preparations for 1999. Preliminary notes have been presented to the ISC meeting, Rome, February 1999.

1. GEOLOGY - DRILLING STRATEGY

1.1 Background - The CIROS- 1 experience.

The drilling programme for CRP was based primarily on drilling experience and conditions found at CIROS- 1 in 1986.
The CRP drilling programme adopted a sea riser and two coring drill string option in comparison to the three coring strings used at CIROS- 1. An increase in maximum operating water depth from 200 m at CIROS- 1 to 500 m for CRP sites was the main constraint in developing the current sea riser system. Cost and the belief that drilling could be successful with only 2 coring strings, HQ and NQ, led to the adoption of the present system. It was assumed from the sea floor conditions at CIROS-1 that 10-20 m of relatively soft Quaternary sediment could be washed through, and that the underlying older lithified strata would be suitable for embedding the sea riser to a depth of at least 20 m bsf with under-reaming techniques.

Drilling equipment purchases (drill rod etc) were based on the drilling strategy of four holes up to 500m deep in water depths of 150 -500m as outlined in the CRP Workshop Report of December 1992. Mike Blong (Baroid, New Plymouth) analysed the CIROS--1 mud usage and developed a simple mud programme for CRP. Drill rod, sea riser and drill fluid products that were expected to be sufficient for all four holes were supplied in December 1994 for the January 1995 ship off-load at Cape Roberts.

Our Experience in 1997 while drilling CRP-1 identified inadequacies in the riser system designed and supplied by Austoil NZ Ltd. These were remedied for CRP-2 with a detailed engineering study of theoretical riser performance, improved deep-water rigid flotation and a sophisticated air bag tensioning system at the top of the riser. A new "off the shelf" two arm under-reamer was also purchased to assist riser embedment. CIROS-1 found no significant down hole fluid over pressure problems although traces of methane were analysed and a bitumen residue found in sandstone.

The drilling of CRP-1 showed that the Quaternary sediment was more than twice as thick as expected from the available seismic survey data, and much more time was spent on seating the sea riser than had been planned. As a consequence it was decided that it was unrealistic to expect to have the time to drill two 500-m-deep holes in a season, and that we should instead set a single 700-m-deep hole as a goal. The drilling of CRP-2 has confirmed the wisdom of this view. A consequence of this decision has been that, following ODP advice, fluid control hardware has been procured for low over-pressure conditions (<1500 psi). For drilling below 500 mbsf this calls for the H casing string to be set in impermeable strata and cemented to withstand down hole pressures.

1.2 CRP-1 and CRP-2 - Results and Lessons

Drilling CRP-1 and CRP-2 has now proven that the good CIROS- 1 drilling experience was anomalous even taking into consideration that at CIROS- 1 we had the advantage of 3 rotary/coring drill strings. CRP drill holes thus far are probably more representative of the drilling conditions over much of the Antarctic shallow continental shelf. We now have to expect:

- Sea floor surface sediments consisting of unconsolidated young [Quaternary?] glacial diamicts, possible enriched in clasts, and even clast supported. Unlithified muddy/sandy matrix. Unknown thickness but likely to be between 20 and 50 metres. Embedding the sea riser in such sediments to a depth of around 20 m bsf is a slow and difficult process and likely to take around 10 days of the 45 day drilling window. This time includes cementing the sea riser, though experience indicates this is worth doing only when it has been fully embedded (i.e. at least 12 m bsf). Experience also shows that these sediments can be cored some tens of metres ahead of the sea riser once it is supported a few metres into the sea floor.
- CRP-1 and the upper part of CRP-2 were younger than expected (16-20 instead of 28-30 Ma). Some strata were poorly lithified, and included soft running sands. These sediments are normally difficult to drill, recover quality core and maintain a stable hole. The problem is compounded when these strata are windowed to the sea floor up-dip [shown by down-hole logging in CRP-2], allowing almost complete loss of drilling fluid and also the incursion of sea water at depth causing uncompacted sands to fluidise. The zones of most concern in the older strata were at ~ 80, 120, 160, 270 and 460 mbsf. Two of the zones lay below the cemented H casing, which had been cemented at 200 m bsf. Tests indicated that the casing was not set deep enough to provide adequate control for over-pressured fluids.

CRP-2 had minor inflammable gas shows detected by the gas monitoring system on two occasions which only lasted a few minutes each. No effervescence was observed in the core on these occasions or at other times and the gas shows were considered minor and transitory Of more concern, however, is that the well returned significant volumes of drilling fluid when the inner tube was pulled to recover the core. On only one occasion did the returning fluid appear to be cut with other down-hole fluid. A pressure test showed that at the initiation of flow the locked in fluid pressure was in order of 160 psi and minor flow was still evident after 36 hours of down-hole logging. It was not clear at the time if this effect was a result of gas pockets or due to the formation relaxing after expansion caused from drill fluid pressures during the coring process. We are seeking advice from other experts familiar with slim-hole coring in gas-bearing sediments, but for the moment we need to consider the possibility of closed gas pockets that may exist up-dip in the formation.

Under ice buoyancy for CRP-2/2A. The two five tonne air bags were deployed under the sea ice below the Drill Rig with the assistance of Crary Lab Divers. About 9 tonnes of buoyancy was applied under the 17 tonne drill rig and this maintained the freeboard in the ice hole to 180 mm (210 mm when unloaded) by the end of drilling. No buoyancy was applied under the Mud Hut complex which is also a significant load especially when the mud tanks are full (about 9 tonnes) and at the end of drilling this freeboard was reduced to less than 100 mm. Both air bags have been recovered but will require an improved mooring system to prevent freeze-on under the sea ice and facilitate recovery at the end of drilling.

Sea Riser & Under-reamer for CRP-2/2A. The two new flotation systems of the refurbished sea riser worked well this season. The syntactic "foam" rigid floats provided reliable service this season. Cracks were observed in a few floats immediately after arrival in Antarctica at WINFLY, when they were subjected to rapid temperature change from the aircraft to lower than minus 40 degrees Celsius, but these did not appear to cause any failure during deployment. The floats were assembled in 4 unit modules and 7 modules deployed on the sea riser at the CRP-2 site. On one or two modules the clamps appear to have slipped during operations but this did not adversely affect the riser operation.

The new inflatable flotation also performed well and enabled precise control of the tension in the riser even when the riser was not anchored into the sea floor. Both flotation systems will require minor modification for operations in 1999.

The riser was initially embedded into the "hard" sea floor to a depth just over 6 m bsf by slow drilling ahead with a 4 inch roller bit and 100% loss of drill fluid to the sea floor. The sediments appeared to be a clast-supported diamict with a soft dark grey muddy matrix. At this point two attempts were made to cement the riser, but the cement did not set up properly on either attempt, and we continued to core ahead to 57 m with minimal top tension on the riser. There was 100% loss of drill fluid thoughout most of this period.

The initial purpose of coring was to provide a better understanding of the strata we were drilling so that the two armed under-reamer could be deployed, but this also provided useful core from the youngest sediments for the science community. Coring was slow, but good recovery was achieved (70%). It should be noted that with this slim hole drilling system that down-hole progress is generally as fast by coring as drilling with a roller bit even with the drill collars that were hired specifically for the roller bit drilling.

The riser was bumped down with the main winch to where we thought we had clast-poor sediments that were suitable for deploying the under-reamer. The process of bumping down the riser is very slow as you are using the hardened riser shoe to cut clasts only millimetres at a time and also flush out the cuttings to the sea floor. The under-reamer was deployed but became disconnected from the drill string even though the standard preparation and torquing up of the tool was carried out. It is still not clear how disconnection occurred but probably resulted from the combination of the following

- clasts in the sediment causing intermittent cutting,
- the two arm design which could experience high torque down hole,
- the API thread which only requires 3 1/4 turns to make up and store rotary energy ("twisting") in the HQ drill string.

The under-reamer was however recovered after some very careful work by the drillers.

In the process of embedding the riser by the bumping down procedure we found that the scanned images of the core obtained from drilling ahead to be an extremely useful tool to help plan the embedment. We now know that we can drill by rotation in the riser for a time with minimal top tension while coring ahead. Coring ahead is vital to plan the embedment process, and bumping the riser into the sea floor appears to be the only reliable way to penetrate clast-rich sediments near the sea floor without redesigning the lower part of the sea riser and using down hole hammer techniques.

Cementing.

The initial cementing operations were not successful. Previous cementing in CIROS- 1 and

CRP-1 appeared to work satisfactorily, but none of this cement had been cored to confirm that cementing techniques and setting times were appropriate. Expert advice and cementing references had suggested that we would need to use high concentrations of Calcium Chloride accelerator in the cement for low temperatures. However, our situation was more complex than the "textbook examples" because we are also using sea water containing Sodium Chloride which is also an accelerator. We also knew that high concentrations of both accelerators can react as a retardant and or weaken the cement
At the time of the first cementing attempt for CRP-2 we therefore had not been able to confirm that the theoretical cementing techniques and previous cementing attempts were working properly at sea floor temperatures of -1.8 degrees Celsius. Placement of the cement was carried out with proprietary cementing plugs directly within the riser for the first two cementing attempts. We hoped these plugs would speed up the operation but the plugs were unsatisfactorily in the modified riser string. The third cementing of the sea riser at about 13 m bsf appeared to work, although we could not positively confirm this by recovering strong cement core.

The cementing of the HQ drill barrel at 199.31 m, where down-hole temperatures were theoretically +5 degrees Celsius worked well, with several metres of hard cement recovered. This confirmed that the cement/accelerator mix was appropriateand indicated maximum setting times. A long setting time was deliberately allowed for this primarily because it was vital that the HQ barrel landing ring and diamond coring bit were locked firmly in place to be successfully drilled through with the NQ drill string. Major delays could have occurred or even hole abandonment if drilling out of the barrel was not successful. However, even with this latest CRP-2 experience we still do not have positive confirmation of the setting times required for initial cementing at the sea floor at - 1.8 degrees Celsius.

Down Hole Logging.
The down-hole loggers had two opportunities to log parts of the hole. They were not allowed access to the uppermost 60 m of hole because this part had already shown itself to be unstable, with some of the hole drilled twice. In the first logging session in the upper part of the hole (HQ-96 mm hole) the loggers were requested not to use their radioactive source tool in case this was lost. It is common practice in many countries not to allow a radioactive tool in an open hole. Loss of this tool could have meant the early abandonment and cementing of the hole because fishing operations could have been hazardous.

In the second logging session (NQ-75.7 mm hole) all tools were available for use at the loggers' discretion but unfortunately the hole became bridged around 440m after running some of the tools to the hole bottom then running the calliper tool. This was the first bore hole wall contact tool, and it's use presumably caused the bridge to form. The Drilling Manager and Science Manager agreed to attempt to try to clear the bridge with wire line tools. We were not prepared to re-run the NQ drill string and chase the bridge which could have meant re-drilling the lower 200m of hole because this could have taken several further drilling shifts. The Drilling Manager pointed out that even running the wire line tools in an open hole represented a risk because the tools would be operated below the casing. Subsequently the wire line tools and much wire line were lost down hole and two days were spent in clearing the hole to 130 mbsf. . We now have confirmed that the current wire line and winch used for the normal core inner tube recovery is inadequate for the operation of the ODP piston and Shelby soft sediment samplers. The remaining deep logging tool runs were now restricted to the middle third of the hole. Further bridging restricted the VSP study to the interval above 130 m bsf. The VSP logging was then treated as an experiment with 24 shots fired in marginal blowing snow conditions. The initial VSP results appeared to be good, although smaller charges will be required for data acquisition in the upper part of future holes.

At the end of the logging the HQ casing was cut and recovered, exposing about the upper 60 m of hole for logging that was obscured by casing in the first logging session. Most of this part of the hole immediately bridged, confirming the original drilling decision not to expose this part of the hole for logging prior to cementing the HQ casing. I believe that the drillers were impressed with the professionalism of the down-hole logging operations. Of minor concern was the time that some tools remained at the bottom of the hole where they were susceptible to being sedimented in. I think that the down hole logging was very successful considering the unstable nature of a major part of the CRP-2 hole. In retrospect, the attempt to clear the bridged hole was a mistake but the other decisions to allow access to only the stable parts of the hole have been proven correct.

CRP-2 Site completion. The drilling plan called for coring to cease on November 23, allowing for 2 days of logging, 5.5 days for returning the drilling system to Cape Roberts, and 7 days for breaking down the camp and storing on Cape Roberts. This presumed a normal ice year in which heavy plant could move safely on the sea ice until the first week in December. In 1998 down-hole progress was much slower than expected early in the season. With the hole 200 m short of the target depth on November 21 and down-hole progress at 30 m/day, it was decided that drilling could be continued a little beyond the schedule date.

The timing of the cessation of drilling was decided by the on-site project management after a new projected time scale was developed primarily by the Science Support Manager and Drilling Manager. Several factors were taken into account :

- Down hole logging requirements
- Sea ice conditions at the drill-site including observations of surface ice conditions.
- Horizontal Sea Ice Offset
- Sea ice conditions on the supply route and the transition onto Cape Roberts
- Time required to complete the Camp Recovery and storage on Cape Roberts
- Aircraft availability for all returning CRP personnel to Christchurch

By the time the drill site was abandoned significant surface melt had occurred in the immediate vicinity of the Drill Rig and Mud Huts primarily due to the reflection of sunlight of the buildings. After the removal of the drill rig it also became apparent that the ice platform immediately under the drill rig was in very poor condition and had been strongly corroded by accumulated minor spills of salt rich drill fluid. We took extreme care in the operation of the heavy plant close to the drill site area during site abandonment. The surface prediction of the timing of surface melting is extremely difficult but can occur within a period of 2-3 days during warm temperatures and bright sunlight. We also hope to reduce the quantity of spilt drill fluid that accumulates around the drill rig in the future with better capture proceedures..
Sea ice offset was evident from the angle of the sea riser at the surface by 18 November, when a chain hoist was fitted to the top of the riser (Annular Diverter) to reduce the angle at the entry point of the NQ drill string. At this time horizontal ice offset from spud-in was 9 m. By the time coring finished on November 25 the offset was at least 11 m and some difficulty with rotation was evident during high current flow. This offset is about 6% of water depth and corresponds well with the latest engineering study and this can now be used to predict part of the system's operational constraints.

The transition route onto Cape Roberts had become flooded with sea water in the tide crack zone by 22 November. Other less suitable routes were available but these crossed more highly fractured ice in the 30-m-wide tide crack zone. The nature of the sea ice and ice foot transition at Cape Roberts varies from season to season which can influence the timing of flooding, melting and cracking and it's safe use.

1.3 Science support of the Drilling Operation

Satellite imagery.

- DMSP. Infra red weather satellite images were processed and supplied primarily by Andy

Archer of ASA HQ. Denver every few days throughout the 1998 winter months when good cloud-free images were available. These images have a spatial resolution of about 500 m per pixel and are useful for providing a history of the fast ice limit through the winter, thus allowing a judgement to be made on whether the sea ice is likely to be suitable for drilling in the spring.

-RADAR SAT. A series of these images were processed and made available to CRP by Bob Onstott, ERIM Michigan in 1998. These images have a resolution in the order of 35 m per pixel and are used to determine the WINFLY reconnaissance sea ice routes to Cape Roberts and drill sites areas. The timing of the successful acquisition of these images can be a problem but they were once again available at the beginning of the WINFLY period. I believe that with GPS navigational control data now to hand that future images will become an even better navigational tool vital for the early season sea-ice reconnaissance operations.

Drill Site Science operations

- Submarine Video. The umbilical of the video camera system was stressed and damaged this season. The system has a vital role in the sea riser embedment process and subsequent monitoring of the riser and sea floor as drilling proceeds. It is not clear at this time if the umbilical can be reliably repaired or if it will have to be replaced. Some other minor repairs will be required for 1999 operation including the building of umbilical/guide wire separators to reduce the risk of future umbilical damage.
- Gas Detection. The sensors for this system will require calibration and minor changes made including a new larger gas sampling line with a heated section installed to reduce freezing problems and false readings. The current system detects both inflammable and hydrogen sulphide gases and does not distinguish the composition of the inflammable components. The current system is sufficient for the safety of the drilling operation and records gas events along with weather data at the drill site. If more sophisticated gas analysis is proposed I would consider this as a scientific study not required for general safety and drilling operations.
- Core processing. Core processing and packaging worked well, with the split core- tube sections being used succesfully for retaining the integrity of unlithified or crumbly core when boxed. Minor modifications are planned for the core splitting saws. Consumables including plastic splits for soft core and diamond saw blades will have to be restocked for 1999. We hope to be able to package all CRP 3 core in plastic splits to reduce core damage and improve handling proceedures at the Crary Lab and core repositories.
- Core orientation tool. This tool will require some modification to operate reliably at the bottom of a deep hole. The tool was only run once this season and damaged the core face at the bottom of the hole so that orientation marks were not recorded and the tool did not trigger. It also requires good hard core that is later continuously cored without loss and this is hard to predict. The deployment of this tool poses a problem in that it requires someone with time and appropriate skills to operate but more importantly requires a dedicated wire-line trip each time and so competes with coring time. I am aware that this allocation of time and the tools operation was not resolved well in 1998 and we intend to improve this in 1999 in conjunction with other experiments related to the in-situ stress studies- Core scan images. These images were provided as a service to the project by Dr Terry Wilson's group and were invaluable at the drill site especially during the process of sea riser advancement. The scanned images provide an immediately useable product that conventional photography cannot. The scanned images will also be reproduced in the initial reports.
- GPS surveying. The GPS surveying of the drill site position in general went very well. A real-time correction signal was broadcast from the temporary Cape Roberts Hut Base Station (CRHBS) for the initial navigation and site selection during the WINFLY period. Subsequently all data was post processed against CRHBS data to give drill site positions with errors normally less than 0.5 m for sea ice offset calculations. The base station computer developed an intermittent fault during November resulting in three days of non-processable data at the end of drilling. This computer will have to be replaced for future

work.

1.4 CRP-3 in 1999 - Scientific and Drilling preparations

- Satellite imagery. The same level of service and supply of product that was achieved in 1998 will be required for the analysis and prediction of any planned drilling season in 1999. The first Radar Sat images hopefully can be supplied by 1 August and navigation control will be improved.
- Currents. We collected a good suite of current data near the expected CRP-3 site. This data will be worked on in the following few months and will be used to help refine the drilling strategy for the CRP-3 hole.
- Riser Deployment. We now have more confidence in operating the riser with minimum top tension for short periods and are prepared to core ahead as a matter of course to assist riser embedment. We expect to use the main winch bump-in method to embed the riser into clast-rich sediments and plan to use a more robust riser cutting shoe. The use of the two-arm under-reamer is not necessarily ruled out but appropriate strata will be required if its deployment is considered. The proper embedment of the riser is still paramount to achieving good down-hole progress. The available embedment techniques are limited and relatively slow but have now been shown to be successful. CRP-3 will be in deeper water, about 350 m, and although we have gained valuable experience in 1998 we should expect drilling operations to take about the same time as for CRP-2. - Drilling prognosis. CRP-3 should begin coring in the time equivalent of the lowest 200 m of CIROS- 1 then into strata of unknown facies and age. In general we can expect the formation to increase in hardness, but circulation was lost in a conglomerate at the base of CIROS-1, and we should expect intervals of circulation loss deep in CRP-3 also. Increase in the expanding clay content of the strata can be expected as we drill into the warmer conditions of the Eocene. This will require maintenance of the potassium content of the drill fluids to avoid expanding clay-induced problems down hole. The drill fluid programme planned for CRP-3 is based on the consumption of fluid in CRP-2/2A and will consist of basically the same mud compositions.

DRILL SITE OPERATIONS and MANAGEMENT

by
A R Pyne, Science Support Manager
February 1999

2.1 General Comment

The operation of the CRP-2 drill site which includes drilling/science support and scientific programmes worked well most of the time. I believe that the major part of the success of CRP-2 is due to the crew of highly motivated and experienced drilling, science and project support staff working at the site. Drilling is normally an unpredictable task and this is made even less predictable in this area of Antarctica where each new hole we drill has to be considered as a wild cat. Decisions on drilling operations which usually affect the entire drill site operations and routine must often be made at very short notice and this is a fact that project operators, scientists and support organisations have to accept.
Support staff provided excellent service in the running and maintenance of drill site services and supplies including fuel, drill fluid supplies and drill rod. Some of the drill fluid components were flown from New Zealand and these arrived at the drill site by helicopter but any lack of supplies on site did not stop drilling at any time.

2.2 Drilling/Science Liaison.

This season the drilling group and the science group worked well together at the drill site. Drilling decisions and options were discussed regularly (hourly) between the Drilling Manager (DM) and Science Support Manager (SSM) and changes in operations undertaken after consultation. When a major decision was required (eg casing) then options and strategy was discussed at the drill site then presented to the Chief Scientist and Project Manager for discussion and agreement.

Communications between the management at the Drill Site and Camp were difficult at times due in part to the lack of a secure phone line between the two sites and the long hours worked by personnel at both sites left little time for meeting after shifts. We are not prepared to detailed drilling discussions by public radio. A phone line of electronic data quality is requested to connect the two sites possibly via Scott Base to improve communication and daily reporting.

The high workload of the management personnel at the drill site is also of concern and a assistant Science Support Manager is proposed to share the drill site management and science support roles. I hope that this new position will also improve our ability to allow the core technicians a day off every two weeks.

2.3 Personnel.

Drill site personnel worked 12 hour shifts on site and normally had a 13 to 14 hour work day when the shift change transport (Helo/Hagglund) is added. After routine drill site operations had begun the long work day meant most drill site personnel were tired when returning to camp and usually weren't able to partake in after work recreational activities. The uncertain nature of the day to day drilling operation also means that planned recreation was usually difficult for drill site personnel. However it was disappointing that they were often forgotten while personnel at the camp were able to go on trips and I believe moral suffered.

The experienced drill site personnel understand and accept the uncertain nature of drilling operations and would normally expect to work through the drilling period without planned time off. To try and force the drilling programme and personnel with a rigid time off plan is unrealistic as it would require extra personnel and training and I believe could seriously compromise the drilling and drill site science operation. It is therefore very important to have a commitment to a recreational programme in place for drill site personnel once all drill site activities are completed. Many of the drilling and science personnel take pay cuts to come to Antarctica and are attracted not only by the challenges of Antarctic drilling and science but they are also interested in other aspects of the Antarctic environment. To send them home without wider antarctic opportunities would be unacceptable. The recreational opportunity that was available in the Wright Valley after drilling I believe was well received by those who could take advantage of it and similar opportunities will be required in the future.

2.4 Catering.

The quality of food provided to the drill site for mid shift meals was generally poor and much of the food was returned to the camp uneaten. In my experience the drill site food was generally of a lower standard that that available at the camp for the same meal times. I believe the reason for this was some food stock were of poor quality (saveloys, old pork chops etc) but also that the Camp's professional chef was uninspired. When the chef had a day off (and left early) the food quality at the drill site improved immeasurably when prepared by Colleen and Kath and replacement cook Leslie.

2.5 Drill Site Visitors.

I did not keep records of the exact number of people who had the opportunity to visit the drill site but I believe it was in the order of 80 to 90 during the coring phase of the drilling and included most of the Crary Lab science group. Both the drilling manager and myself agree that visitors to the drill site are an important consequence of the Cape Roberts Project but I wish to point out that visitor activities were never a planned part of the drill site operations. I think the extent of the visitor program came close to compromising our ability to maintain to the normal routine (especially in the science lab) and respond to any drill site problems on some days. It was disappointing that those people responsible for planning visitor programmes in the ANZ office did not discuss their intentions with management of the camp and drill site in a timely fashion (pre season) and appeared to act as if the visitors took precedence without any consideration to the possible impact to the drilling operations. This season I believe most visitors had a good impression of the entire drill site operation due to the programme that the DM and SSM provided but carrying this out cut heavily into our time. This programme contained the following:

- Visitors were only acceptable during the day shift when both DM and SSM were on shift. Visitors were not acceptable at shift change when personnel hand-over was a priority and when core was readied for transport. Any visitors arriving on shift change helos arrived last and usually were requested to wait in the mess/area until either the DM or SSM were available to brief them, initially on safety issues and drill site etiquette.
- The DM and SSM normally personally conducted drill site tours so that expert opinion could be provided on all aspects of drill site operations and that hazardous areas and drill site etiquette could be pointed out. Visitors who stayed for longer periods were encouraged to look around after the "official tour" and many remarked that they understood much more detail of the drill site operation after observing the operation in their own time. Visitors received the better experience when coring was taking place so that core recovery, core processing and the science routines could be observed.

2.6 Shift change - Helos and Hagglunds.

In the initial set-up and decommissioning periods prior to and after the continuous 24 hour drill site operations the Hagglunds were used to move personnel to and from the drill site. We could improve the efficiency and reduce the stress on personnel during these short periods in the future by using helos and this should be planned for at the beginning of the season.

When the routine 24 hour operations began helos were used for most shift changes except on the few occasions when the weather conditions did not allow flying. During these times Hagglunds were used on an established road but unfortunately the road surface conditions were drifted up because of the bad weather and a trip to the drill site often took in excess of 1.5 hours, hence shift changes were late and drill site personnel quickly became further fatigued. The project should investigate procuring a snow drag that can be towed behind the Hagglunds so that a raised snow road can be constructed and maintained that is less susceptible to drifting. Normal travel of Hagglunds to the drill site during non shift changes by support staff should be sufficient to maintain the snow road once constructed by heavy plant.
An ice road for heavy plant and sledge traffic should be maintained nearby using the same flag route marking.

2.7 Drill-site Lab and Operation

This season's improved Drill-site Lab set-up and operation generally worked very well. Some operations are still a bit cramped but tolerable (core physical properties measurements) but there is no room for further activities. It was noticeable that the day shift suffered greater disruption to the routine primarily due to visitors (see above) but personnel generally coped remarkably well. For details of 1999 requirements/purchases etc. see appendix 1 to this report.

2.8 Cargo to and from the Drill Site and New Zealand

The documentation accompanying cargo needs to be improved so that in the coming season a updated file of drill site cargo and supplies can be maintained by the Science Manager. This is required for equipment and supplies arriving both from the camp and cargo arriving by helicopter from Scott Base.

The movement of cargo from New Zealand to Scott Base and onto the drill site was generally handled well but serious delays and potential damage occurred at Scott Base when cargo was being returned to New Zealand. Even after specific requests from the CRP Liason Officer cargo still remained in the garage another two weeks because of inaction by the stores system. When this valuable and fragile scientific equipment finally returned to Wellington it was contaminated with transparent plastic pellets, sand and ash of unknown origin. I am concerned that the CRP Liason officer has to do many tasks personally that would normally be done by Scott Base staff servicing any of the New Zealand field programs.

2.9 Drill Site Environmental Audit

Fuel, oils and lubricants.
No fuel spills during transfer of drums from Aalener sledges to refuelling Hagglund sledge and pumping into Generator, Drill Rig and Science Lab holding tanks. JP8 and Mogas Herman Nelson hot air machines were refuelled at the equipment pumped from a 209 litre drum and plastic Jerry cans.
Waste oils, primarily from routine generator and drill rig oil changes stored in a 209 litre drum in the Italian tent.
Minor hydraulic connector leaks on the rig floor were captured in the underslung tarpaulin and fluid transferred to a waste oil drum. This tarpaulin could be improved by getting a new one cut to position beneath the rig floor and so it would interfere less with tidal monitoring

attached to the sea riser.

Explosives.
Twenty four Anzomex P explosive primers (0.5 kg each.) with detonators were fired beneath the sea ice for the Vertical Seismic Profiling experiment on 30 November. Seal observations in the drill site area were made daily from the shift change helicopters and seals investigated if within 2 km of the drill site. Lone seals were noted on 10 November 1.4 and 1 km North West of the drill site but they had left after two days. A single seal was noted on 23 November 0.6+ km south of the drill rig and remained less than 24 hours. All seals did not have ice holes when investigated and were transient. No seals were observed in the drill site area on the 7 days leading up to the VSP experiment.
A explosive cutter was used to sever the sea riser casing at the sea floor in 178 m of water on 01 December.

Chemicals.
Up to 2 litres of food grade glycol was used in gas detection system. Most of this was recovered on decommissioning the site and consigned to the waste oil containers.
No chemical consumables are used in the laboratory operations. The radioactive sources installed in the core logging equipment and used during down-hole logging were used routinely without incident and transported from the drill site after use.

Drilling Cuttings
Sediment recovered from the drill fluid by centrifuge and sediment rich sea water from the Laboratory core cutting saws and sink was dumped on the sea ice 50 m west of the Lab. Some cuttings and minor spilled drill fluid from the centrifuge were returned directly to the sea via the sea ice access holes.

Sea Floor Impact
Drill fluids and cuttings and grout (cement) reached the sea floor during the riser installation to 6.25 m bsf, coring ahead with HQ to 57.5 m bsf and a second riser installation to 13 m bsf. After the second riser installation no drill fluid or cuttings were observed with the submarine video that exited the annulus around the riser at the sea floor. A flat cone of cuttings and cement was created on the sea floor that was less than 5 m in diameter and 0.6 m high with an approximate volume of 1.25 cubic metres.
During this phase of riser installation and HQ coring ahead a volume of 300 cubic metres of drill fluid was used comprising 17.5 tonnes of biodegradable dry mud products that was dispersed into the sea water at the sea floor. Cementing the riser used 2.2 tonnes of dry cement to mix 1.1 cubic metres of grout that was distributed in the annulus around the riser to a depth of 13 m bsf and in the sea floor cuttings. Drill fluids used after installation of the riser and sealing at the sea floor annulus were not observed exiting the sea floor in the video system field of view and were presumed to be lost to the formation.

Drill Fluids CRP-2/2A
Total drill fluids used: 600 cubic metres (38 tonnes of biodegradable dry products or inert mineral products [mica and barytes).
Total cement fluid grout 1.385 cubic metres (2.64 tonnes of dry product).

Casing and hole completion
HQ casing (with barrel assembly later drilled out) was cemented at 199.3 m bsf. This casing was cut off around 70? m bsf [confirm with drilling manager's report] leaving approximately 130 m of casing cemented in the well. The cut off HQ casing was with- drawn to expose the formation above 70? m bsf for down hole logging but immediately bridged at the 25 m and probably collapsed down to the casing cut off.
The hole was sealed above 25 m bsf with 165 litres of grout on December 1?
The sea riser casing was cut off about 1-1.5 m bsf leaving approximately 12.5 m of casing

cemented below the sea floor.

Drill Fluid spillage.

Spills were minor in 1998. This is not a environmental problem as this material comprises sea water and biodegradable products. In the colder part of the season spills on the sea ice surface froze and were shovelled up and either dumped through the ice hole or taken to the surface dumping area or reused if the product was clean. The problem is that later in the season when ice temperatures have warmed the saline enriched fluid is corrosive on and penetrates the sea ice causing premature weakening of the sea ice structure. We should consider ways to capture/divert spilt drill fluid in the cellar floor area to maintain the integrity of the ice directly under the drill rig.

Appendix 1

Cape Roberts Project: Equipment Modifications and Development and Purchases.

1. SEA RISER

1.1 Tungsten insert cutting shoe. (Drill Manager)
1.2 Riser Sea Floor packer?? (Drill Manager)
1.3 Air bag airlines replace with new 14 mm tubing and supply blanking fittings. (ARP to spec.)
1.4 Annular Preventer horizontal tensioning. Trolleys to run on drill rig platform columns. (ARP design)
1.5 Drilling ice hole melting. Permanent freeze-in rigid glycol ring (ARP design)
1.6 Fit filter to compressed air line before regulator to prevent intermittant regular operation.

2. UNDER ICE BUOYANCY

2.1 14 mm Airlines and blanking plugs.
2.2 New mooring straps. Check existing bags in Chch. (ARP to design, CRP purchase).
2.2 Mooring tubes. Through ice pipes of s.steel/polythene with bottom V pulley for rope and air line guides. Eight required. (ARP to design, CRP purchase).
2.4 Electrical 2 m long heating probes to free mooring tubes. Eight maximum. (ARP design, CRP Electrician)
2.5 Air Bags under Mud Hut. Discuss.
2.6 Filter in air line before regulator in Generator container to prevent regulator failure.

3. GAS DETECTION

3.1 Calibrate sensors (Auckland suppliers) (ARP to arrange, CRP Pay))
3.2 10/12 mm airline to replace 8 mm between glycol trap and Generator Container. Run airline in glycol loop insulated cover. (CRP Purchase)
3.3 Heat trace Glycol trap head, insulated head cover (snowfoam /velcro and canvas), heat trace and insulate 4 m of exposed air line. (ARP design, CRP Electrician)
3.4 Push in fittings to convert from existing 8 mm line. (ARP to design, CRP purchase).
3.5 Replace incompatible Y2K laptop computer for Science Lab Gas Readout and data storage. (ARP to spec.)

4. SUBMARINE VIDEO SYSTEM

4.1 Access damage to umbilical (ARP to arrange WHO pays?)
4.2 Repair/Purchase new umbilical (WHO PAYS?)
4.3 Normal maintenance of equipment (ARP, VUW MWksp)
4.4 Umbilical - guide wire separators (ARP design, CRP?).
4.5 Repair/Replace B&W Drill Floor Monitor and environmental enclosure (CRP).
4.6 Purchase new tapes. (CRP)

5. CORE ORIENTING TOOL

5.1 Pressure Transducer Housing design/build (ARP/EWB design, VUW MWkshp).
5.2 Pin impression type head, design/build (ARP/EWB design, VUW Mwkshp).
5.3 Software modifications (ARP/EWB)

6. CORE SPLITTING SAW

6.1 Modify core clamping rails to centre blade. (ARP, VUW Mwkshp).
6.2 Replace blade shafts with stainless steel bearings.
6.3 Purchase diamond saw blades @ 75 m/blade (ARP/CRP).

7. GPS SURVEYING

7.1 Y2K (486+) required for Community Base Station at Cape Roberts Hut.

7.2 Real Time Correction Signal - Compatible with any new Vehicle GPS units purchased and RTCM 104 compatable.

8. DRILLING

8.1 Down hole wire line cutters. Crimp and charge type for wire line.

8.2 Modify HQ fishing tool with HQ box? [tool was put in VUW cargo.]

8.3 Modify Bull Ring slips? [slips were put in VUW cargo.]

8.4 Van Routh plugs for cementing open hole sections to be drilled out later.

9. SCIENCE LABORATORY

9.1 Paper towels consumed @ 2 packs per 24 hours.

9.2 Core splitting blades, allow 80 m of drill hole each (10 x .065 x 5/8 inch).

9.3 Replace two hand pump garden sprayers (sea water corrosion and used for other purposes - contaminated during decommissioning).

9.4 Four Lab-distinctive Tape Measures, 8 m quality/coated for better performance for sea water exposure.

9.5 Plastic core splits for boxed core. The core repository has requested that all core be boxed with splits.

Alex Pyne
CRPSSM

CAPE ROBERTS PROJECT – CRP2
1998/99 ENVIRONMENTAL REPORT

INTRODUCTION

1. The Project operated in the Cape Roberts (CR) area from early September 1998 to the end of January 1999. This period can be divided into four distinct phases:
a. **Set-up** – September; during which the support team of eight deployed the main CR Camp and DS Camp onto the sea ice in preparation for drilling. The main activity during this period was hauling all buildings, equipment and fuel off CR and setting up the two camps. The team arrived at CR by Hagglunds all-terrain vehicles and lived on CR for eight nights until the main Camp was assembled and habitable. Later in the month they began deploying buildings and equipment to the Drill Site after a safe route was surveyed. This is a phase of the Project where environmental 'incidents' can easily occur because of the extreme cold temperatures adversely affecting both machinery and people. The period was incident free.
b. **Drilling Operations** – October and November; during which drilling and core recovery was undertaken and up to 46 people – support staff, drillers, scientists and visitors – were at CR. High levels of activity and occupancy sum up this phase. Drilling was a two-shift around-the-clock operation and, weather permitting, shift changes were done by helicopter. There was also a significant amount of travel done over sea ice, moving people and supplies between CR, the Main Camp and the Drill Site. Two sledge train trips were made to Marble Point to obtain more fuel. During this phase, mainly in November, some 100 people visited the Project.
c. **Decommission** – early December; during which a support team of seven returned all equipment and buildings to CR for storage. Drillers and scientists returned to Scott Base soon after drilling finished leaving the support team to decommission the Main Camp and store all buildings, sledges and fuel on CR. This was an eight day operation. The support team returned to Scott Base by Hagglunds vehicles.
e. **Maintenance and Winterisation** – January; during which a support team of four carried out essential equipment maintenance and winterisation of all plant and buildings on CR. Environmental monitoring and sampling was done during this period.

2. Unlike the previous season, this season for CRP went very much to plan – the key to this was thick stable sea ice. The set-up phase went very smoothly and efficiently. The drilling got off to a slow start mainly because of the difficult nature of the strata, but at completion a depth of 625 metres below-sea-floor was reached with a very high percentage of core recovered.

3. From an environmental perspective the CRP 'season' was also highly successful. **There are no 'environmental incidents' to report.** Once again all people involved in the Project demonstrated a high level of environmental awareness and responsibility. This was confirmed by the independent environmental review carried out in early November by the Environmental Manager for the Australian Antarctic Programme. As in previous years, Antarctica New Zealand's Environmental Manager also made working visits to the Project as part of ongoing environmental monitoring.

CRP PERSON-DAYS

4. CRP personnel first arrived at CR on 04 September 1998 and the last departed at the end of the drilling operations phase on 11 December. At the beginning and end of this phase **93 person-days** were spent living on CR, while the main Camp was set-up and then taken down. A total of **2,130 person-days** was spent at the main CR Camp, the majority in October and November. **The average occupancy rate at the sea ice camp from 13 September to 07 December was 25 persons per night.**

5.The 'maintenance and winterisation' phase on CR extended from 13 to 29 January 1999 with a total of **60 person days** and **an average occupancy rate of 3.5 persons per night. Refer to Appendix 1** for a breakdown of person-days during the 1998/99 Season.

VISITORS TO CAPE ROBERTS DURING 1998/99 SEASON

6. A record was kept of non-CRP visitors to Cape Roberts during the drilling operations phase. **Refer to Appendix 2** for a breakdown of visitors and main places they visited. However, Appendix 2 does not include CRP scientists based at the Crary Laboratory, McMurdo Station. The majority of these scientists, about 22, visited both the main Camp and the Drill Site and most overnighted at CR. About 30 Scott Base and McMurdo personnel (most not recorded in Appendix 2) were given the opportunity to visit the main Camp on shift change helicopters during the season. Maximum ground time of about 45 minutes meant they were restricted to the Camp.

7. **Of the 81 'visitors' listed in Appendix 2, 26 of them were official Project visitors or specialists – media, Distinguished Visitors (DVs), environmentalists and divers**. These people all overnighted at CR, usually for two or more nights. The remainder was predominantly DVs, media and senior NZ and US officials whose visits were usually no more than two to three hours.

8. In summary then, some **85 persons** not directly associated with the Project visited CRP. Most did not overnight and the average length of stay would have been about two hours. About a third of these visitors only visited the CR Camp for a short time – long enough for a quick tour and a cup of coffee.

ENVIRONMENTAL INCIDENTS

9. There were no 'environmental incidents' observed or reported to the Project Manager or the Science Support Manager (responsible for Drill Site area) during the operational phases of the Project for the 1998/99 season.

AMENDMENTS TO THE CRP COMPREHENSIVE ENVIRONMENTAL EVALUATION (CEE)

10. Two amendments to the CEE were approved prior to the 1998/99 Season. They were to use an additional drilling 'mud' and to use new rigid buoyancy on the Sea Riser called Syntactic Foam.

a. **Guar Gum Drill Mud**. Guar Gum is an organic polymer extracted from lima beans. It is used in drilling as a viscosifier to shore up an unstable drill-hole formation. This season 1.25 metric tonnes of Guar Gum was pumped down the hole, along with other 'muds' appoved by the CEE. The Guar Gum was successfully used and no problems were experienced with it.

b. **Syntactic Foam Floats**. One hundred of these floats were transported to CR in September and the majority was fitted to the Sea Riser casing (four to a 5.5m length of casing). In an effort to avoid impacts, abrasion and damage to the floats that might result in material contaminating the sea ice or sea, a sledge with specially designed 'stocks' was used and special handling techniques were developed at the Drill Site for the floats. All were successful. Close inspection of the 28 floats deployed on the Sea Riser for CRP2 (hole) revealed no damage, abrasion or chipping of the Syntactic Foam.

FUELS, OILS & LUBRICANTS (FOL)

11. No FOL spills were reported to or observed by the Project Manager during the season, either on CR or the sea ice. Day to day fuel handling was the responsibility of two support staff who are experienced and well trained operators. Wherever minor (ie. a few millilitres) oil or hydraulic leaks were observed, mainly at the 'hitching rails', contaminated or suspected contaminated snow was collected and put through the 'separator'. Snow collected in the outside drip trays was also regularly put through the 'separator' as a precaution. Other than minor drips/leaks the season was free from major hydraulic failures.

12. **Fuel Storage**. Fuel storage on the Project continues to improve each year. At the end of the previous summer secondary containment, in the form of heavy-duty tarpaulins, was added to the two fuel frames on CR. A plywood base had also been added to one fuel frame to improve the containment. The tarpaulins survived the winter intact. This summer the other fuel frame was also upgraded with a plywood base.

13. One of the first tasks of the support team when they arrived at CR was to haul the two laden fuel sledges (about 150 drums total) off the land to minimise any potential for a damaging spill there. Fuel 'farms' (dedicated storage areas) were then set up on the sea ice at the main Camp and the Drill Site Camp. These 'farms' were isolated from buildings and general traffic areas, and wherever possible all refuelling activities were carried out there. The two fuel farms were clearly sign-posted, and fire extinguishers and spill kits kept there. At the CR Camp a separate cache of 24 drums of 'fresh' fuel was stored about 100m from the helicopter pad for emergency refuelling. Nine drums were used. Helicopter crewmen were responsible for their own refuelling operation. No spills at this site were reported or observed.

14. During the summer season all fuel stocks were checked daily for leaks or damage. Special attention was paid to the fuel stored on CR. No leaks or damage were found.

15. **Fuel Resupply**. Two refuelling sledge trips were made to Marble Point, about 40 km south of CR, in late October and mid November to refill fuel drums from the American tanks there. The Project Manager accompanied the first sledge train to

obtain first-hand experience of the operation. **A total of 322 209litre drums were refilled with JP5**. At the same time 15 empty drums were rejected for refilling at Marble Point mainly because of internal rust. A further 30 or more drums were removed from stock following external inspection at CR prior to departure on the fuel runs. The main defect was 'creasing' – indentations caused by impact – which can result in hairline cracks, especially in conjunction with rust. Both fuel runs were carried out successfully without incident. Refer to Appendix xx of the CRP EOS Report for the reports on each of the refueling trips.

16. **Fuel Usage and End-Of-Season Fuel Stocks**. Fuel usage for the 1998/99 CRP season was close to 400 x 209 litre drums of JP8/JP5/Jet A1. Twelve drums of Mogas (mainly two-stroke mix) were also used. An approximate usage rate through October and November was five drums per day – three at the Drill Site and two at CR Camp. **At 30 January 1999 JP5 stored at CR totaled 229 drums:**
a. North Fuel Frame – 58 drums.
b. Aalener sledges – 171 drums.
Small quantities of other FOL are also stored at CR, either on the fuel frame or in containers. Total volume would be less than 2,000 litres.

WASTE DISPOSAL & MANAGEMENT

17. Waste generated at CR consisted of human waste, grey water (from kitchen, ablutions and laundry facilities), food waste, used or contaminated FOL, drill 'mud' residue and drill cuttings, drill pipe and miscellaneous waste, eg. packaging, timber, scrap metal, plastic, glass. All waste generated was disposed of in accordance with the CEE.

18. At the conclusion of the CRP season all waste, other than that able to be disposed of either in the sea or on the sea ice, had been removed to Scott Base. It is Project policy to remove all waste in the season that it is generated. In addition to not storing waste at CR from one season to the next, it was also practice to return rubbish to Scott Base at every opportunity, especially through the backloading of helicopters. Although not always appreciated by helicopter crews, it was nonetheless critical to waste management to 'keep ahead of it'. That way excessive amounts did not build up which were then difficult to shift, and the risk was minimised of having waste blow away or lost under snow cover.

19. **Types of Waste and Disposal Methods**.
a. **Human Waste**. At the CR Camp and Drill Site Camp free standing, unheated toilets were set up over holes in the sea ice. The holes measured approximately 1.2m deep x 0.6m in diameter. They were not drilled through to the sea. Ten holes were used at the main Camp and three at the Drill Site. Observations of sea ice breakup in this area from previous years suggests the contents of these holes could ultimately be dispersed well out in McMurdo Sound. Human waste generated while living on CR was 'tide-cracked' in the time honoured way. The plastic bags which contained the waste are returned to Scott Base for disposal.

b. **Grey Water**. Depending on the Camp population, between 1,000 and 5,000 litres per day of diluted (mixed with brine solution from the Reverse Osmosis plant) grey water was pumped into the sea beneath the Camp. Under-sea-ice video observation showed the current quickly dispersed this water in a laminar flow. A visual check of water clarity in early November showed clear water 1m upstream of the outflow and only slight discoloration downstream. At 3m downstream from source the water was clear.

c. **Food Waste**. This season all waste food was bagged and returned to Scott Base. Last season food was macerated and incorporated into the grey water, but this was stopped for technical reasons. Although this noticeably increased the volume of waste to be returned to Scott Base the Project Manager, for environmental as well as technical and health reasons, believes transportation to Scott Base to be the better disposal option and it will be retained for next season.

d. **FOL Waste**. Used oil and contaminated FOL that was recovered from the separator was stored in overpack drums. Two drums of used oil and contaminants and one of oily rags and used filters were returned to Scott Base by the sea ice traverse party in December.

e. **Drill Mud and Cuttings Residue**. Close to **40 metric tonnes of biodegradable dry 'mud' products and 2.6 metric tonnes of dry cement** were pumped down the CRP2 hole. This quantity translated to about **600 cubic metres mixed**. During the embedment and early coring phases of the drilling some cement grout, drill mud and cuttings 'escaped' from around the drill annulus up to the sea floor. An area of the sea floor, about 5m in diameter by about 1m thick at the centre, was covered. **Total volume exiting to the sea floor was estimated to be 1.25 cubic metres or 0.2 percent of the total drill mud and grout used in the hole**. As drilling deepened drill fluids ceased escaping to the sea floor surface. The majority of drill fluids used in drilling CRP2 were 'lost' to the formation. Drill mud and cuttings retrieved at the drill rig were disposed of either by spreading on the sea ice or dumping down the sea riser ice hole. At the completion of coring and down-hole logging CRP2 hole was sealed with a cement grout plug. Refer to Science Support Manager's EOS Report for more details.

f. **Drill Pipe**. Drill pipe discarded in CRP2 hole at the completion of drilling was:
a. HQ coring rod – 120m.
b. 5" sea riser outer casing - 12.5m.

g. **Miscellaneous Waste**. This was efficiently disposed of IAW Antarctica New Zealand's guidelines. All waste was separated into 'burnable' and 'non-burnable' and some non-burnable items, eg. batteries, metal; further separated. Most was returned to Scott base via helicopters. Bulky and heavy items were returned by sledge traverse.

TRANSPORTATION

20. The CRP vehicle fleet functioned efficiently throughout the season and no fuel, oil or hydraulic leaks, other than minor drips, were reported. A flagged vehicle route from CR to the CR Camp and CR Camp to the Drill Site Camp was established and maintained throughout the season. All flags were recovered. No seals appeared to take up residence near the South Beach transition or around CR itself during the season so vehicle operations were made very easy. Only one road was made to the Drill Site this season. It was 26 km long and 'turned' the CR Crack to the north. Later

in November the odd seal began to appear in the vicinity of the road. They were never a problem.

21. **Helicopter Operations**. Almost 229 hours were flown in support of the Project during the season. Most were shift change flights originating either at McMurdo or Marble Point. Helicopter pads were designated at both CR and Drill Site Camps. When landing at CR Camp pilots were instructed to avoid overflying CR itself on their approach**. Only six helicopter landings were made on CR** in support of the Project during the season – two in early December and the others in January. More landings were made on CR during the season by USGS personnel in support of an unrelated project.

22. A **Twin Otter** aircraft from Terra Nova Bay Base landed on the sea ice in front of the CR Camp on 21 November. It delivered an Italian TV crew to film the Project. Time on the ground was less than 15 minutes.

RESTRICTED ACCESS AREAS

23. The two local areas **designated 'restricted access' were parts of CR and the Granite House at Botany Bay** which is designated a Site of Special Scientific Interest (SSSI). All CRP personnel were briefed about these restricted areas and maps were displayed for all to see. Personnel accepted the reasoning behind the restrictions and compliance appeared to be excellent. This was especially so of CR given its close proximity to the Camp.

24. The Project Manager approved all proposed visits to **Granite House**. Seven parties visited the historic site, the first on 21 October and the last on 27 November. Transport into Granite Harbour was by either skidoo or Hagglunds and approach to the site only by foot. The largest party numbered 10, the maximum permissible. **A total of 47 made the visit**, an average of seven persons per party. Each party had a nominated visit-leader to ensure correct visit compliance.

RECREATIONAL ACTIVITIES

25. Contrary to popular belief CRP personnel do not have a lot of spare time to recreate in the Cape Roberts-Granite Harbour area. Having said that recreational trips were made as far north as Cape Ross and south to the Debenham Glacier ice caves. The most popular area was Granite Harbour as indicated in Para 22 above. Ascents were made of Mts England, Marston, Haystack and Doublefinger by small parties. The most common form of recreation, other than relaxing around Camp, was to take one of the local walks - to CR or the cluster of icebergs to the north of the Camp or to First View Point in Granite Harbour or up to the Piedmont repeater.

PERMIT ISSUED UNDER THE ANTARCTIC ENVIRONMENTAL PROTECTION ACT 1994

26. Permit No. 98/02 issued 30/10/98 to CRP approved (Appendix 3):
a. Controlled access to Granite House (refer Para 22),
b. Use of explosives to cut the sea riser casing at the sea floor on completion of drilling,

c. Use of explosives under the sea ice to carry out vertical seismic profiling (VSP) as part of scientific down-hole logging.

27. One explosive device – a Colliding Detonator Cutter – was used to successfully cut the casing at sea floor (178m) to enable the rest of the sea riser to be recovered. At the surface the explosion was detectable only as a 'pinging' sound transmitted up the casing pipe.

28. Twenty four explosive charges were safely and successfully fired as part of the VSP experiment on 30 November. The Science Support Manager who was responsible for this, had ensured no marine life, namely seals, was in the area at the time of the explosions. Refer to his EOS Report for more detail.

HAZARDOUS SUBSTANCES REGISTER

29. A Hazardous Substances Register was compiled and advertised at CR early this season (**refer to Appendix 3 of this report**). The purpose of this register was twofold – to increase personal safety and health awareness, and to increase environmental awareness because of the risks most of these substances pose for the environment if not handled correctly. No incidents involving any hazardous substances were either reported to or observed by the Project Manager.

SKUA CENSUS

30. The Project Manager completed a Skua census over the whole of CR from O1 to 04 December. Bird numbers appeared 'healthy' and at least **59 pairs of birds** were recorded and a number of nests observed with eggs present. Some nests already had broken eggs evident.

31. Antarctica New Zealand's Environmental Manager updated the census in late January. Eighteen chicks were counted. It was both interesting and disconcerting for members of the small maintenance team at CR in January to observe five incidents of adult birds killing apparently healthy chicks.

FURTHER AMENDMENTS TO CEE

32. No further amendments to the CEE are planned for continued drilling in 1999/2000 season. However, the fact that the Project has been extended an extra year raises the question of whether the 'life' of the CEE can be simply extended to allow for this or whether a review of the process and/or the Project needs to be undertaken. The Project Manager and Antarctica New Zealand's CEO and Environmental Manager will address this issue in due course.

Jim Cowie
Cape Roberts Project Manager

16 February 1999

Appendices:

1. CRP2 Person-days 1998/99.
2. Visitors to CRP 1998/99.
3. CRP2 Hazardous Substances Report.

Appendix 1 to
CRP2 Enviro. Report
Dated 16 Feb 99

CRP2 PERSON-DAYS 1998/1999 SEASON

September	Number	October	Number	November	Number	December	Number	January	Number
1	Nil	1	8	1	35	1	22	1	Nil
2	Nil	2	8	2	36	2	18	2	Nil
3	Nil	3	8	3	40	3	18	3	Nil
4	8*	4	8	4	40	4	13	4	Nil
5	8*	5	8	5	40	5	7	5	Nil
6	8*	6	8	6	35	6	7	6	Nil
7	8*	7	16	7	33	7	7	7	Nil
8	8*	8	24	8	33	8	7*	8	Nil
9	8*	9	24	9	38	9	7*	9	Nil
10	8*	10	24	10	35	10	7*	10	Nil
11	8*	11	24	11	32	11	Nil	11	Nil
12	8*	12	21	12	32	12	Nil	12	Nil
13	5	13	21	13	40	13	Nil	13	3*
14	5	14	23	14	45	14	Nil	14	3*
15	5	15	29	15	44	15	Nil	15	3*
16	5	16	29	16	34	16	Nil	16	3*
17	5	17	32	17	37	17	Nil	17	3*
18	5	18	38	18	33	18	Nil	18	3*
19	5	19	36	19	31	19	Nil	19	3*
20	5	20	37	20	40	20	Nil	20	3*
21	5	21	41	21	39	21	Nil	21	3*
22	8	22	35	22	41	22	Nil	22	4*
23	8	23	35	23	38	23	Nil	23	4*
24	8	24	35	24	38	24	Nil	24	4*
25	8	25	35	25	37	25	Nil	25	5*
26	8	26	31	26	37	26	Nil	26	5*
27	8	27	32	27	37	27	Nil	27	5*
28	8	28	35	28	33	28	Nil	28	3*
29	8	29	35	29	42	29	Nil	29	3*
30	8	30	39	30	31	30	Nil	30	Nil
		31	36			31	Nil	31	Nil
Monthly Person-Days (On CR)*	72*		nil		nil		21*		60*
Monthly Person-Days (At CR Camp)	117		815		1106		92		nil

TOTAL PERSON DAYS (On CR): 153

TOTAL PERSON DAYS (At CR Camp): 2,130

CRP VISITORS 1998/99 SEASON

No.	DATE	NAMES	AFFILIATION	TRANSPORT	AREA VISITED
1	7-Oct	Peter Cleary	Scott Base Operations Mngr	K001	CR Camp
2	8 - 12 Oct	Christian MacDonald	USAP diver	K001	CR Camp, CR, DS, Couloir Cliffs
3		Rob Robbins	USAP diver	K001	CR Camp, CR, DS, Couloir Cliffs
4		Robbie Score	USAP (Crary Lab)	K001	CR Camp, CR, DS, Couloir Cliffs
5	18 - 19 Oct	Peter Cleary	Scott Base Operations Mngr	K001	CR Camp, CR.
6		Julian Tangaere	Scott Base Mngr	K001	CR Camp, CR.
7	20-Oct	Dean Peterson	Science Strategy Mngr, Antarctica NZ	K001	CR Camp, CR, DS
8		Dr Azizan	Malaysian Scientist	K001	CR Camp, CR, DS
9	20 - 22 Oct	Jenny Ackley	USAP (Natural History NZ Ltd)	V005	CR Camp, CR, DS
10		Mike Single	USAP (Natural History NZ Ltd)	V005	CR Camp, CR, DS
11	24 - 26 Oct	Jim Barker	USAP Artist & Writers	K001	CR Camp, CR, DS, MPt
12	29-Oct	Mario Zucchelli	Director Italian Antarctic Programme	HNZ	CR Camp, DS
13	31-Oct	Tim Higham	Communications Mngr, Antarctica NZ	K390	CR Camp, DS
14		Peter Hillary	Ice Trek Expedition	K390	CR Camp, DS
15		John Muir	Ice Trek Expedition	K390	CR Camp, DS
16		Eric Phillips	Ice Trek Expedition	K390	CR Camp, DS
17		John Selwood	TVNZ	K390	CR Camp, DS
18		Jenny Ackley	Natural History NZ Ltd	K390	CR Camp, DS
19		Mike Single	Natural History NZ Ltd	K390	CR Camp, DS
20	31 Oct-2 Nov	Jim Barker	USAP Artist & Writers	K001	CR Camp, DS
21	2 - 5 Nov	Emma Waterhouse	Environmental Mngr, Antarctica NZ	K407	CR Camp, CR, DS, Granite Harbour
22		Tom Maggs	Environmental Mngr, Australian Antarctic Division	K407	CR Camp, CR, DS, Granite Harbour
23		Jennifer MacDonald	Legal Section, Ministry Foreign Affairs & Trade	K407	CR Camp, CR, DS, Granite Harbour
24	3 - 5 Nov	Gillian Wratt	CEO, Antarctica New Zealand	K392A/K001	CR Camp, CR, DS, Granite Harbour
25	3-Nov	Dean Peterson	Science Strategy Mngr, Antarctica NZ	K392A	CR Camp, DS, Granite Harbour
26		Michael Irving	Vice Chancellor Victoria University	K392A	CR Camp, DS, Granite Harbour
27		Stephen Thompson	CEO FRST	K392A	CR Camp, DS, Granite Harbour
28		Jane Shearer	Canterbury University	K392A	CR Camp, DS, Granite Harbour
29	3 - 5 Nov	Bob Carter	James Cook University, Townsville, Australia	K001	CR Camp, CR, DS, Granite Harbour
30		Jeff Fox	Director Ocean Drilling Program, Texas, USA	K001	CR Camp, CR, DS, Granite Harbour

CRP VISITORS 1998/99 SEASON

31	8-Nov	Gillian Wratt	CEO, Antarctica New Zealand	K392B	CR Camp, DS
32		Chris Mace	Chairman Board, Antarctica New Zealand	K392B	CR Camp, DS
33		Sue Suckling	Board Member, Antarctica New Zealand	K392B	CR Camp, DS
34		Clive Howard-Williams	Board Member, Antarctica New Zealand	K392B	CR Camp, DS
35		Ron Heaps	Board Member, Antarctica New Zealand	K392B	CR Camp, DS
36		Julian Tangaere	Scott Base Mngr	K392B	CR Camp, DS
37	9-Nov	Simon Stephenson	NSF Manager McMurdo	NSF	CR Camp, DS
38		Ingrid Koldstadt	Doctor McMurdo Station	NSF	CR Camp, DS
39	9-11 Nov	Hannes Grobe	Cure Curator, AWI	K001	CR Camp, DS
40	10 -11 Nov	Julian Tangaere	Scott Base Mngr	K001	CR Camp, CR, DS,
41		Chris Mace	Chairman Board, Antarctica New Zealand	K001	CR Camp, CR, DS,
42	13-16 Nov	Maria Bianca Cita	Italian ISC Member	K001	CR Camp, CR, DS, Granite Harbour
43		Franz Tessensohn	German ISC Member	K001	CR Camp, CR, DS, Granite Harbour
44		Michael Thomson	British ISC Member	K001	CR Camp, CR, DS, Granite Harbour
45		Peter Webb	USA ISC Member	K001	CR Camp, CR, DS, Granite Harbour
46		Fred Davey	NZ ISC Member	K001	CR Camp, CR, DS, Granite Harbour
47	13-Nov	Gillian Wratt	CEO, Antarctica New Zealand	K392C	CR Camp, DS
48		Chris Mace	Chairman Board, Antarctica New Zealand	K001	CR Camp, CR, DS,
49		Doug Kidd	Speaker of the House, NZ MP	K392C	CR Camp, DS
50		Geoff Miller	Australian High Commissioner	K392C	CR Camp, DS
51		Helen Anderson	Chief Science Advisor, MoRST	K392C	CR Camp, DS
52		John Spittal	CEO LINZ	K392C	CR Camp, DS
53	14-15 Nov	Scott Borg	USA ISC Observer	K001	CR Camp, CR, DS
54	14-16 Nov	Ian Anderson	Australian Editor, New Scientist	K393	CR Camp, DS
55		Monika Huch	CRP DV/ German Science Journalist	K001	CR Camp, CR, DS, Granite Harbour
56	16-Nov	Tim Higham	Communications Mngr, Antarctica NZ	K393	CR Camp, CR, DS
57		Libby Hakaraia	Journalist, National Radio	K393	CR Camp, CR, DS
58		Lucy Wilkins	Journalist, NZPA	K393	CR Camp, CR, DS
59		Geoff Pearman	Continuing Education, Canterbury University	K393	CR Camp, CR, DS
60	20-Nov	Gillian Wratt	CEO, Antarctica New Zealand	K392D	CR Camp, DS
61		Don Sollitt	CEO NIWA	K392D	CR Camp, DS
62		Richard Westlake	CEO Westpac Trust	K392D	CR Camp, DS
63		Felicity Wong	Environmental Lawyer,	K392D	CR Camp, DS
64		Garry Morre	Mayor of Christchurch	K392D	CR Camp, DS

CRP VISITORS 1998/99 SEASON

65		Derek Milne	Chairman IGNS	K392D	CR Camp, DS
66		Tim Higham	Communications Mngr, Antarctica NZ	K392D	CR Camp, DS
67	20-Nov	Harry Mahar	NSF	V-002	CR Camp, DS
68		Stephen Eule	NSF DV	V-002	CR Camp, DS
69		Philip Kiko	NSF DV	V-002	CR Camp, DS
70		William Styles	NSF DV	V-002	CR Camp, DS
71		Mark Powden	NSF DV	V-002	CR Camp, DS
72		Suzanne Day	NSF DV	V-002	CR Camp, DS
73	21-Nov	Angela	Italian TV	K001	CR, CR Camp, DS
74		Ambrosino	Italian TV	K001	CR, CR Camp, DS
75		Pepe	Italian TV	K001	CR, CR Camp, DS
76	21-Nov	Ron Rogers	Base Mngr SB	K001	CR, CR Camp, DS
77	26-Nov	Chris Bray	SB	K001	CR Camp
78	27-Nov	Mike Mahan	Science Tech SB	K001	CR Camp
79	30 Nov to 2 Dec	Christian MacDonald	USAP Diver	K001	CR Camp, DS
80	30 Nov to 2 Dec	Rob Robbins	USAP Diver	K001	CR Camp, DS
81	30 Nov to 2 Dec	Robbie Score	USAP (Crary Lab)	K001	CR Camp, DS

Appendix 3 to

CRP2 Enviro. Report

Dated 16 Feb 99

HAZARDOUS SUBSTANCES AT CAPE ROBERTS,

CR CAMP & DRILL SITE.

There are some hazardous substances located at each of the three areas of operation on the Project. For reasons of personal safety, environmental protection and equipment protection personnel should be aware of what these substances are, their storage location, who is responsible for them and what to do in case of damage, leakage, or inappropriate storage. The substances are:

FUELS, OILS & LUBRICANTS (FOL).

1. **FOL Types**. These include JP8, Jet A1, Mogas (petrol), Two-stroke mix (mogas and oil), lubricating oils (eg.Mobil Delvac 1330), hydraulic fluid (Mobil DTE 11M), Anti-freeze Radiator Protector (glycol), CRC lubricant products, Isopropyl Alcohol, brake fluid, used/contaminated FOL and oily rags. JP8 and Jet A1 are a kerosine/diesel type fuel and make up over 90% of the fuel stock; approximately 300 x 209 litre (44 gal) drums. Other FOL are stored in 209 litre and 60 litre drums and 20 and 4 litre plastic containers.

2. **Storage Areas and Responsibility**. Fuels are stored outside at all three operational locations and on sledges. On Cape Roberts the drums are on three fuel racks on the western side of the storage area. No vehicles should be driven in the vicinity of the fuel racks except for the express purpose of loading or unloading drums. Mogas is stored in red drums and Two-stroke mix in drums with red and green lids. All three fuels (JP8, Mogas, two-stroke) can be stored in red 20 litre plastic containers. Check the metal identification tags for content.

3. The remaining oils and lubricants are only kept in small quantities and are found in the green 'Italian' tents at the main Camp and at the Drill Site or in the two workshops at these sites. The 'used oil' drum is in the Italian tent at CR Camp.

4.Day to day responsibility for FOL at all storage sites lies with Jeremy Ridgen, Brian Howat and Murray Knox.

5. **Hazard of FOL and Action To Take**. The two main hazards are FIRE and POLLUTION. It is important that all of us accept responsibility for safe handling, storage and usage of these products.

a. Fire precautions are no smoking or naked flame near any FOL, and correct procedures when using or handling FOL. Dry-powder low-temperature fire extinguishers are clearly situated at or near all fuel storage and usage sites. Given the limited capability to fight a fuel fire it is probably more important to isolate and contain it. This could be done by moving other fuel, combustibles and valuable equipment away. There are two sets of breathing apparatus (BA) at CR Camp and Drill Site. These are only to be used to rescue someone trapped by fire or gas – they are not to be used to fight a fire.

b. Pollution can be avoided or minimised by correct handling, storage and usage procedures, regular inspections of stored FOL, use of drip trays and absorbent materials. Spill kits, which contain absorbant pads, rolls, plastic bags and gloves are located on fuel sleds and at main refuelling site at CR Camp. Spare pads are in the Italian tent at CR Camp and in the Italian storage container on Cape Roberts. If a leak or spill is detected absorbent pads and 'rolls' should be used to mop up FOL and all contaminated snow, ice or gravels collected for further disposal. Action is to be taken to stop the leak or spill at source.

6. FOL do not pose a significant risk to health (fire excluded) provided sensible precautions are taken, eg. wear suitable gloves and do not inhale the fumes.

GASES

7. **Gas Types**. The gases, stored under pressure in cylinders, are oxygen, acetylene, ethyl ether and LPG. Oxygen and acetylene are used by the engineers for gas cutting and brazing. There are also four smaller cylinders of medical oxygen. LPG gas is used for cooking and is stored in 9kg cylinders. Ethyl ether is used as a diesel motor starter.

8. **Storage Areas and Responsibilities**. Oxygen and acetylene cylinders are stored in the Italian and 'red' storage containers on Cape Roberts and in the Italian tent at CR Camp. There are Oxy-acetylene sets at both the CR Camp and Drill Site. They may be temporarily left wherever they are being used. LPG cylinders are with the BBQ at CR Camp, in the Mess Hut at Cape Roberts and in NZ1 and NZ3 at the Drill Site. LPG cylinders have been temporarily removed from NZ9 and NZ10 while they are being used for accommodation. The small 'Quick Start' red ethyl ether cylinders are stored in the Italian tent at CR Camp. Jeremy Ridgen and Brian Howat are responsible for these cylinders.

9. The four cylinders of medical oxygen are with the medical equipment in the cubicle in the drying room. They are the responsibility of Colleen Clarke.

10. **Hazard of Gases and Action To Take**. The two main hazards of gases are FIRE/EXPLOSION and INHALATION (except oxygen). All the above gases are inflammable or will aid combustion and therefore it is important they are kept away from heat, naked flame or sparks. These gases should not be inhaled, especially in a confined space. Gas cylinders should be treated as for fire, ie. isolate, contain and remove other combustible materials and equipment from vicinity.

EXPLOSIVES

11. There are two types of explosives used in the Project. One type is to be used in the down-hole logging process and the other, known as a Colliding Detonation Cutter (CDC) is used to cut the Sea Riser casing at the sea floor at the end of the drilling. Both explosive types are stored in the explosives wannigan, NZX2, on Cape Roberts. The wannigan is kept locked. The detonators are stored in a clearly marked wooden box at the rear of the red storage container. The people responsible for the explosives are Jim Cowie and Alex Pyne.

12. During drilling one CDC and a small number of detonators are kept at the Drill Site. The detonators are in a small red box and the CDC in a wooden box (1m x 150mm x 150mm). Both are clearly labelled. At the Drill Site Alex Pyne is responsible for these explosives.

MISCELLANEOUS

13. **Battery Acid (sulphuric acid)**. There are two 20 litre clear plastic containers of battery acid. Each is kept in the Italian tent at the Drill Site and CR Camp. The person responsible for this acid is Jeremy Ridgen.

14. **Hydrochloric Acid**. A 500ml plastic bottle of 10% hydrochloric acid is kept in the CR Camp Laboratory where small amounts are used by the sedimentologists. This strength acid is about twice the acidity of vinegar, but it is still capable of damaging skin and eyes. The person responsible for the acid is Dr Ross Powell.

15. **Lime-Away**. This is a caustic soda-based cleaning agent for removing scale in pipes. It is poisonous and will burn the skin. It is in a 1 litre red plastic container in the CR Camp workshop. The person responsible for it is Brian Reid.

16. **Calcium Chloride (CaCl).** CaCl is used as an accelerant in the curing of cement in the drill hole. It comes in cystal form in clearly labelled 25kg bags. It is stored on Cape Roberts with the drill muds and also at the Drill Site, also with the drill muds. In its dry form, and even more so when mixed with water, it is a skin, eyes and respiratory irritant. The results of prolonged exposure can be severe. It is corrosive to metals when moist or dissolved in water.

17. When working with CaCl ensure skin is covered. A dust mask is advised. Safety glasses should be worn especially when it is dissolved in water. The persons responsible for the CaCl the Drill Manager and the 'mud doctors' on each shift.

18. **Radianuclide**. A small radioactive source, Cs-137, is used in core scanning analysis at the DS Laboratory. This source is enclosed in a lead-lined cylinder labelled with the radioactive logo. Protected as it is the radioactive source is harmless but for obvious safety reasons the cylinder is not to be touched or a hand placed in the area where the beam scans the core . When not in use scanning core the radioactive source is closed off. The person responsible for the radionuclide is Dr Frank Neissen.

19. The radioactive source conforms to international standards in terms of its storage, transportation and use. If for example, the Laboratory was destroyed by fire it is highly unlikely the container would sustain any damage likely to result in a leak or contamination.

Jim Cowie
Cape Roberts Project Manager

12 Oct 98