XXV ATCM
Working Paper **WP-25**
Agenda Item:.....
COMNAP
Original: English

Council of Managers
of National Antarctic Programs

ATCM XXV
Warsaw Poland
10-20 September 2002

Working Paper on "Worst Case" & "Less than Worst Case" Environmental scenarios

INTRODUCTION

1. During discussions on the "Liability Annex" at ATCM XXIV in St Petersburg, the meeting requested:

"COMNAP, in consultation with SCAR, to provide the following information in respect of national program operations, for the purpose of establishing limits on financial liability, compensation, and insurability.

(a) "Worst case scenarios" for land-based and sea-based environmental emergencies in the Antarctic Treaty Area including the probability of occurrence and estimated cost for responses action;
(b) For the purposes of illustration, a range of scenarios less than worst case that might result in environmental impacts, including probability of occurrence and estimated cost of response actions;
(c) Scenarios similar to those in (a) and (b) for which response action would not be possible."

2. This paper essentially represents "work in progress". It gives information on the types of scenarios that are considered to be likely, but does not provide information yet on probability or cost. Work still remains to be done on the latter and COMNAP intends to produce a further response, including comment on these important issues, in due course.

INTERIM RESPONSE

(a) "Worst case scenarios" for land based and sea based environmental emergencies in the Antarctic Treaty Area

3. The worst case scenario for a sea-based environmental emergency would be a vessel that sinks, and breaks up, releasing it's bunkers (ship's fuel) or cargo fuel being carried for the resupply of a station(s), that impacts on an environmentally sensitive area, where response is not possible. In the Antarctic, the ship's bunkers or fuel being carried to resupply a station is considered to be the most likely material that can result in "worst case" environmental damage, because other materials are normally carried in much lower quantities. This is considered also to be the case with tour vessels.

4. Three points were raised in the discussion of this scenario that are relevant:

- A vessel that sinks and breaks up at sea well away from environmentally sensitive areas – where its fuel will evaporate or be dispersed due to winds and sea conditions, is less likely to create an environmental emergency.
- Ship size and amount of fuel carried was discussed. While an important factor, this is considered secondary to the area that is impacted; i.e. a relatively small amount of fuel that impacts a sensitive area can result in damage that would exceed a large volume of fuel dispersed over a less sensitive area.
- Most vessels used by national operators in Antarctic waters use arctic diesel fuel which tends to disperse and evaporate more quickly than heavy fuel, thus reducing the severity and duration of environmental impact. This may not be the case however for vessels engaged in tourist operations.

5. For information, in the last twenty years two national program vessels – the *Gotlund II* and *Bahia Paraiso* – and one private expedition – *Southern Que*st – are known to have sunk.
In the case of the *Bahia Paraiso*, there was a prolonged multi-national recovery and clean-up operation which involved a total cost of approximately $US3M in 1989 dollars.

6. Several "worse case" scenarios can be imagined for land based environmental emergencies, namely:

- An air crash by helicopter or fixed wing aircraft into an environmentally sensitive area; e.g.. the Dry Valleys, lakes or rookeries.
- The rupture/breach of an uncontained fuel storage tank..
- The introduction of non-indigeneous species or disease. This third item is mentioned for the sake of completeness. While documented cases of rat and cat infestations on the sub-Antarctic islands are available, there are no known cases of any viable presence of non-indigeneous species on the Antarctic or the islands of the northern Antarctic. Similarly there are no known cases for the introduction of diseases.

7. The release of other hazardous materials has also been discussed, and includes chemicals, solvents, hydraulic fluids, radio nuclide tracers, etc. These substances are typically used in small quantities in laboratories or within station boundaries. Exceptions are the use of chemicals at field laboratory sites and hydraulic fluids in vehicles. Release to the environment is possible, but in amounts that would have an insignificant environmental impact but potentially a significant scientific impact In addition to preventive measures and contingency plans to avoid release to the environment of these substances, such precautions are also recommended from the perspective of the safety and health of the workforce.

8. COMNAP guidelines recommend containing fuel storage tanks through the construction of catchment basins or the use of double walled storage tanks. The volume of the containment area needs to equal the total amount of fuel to be contained. Since the introduction of the COMNAP guidelines , there have been no known incidents in Antarctica where the containment for storage tanks has been breached.

(b) For the purpose of illustration, a range of scenarios less than worse case that might result in environmental impacts.

9. The range of scenarios less than worse case that might result in environmental impacts and the probability that those impacts could result in environmental harm has been qualitatively described in the ATCM XXIII/WP14 and are given in the attached Table.

(c) Scenarios similar to those in a) and b) for which response action would not be possible.

10. In preparation for ATCM XXIV, and in response to the question "Whether, and under what circumstances, would it be possible and/or practicable to take containment, mitigation or clean up action, and whether, and under what circumstances, would it be possible to restore the environment?" COMNAP defined the terms containment, mitigation, clean-up, and restoration. A clear distinction became apparent between primary actions (containment; mitigation), and follow-up actions (clean-up; restoration).

11. Primary actions would be comparable to immediate response actions which focus on "assessments first of risk to safety and life, and second to the practicality of any intervention under existing conditions of weather, and environment". Follow-up actions would result after "an assessment of whether such actions are feasible, cost effective, appreciably affect the natural rate of recovery, or will cause more harm than the impact of the incident."

12. Referring to the examples of incidents that could cause environment harm, of the fourteen given in the attached Table, six are identified for which primary actions **would not** be possible because of several factors including search and rescue, time, whether or not preventive measures or contingency plans have been put in place. These are Items (1), (2), (5), (7), (10) and (11).

CONCLUSIONS

13. This paper notes the possible worse case and less than worse case scenarios that could lead to environmental emergencies in Antarctica. It is difficult to estimate the probability of occurrence and cost of response to such scenarios because few incidents have occurred in the history of Antarctic research and exploration in modern times. This risk assessment is further complicated by the consideration that the probability of occurrence of incidents in these scenarios could decrease. Several reasons could contribute to such a decrease in the probability of occurrence. These are:

- the adoption and application of the COMNAP guidelines for spill prevention and contingency planning (land and sea);
- adoption and application of appropriate construction design criteria for ships, and
- the increasing application of satellite imagery and other remote sensing techniques for navigation and aviation forecasting in the polar environment.

14. Whilst COMNAP can provide historical information to help determine probability and cost based on the experience of its members, determination of these factors for actuarial purposes does not lie within the areas of competence of COMNAP. Nevertheless, COMNAP/SCALOP will assemble and make available the necessary historical data to assist in this process. These data will be presented in a follow-up paper in due course.

TABLE Examples of Incidents that could Cause Environmental Harm

Function	Location	Incident (examples)	Response
1) Aircraft Operations	Flying over the coastal zone (ice covered; or ice free)	Crash involving spillage of fuel which can approach 20K liters	Only likely response is **clean-up**. Initial action will be search and rescue. Because of time involved in initial recovery operations, containment; and mitigation measures will not be possible.
2) Aircraft Operations	Flying over ice free inland locations	Crash of small aircraft or helicopters with spill <1000 liters	Only likely response is **clean-up**. Initial action will be search and rescue. Because of time involved in initial recovery operations, containment; and mitigation measures will not be possible.
3) Ship Operations	Loading or unloading fuel at the base or facility	Fuel hose ruptures	Base operations should be able to **contain, mitigate, and clean-up** the spill. Contingency plans should identify this possibility, erect containment booms or have response teams at the ready during this operation.
4) Ship Operations	Enroute to a base or facility along the coast	Ship going aground or impacting ice away from the station	The ship should have some response capability that would enable them to **contain** a spill in a limited fashion. **Mitigation, and clean-up** would likely have to be done with outside assistance.
5) Vehicle Operations	Operating in an ice-free inland area	Vehicle overturns or otherwise spills fuel	The only likely response is **clean-up**, although some **mitigation** may be possible if the spill is small (<10liters). Other response capability is not likely to be available.
6) Fuel Storage	Fuel Storage tanks located on bases or facilities	Rupture of a storage tank	Preventive measures and contingency plans should enable **containment, mitigation, and clean-up**. Storage tanks should be double walled or bermed to contain fuel should the tank rupture. If mitigative measures are needed, the station response team should be able to handle contingencies, and clean-up should follow.
7) Fuel storage	Fuel caches located away from bases or facilities	Leakage of unattended drums or storage containers	The only likely response is **clean-up.** Fuel caches are typically unattended and in 200 l. drums. Leaks are not likely to be noted until the cache is visited and therefore the remedy for leakage is clean-up. Preventive measures are relatively simple, and would minimize leaks to the environment.
8) Sewage/waste water	Waste utility lines at bases and facilities	Failed lines resulting in leaks or dumping from	Preventive measures and contingency plans should enable **containment,**

		the sewage system onto ice or ice free land	**mitigation, and clean-up**. Sewage and waste water lines should be valved so they may be closed and repaired and mitigation and clean-up initiated.

Function	Location	Incident (example)	Response
9) Waste Disposal	Trash and debris at bases and facilities	Improper handling of waste resulting in material being dispersed by the wind	This can be readily prevented through **containment. Mitigation and clean-up** would be more difficult since materials would be very widely dispersed.
10) Abandoned Bases and Facilities	Varied. Can be coastal, or inland	Melt water through abandoned tips (landfills), and leaks from abandoned fuel tanks	Because these facilities are abandoned, assessments will have to be made on potential risks, and costs. **Mitigation and clean-up** would be the possible responses, since containment may no longer be possible.
11) Transport	In the coastal zone on the sea-ice	Vehicles working on or transiting across the sea ice and falls through	Fuel and chemicals that may be aboard the vehicle pose the risk to the environment. If significant, efforts could be made to recover the vehicle and cargo to **mitigate and clean-up** the spill.
12) Fuel Handling	Fuel tanks and distribution lines at stations and bases	Spills resulting from overfilling of tanks; failure in pipe connections; punctured storage drums	At bases and facilities, is likely that preventive measures, materials, and personnel are available and in place to enable **containment, mitigation, and clean-up**
13) Fuel Handling away from bases and facilities	Fuel drums and small storage tanks at remote field sites	Spills resulting from sloppy fuel transfers and leaking drums	Since these facilities are typically manned and preventive measures and contingency plans should have been adopted for the operation of these sites**, containment, mitigation and clean-up** should be possible.
14) Scientific Activities	Laboratories and field sites in ice free inland locations	Chemical and other hazardous material spills	Since these facilities are typically manned and preventive measures and contingency plans should have been adopted for the operation of these sites**, containment, mitigation and clean-up** should be possible.