# WORKSHOP REPORT

## EXECUTIVE SUMMARY

In the event of an oil spill it is advantageous to have as many response options available as possible as no two spills are the same and any one spill is dynamic. Bioremediation, or the use of hydrocarbon degrading microbes to clean up oil pollution, is a technique that has been receiving increasing attention in recent years. However there has been very little focus on 'bioremediation as an oil spill response option in the Great Barrier Reef Region, or indeed in Australia generally. The Bioremediation Workshop held by the Great Barrier Reef Marine Park Authority (GBRMPA) on 25 February 1991 provided a forum for scientists, oil spill response agencies, industry and environmental groups to exchange information and develop recommendations regarding the use of bioremediation in the Great Barrier Reef Region. The workshop resulted in unanimous agreement that bioremediation has significant potential for combating oil spills but that considerable research is still needed before it can be incorporated into REEFPLAN as an operational response option.

The primary concern expressed at the workshop was the lack of data relevant to tropical areas. The majority of data concerning bioremediation is based on temperate studies. Further research into the techniques and effects of bioremediation in tropical locations was urged. The natural ability of the tropical marine system to dissipate oil was another area designated for further research.

Concern was raised regarding the possible impacts of bioremediation on the ecosystems of the Great Barrier Reef Region, and it was agreed that this would need to be assessed through research.

Workshop participants developed a list of organisations and institutions that have the expertise and facilities to participate in ongoing research. Oil and shipping industries were suggested as sources of funding with assistance from the Queensland and Federal governments. The Great Barrier Reef Marine Park Authority was recommended as coordinator of funding and research.

The bioremediation workshop provided an opportunity for various groups involved in bioremediation and oil spill response in general to exchange information, identify areas where further work is needed and suggest a policy statement to guide GBRMPA on the use of bioremediation.

## INTRODUCTION

Responding to an oil spill of any significant size in the Great Barrier Reef Region presents a formidable task to say the least, and all response options need to be considered.

Bioremediation may offer a useful addition to the range of options available in oil spill response. However the use of bioremediation remains a controversial issue as there appear to be conflicting reports regarding its effectiveness and very little is known about bioremediation in tropical marine environments. Its use in pristine coral reef environments is a matter of particular concern as it may involve the addition of nutrients (phosphates and nitrates) to the environment.

Various bioremediation agents are currently available from private/commercial sources adjacent to the Great Barrier Reef Region and these would be offered for use immediately in the event of a major spill. There is therefore a need to develop a policy statement to guide GBRMPA in the use of bioremediation in the Great Barrier Reef Region.

It is hoped that the workshop will result in the clear identification of GBRMPA's research needs and establish links between government, industry and the research community to facilitate the initiation of this research, and suggest a policy statement on the use of bioremediation in the Great Barrier Reef Region.

## OBJECTIVES

1. -- Summarise existing information on bioremediation.

2. Identify and prioritise research needs for the Great Barrier Reef Region.

3. Identify research institutions/organisations capable of addressing those research needs.

4. Establish links between government, industry and the research community to facilitate initiation of research.

5. Suggest a policy statement on the use of bioremediation in the Great Barrier Reef Region.

P R O G R A M

## A ) Presentations

The morning session involved presentations from oil spill and bioremediation authorities giving background information on oil spills in the Great Barrier Reef Region, how bioremediation works,, case histories of use, history of bioremediation research and research capabilities available in Australia.

8.30am : Registration

9.00am : *The Oil Spill Threat, Response Plans in Place and the Need for Bioremediation*

Dr Wendy Craik - Great Barrier Reef Marine Park Authority

9.40am : *Bioremediation - The Biological and Physical Basis*

Dr Richard Edgehill - University of Queensland

10.20am : Morning Tea

10.40am : *Bioremediation of Industrial Wastes*

Dr Bruce Kelley - CRA Advanced Technical Development

11.20am : *A History of Research on Bioremediation in Australia - Summary of Results*

Ms Randi Larsen - James Cook University of North Queensland

12.00pm : *Bioremediation Research Needs and Capabilities: Where do we Stand?*

Professor Paul Greenfield - The University of Queensland

12.40pm : Discussion and other presentations:

*Bioremediation of Oil Spills*

Dr Alan Sheehy - University of Canberra

*The Exxon Valdez Oil Spill - Woodward-Clyde Consultants' Contributions to Bioremediation*

Mr Locon Wall - AGC Woodward-Clyde

1.00pm : L u n c h

B) Workshop

The afternoon session involved breaking into several groups of six to eight people, each headed by a facilitator, for a workshop session to achieve the objectives listed above. Each group contained a cross-section of people from government, industry and the research community. After the workshop session of an hour the groups presented their results for general discussion and to finalise achievement of the objectives.

2.00pm : Divided into groups and commenced workshop

3.00pm : Afternoon tea

3.20pm : Presentation of results and general discussion

5.00pm : Close

## DISCUSSION GROUP RESULTS

Each group was given a series of questions to debate and asked to record their results. Following is a summation of the recommendations that resulted from the, discussion groups.

**'Question, One:**

Do you think that GBRMPA and other oil spill authorities in the Great Barrier Reef Region should pursue bioremediation as an oil spill response option?

**Response:**

The discussion groups unanimously agreed that an accurate assessment of the potential of bioremediation is difficult at present due to the relatively small amount of data available relevant to tropical environments. Notwithstanding the insufficient data, it was recommended by all workshop groups that GBRMPA should persue bioremediation as an oil spill response option. In order to better understand the effectiveness and impact of bioremediation all groups recommended the establishment of a specialised research program.

Each group stressed some possible limitations of bioremediation. Two groups recognised that the use of bioremediation could be restricted to isolated areas such as fringing reefs, beaches, and mangroves. Two other groups identified the possible ecological impacts of bioremediation as a potential problem. One group stated the need to recognise the ethical debates that could arise from releasing bacteria in the Great Barrier Reef Region.

**Question Two:**

What specific areas of bioremediation still need to be researched in relation to the Great Barrier Reef?

**Response:**

An increase'in the range of research on bioremediation was recommended by all groups. Four areas of research were identified as being needed. these are: geographical aspects, natural biodegradation pathways, methods and techniques and side effects and impacts.

All groups agreed that research relevant to tropical marine environments; including on-site testing in the Great Barrier Reef Region itself, is needed as the vast majority of work to date has been carried out in temperate regions. Two groups emphasised the need for critical analysis of information that resulted from studies performed in temperate regions in order to evaluate the possibility of similar success rates in the Great Barrier Reef Region.

All groups emphasised the need for further research on the success rate of bioremediation in a variety of locations and conditions (i.e. weather, size and type of spill, substrate composition) as well as the effects on the environment of enhancing levels of naturally occurring microbes. One group recommended extending research into the possible use of bioemulsifiers as an alternative or adjunct to bioremediation. Another group suggested further research into the long term viability of stored bioremediation products.

Each group recommended the need for further research into the natural response of the marine system. Two groups suggested researching metabolic and physiological studies of indigenous microbial populations. It was recommended by three groups to study natural biodegradation pathways. Two groups were concerned with the lack of on-going research of effects of oil on coral and suggested that this information is important in order to determine the scope of any oil spill response effort in general.

**Question Three:**
What capabilities and facilities are available to address these research needs?

**Response**
Discussion groups suggested a variety of organisations for coordinating and facilitating the proposed multidisciplinary research. It was emphasised by all groups that the research should be policy driven as opposed to client driven. Workshop participants compiled a list of organisations and institutions with the facilities and capabilities to implement the recommended research program, however specific roles were not allocated. The list includes:

- Great Barrier Reef Marine Park Authority
- The University of Queensland
- James Cook University of North Queensland
- Australian Institute of Marine Science
- Queensland Department of Primary Industries
- Industry research facilities
- Queensland Government Chemical Labratory.
- Commonwealth Scientific Industrial Research Organisation
- State environment departments

**Question Four:**
What are the options for putting a system in place to initiate such research - who pays, who manages etc.?

**Response:**
The discussion groups unanimously agreed that the funding necessary to initiate and maintain a bioremediation research program should be provided by the oil and shipping industry. Three groups recommended that further financial assistance be obtained from Federal and Queensland governments. All groups recommended GBRMPA to coordinate funding and manage the research program.

**Question Five:**
At this stage what would be an appropriate policy statement on the use of bioremediation in the Great Barrier Reef region for adoption by GBRMPA?

**Responses:**

Group 1:
"Due to the potential benefits of bioremediation for oil spill response, GBRMPA will pursue vigorously the facilitation, research, and coordination to necessarily asses its viability."

Group 2 :
"GBRMPA recognises the potential benefits of bioremediation as an oil spill response option. However it is recognised that considerable research needs to be undertaken into effects of biological treatment in tropical waters and coral reef areas."

Group 3:
"At the moment very little is known of the natural biodegradation of hydrocarbons in the Great Barrier Reef, consequentially before research is activated in this area research on natural pathways/effects should be initiated. However the United States Environmental Protection Agency has suggested that bioremediation is the preferred option for oil deposited on land/beaches and initial research could start here."

Group 4:
"Bioremediation is a possible new tool for treating oil spills and has been used with some success in cold temperature conditions e.g. Alaska. It has potential for use in the Great Barrier Reef but needs to be carefully evaluated for effects and usefulness in tropical environments. Nutrients are sometimes used to enhance effects of microbes, and there is a need to research effects of one-off input of nutrients. Coordination of the research is essential to optimise research results. A research program should be prepared for consideration by government. GBRMPA policy of not permitting introduced organisms should be maintained."

## SUMMARY OF RECOMMENDATIONS

1. GBRMPA and other oil spill response authorities should pursue bioremediation as an oil spill response option, however considerable research is still required in tropical environments.

2. A policy driven specialised research program should be established.

3. The ecological impacts of bioremediation should be assessed.

4. The oil and shipping industries and government should provide research funding.

5. GBRMPA should coordinate funding and manage the research program.

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