

# Enclosure treatment: A biosecure treatment for oil rig pontoons

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# 1. Introduction

Biosecurity New Zealand (MAFBNZ) is the division of the Ministry of Agriculture and Forestry charged with the leadership of the New Zealand biosecurity system. MAFBNZ is responsible for preventing the introduction of non indigenous marine species (NIMS) to New Zealand waters.

A pathway for NIMS is as biofouling on slow moving vessels (i.e. semi-submersible oil rigs, barges, etc) and at present there is no management for this pathway.

The Petroleum Industry provides substantial economic and energy benefits to New Zealand. With an increase in exploration activity, there are concerns regarding NIMS entering New Zealand's waters on semi-submersible oil rigs (Figure 1), as these rigs often arrive carrying biofouling species accumulated in other countries. This was demonstrated when the brown mussel (*Perna perna*) was detected in Tasman Bay, following the defouling of a semi-submersible oil rig that had arrived from Australia.

Figure 1      The *Ocean Patriot* in New Zealand waters



As other semi-submersible oil rigs are planning to operate in New Zealand waters, MAFBNZ is interested in encouraging the development of possible methods for cleaning marine biofouling from oil rigs before they are deployed to New Zealand. These methods could also be employed to treat New Zealand based oil rigs before they redeploy to another country.

Aquenal Pty Ltd (Aquenal) and its subsidiary Biofouling Solutions Pty Ltd (BFS) have been developing and testing enclosure based treatments for the submerged surfaces of vessels since 2007. This work is based on research conducted by Ashley Coutts and others over the past decade. MAFBNZ awarded Aquenal this contract to further develop our enclosure treatment so it could be applied to the pontoons of semi-submersible oil rigs.

The purpose of this report is to demonstrate to MAFBNZ, the operators of oil rigs, and to the agents importing them, that fast acting biosecurity treatments for pontoons of semi-submersible oil rigs are feasible.

## 2. Confidentiality Agreement

MAFBNZ acknowledges that Aquenal has developed the majority of the information behind this project at their expense prior to the commissioning of the project.

The Intellectual property developed under Contract 10877 is presented here. A description of the enclosure system developed by Aquenal and its operation are included to provide background to this information.

## 3. Background

### 3.1. GOVERNMENT REGULATIONS PRESENT AND FUTURE

#### 3.1.1. New Zealand

Presently the Ministry of Agriculture and Forestry's Biosecurity New Zealand division are capable of managing the arrival of biofouling pests as "unwanted organisms" or "risk goods" using their *Biosecurity Act 1993*. Unwanted organisms, pursuant to section 2(1) of the *Biosecurity Act 1993*, means any organism that the Chief Technical Officer believes is capable or potentially capable of causing unwanted harm to any natural and physical resources or human health. Only a few marine organisms have been declared under this provision and these are mainly included for the purpose of giving examples of the type of organism that could arrive in New Zealand waters and have some impact on resources. Risk goods pursuant to the same section of the Act means an organism, organic material, or other thing that it is reasonable to suspect constitutes, harbours or contains an organism that may

- cause unwanted harm to natural and physical resources or human health; or
- interfere with diagnosis, management, or treatment, in New Zealand, of pests or unwanted organisms.

All biofouling on vessels and structures brought into New Zealand is considered to be a risk good and MAFBNZ border inspectors can direct risk goods to be dealt with if considered above the acceptable level of risk.

MAFBNZ are proposing to implement a standard under the *Biosecurity Act 1993* for vessel biofouling that will require vessel owners/operators to maintain effective antifouling coatings and keep niche areas free of biofouling. This will have annexes for vessel categories with specific requirements such as one for yachts requiring them to have clean hulls or be hauled out for cleaning on arrival. It is expected that under the standard, rigs will still be considered on a case by case basis as mitigation methods need to be tailored to fit the particular rig and programme and be practical and cost effective for the industry.

For vessels arriving to work on major projects, including oil rigs, MAFBNZ will work with industry to find a solution to fit the specific circumstances. They do not envisage needing to turn any away but may require specific measures to be taken either before the voyage to

New Zealand or once they arrive. This enclosure treatment study has been commissioned as part of MAFBNZ's contribution towards working with industry to find solutions.

### 3.1.2. Australia

The Commonwealth Government is able to manage the arrival of biofouling pests on international vessels as “quarantinable diseases or pests” under the *Quarantine Act 1908* and subordinate legislation. However, the subordinate legislation does not define any specific species of concern relevant to biofouling and reliance is placed on the Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) “Trigger List” which comprises of 35 species of concern.

The Australian Quarantine and Inspection Service (AQIS) presently inspect international vessels less than 25 m in length for “trigger list” species as part of their voluntary biofouling management requirements. They do not actively inspect other international vessels for biofouling (<http://www.daff.gov.au/aqis/avm/vessels/less-25m/biofouling-protocols>). However, the Commonwealth is in the process of developing new mandatory biofouling management requirements and if implemented is likely to require all international vessels to be free of prescribed species of concern.

The Commonwealth in conjunction with the States/Territory jurisdictions are also capable of managing the introduction of species of concern via vessel biofouling using the *Petroleum (Submerged Lands) Act 1967* (PLSA) and the associated *Petroleum (Submerged Lands) (Management of Environment) Regulations 1999* and ‘Schedule of Specific Requirements as to Offshore Petroleum Exploration and Production (2005)’. As part of this legislation, an Environmental Management Plan is developed in consultation with the petroleum industry. This specifies agreed environmental performance objectives and standards which could require that vessels/infrastructure are to be free biofouling species of concern. Under Commonwealth-State/Territory agreements, the States and Territory governments administer Environmental Management application and approvals processes relating to petroleum activities in the Commonwealth waters that lie beyond their respective State and Territory waters (i.e. > 3 and >12 nm respectively).

Given the Commonwealth has yet to implement national biofouling standards or requirements, States and the Northern Territory have started amending their existing legislation, predominantly *Fisheries Acts* and *Regulations* in an attempt to protect their coastal waters against the arrival of species of concern. Presently, all State and Territory jurisdictions have the powers to manage the arrival of biofouling pests via vessel biofouling, however the extent to which they can or will act varies considerably. While some jurisdictions such as New South Wales and Northern Territory have amended their legislation to define specific species of concern relevant to biofouling, other jurisdictions have simply stated that they are capable of acting against any “aquatic, noxious or exotic species”, hence there is no certainty as to which species they are concerned about.

### 3.1.3. Hawaii

The State of Hawaii may have been the first government to officially initiate action to address the issue of biofouling of ships' hulls when, in 2000, it designated the Hawaii Department of Land and Natural Resources as the lead state agency for preventing the introduction and carrying out the destruction of alien aquatic organisms through the regulation of ballast water discharges and hull fouling organisms. While the Department was authorised to adopt rules in accordance with this mandate and to enforce penalties for violation thereof, to date, little has been done other than public outreach and voluntary efforts due to a lack of funding. In 2003,

the State of Hawaii Aquatic Invasive Species (AIS) Management Plan was adopted. Among other things, this plan advocates the implementation and funding of the Ballast Water and Hull Fouling Prevention Plan.

#### 3.1.4. California

In February 2007, in its report to the state legislature on its marine invasive species program, the State Lands Commission (SLC) discussed at length the biofouling issue and its role as a potential vector for introduction of non-indigenous species (NIS) into California waters. The report noted that the “most difficult challenge to evaluating NIS risk and for developing management recommendations was the limited amount of baseline information available on fouling and NIS across the types of vessels that regularly operate in California”. The report then recommended that the legislature authorise the SLC to develop and adopt regulations to minimise NIS release; to expand biological research to characterise the NIS risk posed by commercial chip fouling; and to collect information from vessels that call in California on those factors that influence fouling accumulation, such as vessel movement patterns and maintenance practices.

The California Legislature provided the SLC with the authority in legislation adopted eight months later. The legislation, Assembly Bill No. 740, amends the California Marine Invasive Species Act, in pertinent part, to require owners and operators of large commercial vessels to provide hull condition information to the SLC as requested. On January 28, 2008, the SLC issued form letters to shipping agents throughout the State of California advising of the new reporting requirement and asking the shipping agents to forward the information to vessel owners and operators which they represent.

#### 3.1.5. International Maritime Organization

The 56th session of the International Maritime Organisation’s Marine Environment Protection Committee in July 2007 approved a new work item for its Sub-Committee on Bulk Liquids and Gasses (BLG) for the “development of international measures for minimising the translocation of invasive aquatic species through biofouling of ships.” A target completion date of 2010 has now been assigned, giving the subcommittee three sessions to complete the work.

BLG has since given preliminary consideration to the issue and formed a correspondence group to review research, consider best practices, consider the practicality and feasibility of various options for international measures for control and make a recommendation to the subcommittee. The group also will begin developing interim guidance for minimising the transfer of invasive aquatic species through biofouling.

## 3.2. OPTIONS FOR MITIGATING THE TRANSFER OF BIOFOULING AND NIMS

### 3.2.1. Dry docking

Thorough cleaning in a dry dock is the option preferred by regulators, particularly if it is followed by repainting. It can be easily verified, poses no risk of environmental contamination and does not allow recontamination during the process. Depending on circumstances cleaning takes between 4 and 10 days.

Dry docks normally are booked up for months in advance so this cleaning option must be well planned into the rig program and locks the rig into a time slot. This aspect may become more troublesome in the next few years as the many ships at anchor during the global financial

crisis may require dry docking before they can resume trading once the world economy improves.

Suitable dry docking facilities are situated in widely separated locations around the world, often requiring long detours from the rig's optimal relocation route. This is particularly problematic for rigs relocating from Australia to New Zealand where the nearest dry dock is in Singapore. It is also costly to use dry docking facilities.

A disadvantage of relying on dry docking for biofouling maintenance is that it does not provide on-going protection. Once a cleaned rig has worked in one country, such as Australia, it may have become contaminated with species New Zealand has concerns about. Therefore it may have to be cleaned again before it can enter New Zealand. A return to Australia or travel to another country with similar biofouling concerns may require cleaning again. Therefore, unless it is intended that a rig remains in one country for several years it is probably impractical to rely on dry docking for biofouling maintenance.

Figure 2 A semi-submersible oil rig being transported on a heavy lift vessel



### 3.2.2. Dry-tow/heavy lift vessel

Biosecurity wise, this is the second best option (Figure 2). Most of the underwater surfaces of the rig can be cleaned during the voyage (

Figure 3) and most of the remaining biofouling can be expected to die through desiccation during a voyage longer than 2 weeks. Verification is relatively easy once the rig arrives on location, however, if viable species of concern are found there can be major complications. Dry tows can save money and time relative to long wet-tows and avoid the costs of dry docking. However, heavy lift vessels are limited in number so have to be booked in advance and lock the rig into a limited time slot. For short voyages, such as from Australia to New Zealand, they are probably not economically feasible.

Figure 3 An oil rig that has been cleaned during transportation on a heavy lift vessel



### 3.2.3. In-water cleaning

In-water cleaning using divers with water blasters (

Figure 4) and scraping, brushing machines (Figure 5) takes 20 to 30 days to clean a semi-submersible rig thoroughly. Verification is difficult, requiring cooperation between dive crews and inspectors. Presently this can be undertaken in various countries and can be conducted in offshore waters, weather permitting. Therefore timing can be flexible and, in many cases, only minor detours are required. Potentially, if a rig arrived in a country clean it could be cleaned in that country before departing without any risk of introducing NIMS. New Zealand has permitted in-water cleaning in the past under exceptional circumstances.

The number of countries which will allow international rigs to stop in their waters to conduct in-water cleaning can be expected to decrease as countries become aware of the associated risks. Also, rig operators may be liable to clean up the dislodged material should any species of concern be found during cleaning, as happened when the Ocean Patriot in-water cleaned in New Zealand. Not only may the rig introduce NIMS to its host country but it may also become contaminated by species from that country during the long period required for cleaning. The newly cleaned, non-antifouled surfaces provide ideal settling habitat for larval life stages of many species. This type of contamination may not become apparent until months later, once the rig has commenced operations at its new location.

In-water cleaning is expensive due to the number of diving hours involved and the down time required. It is hazardous for the divers and raises many OH&S issues.

Figure 4 A worker testing a Sub-Sea retro jetting lance



Figure 5 Sub-Sea Industries MC312 Typhoon brush cart (left) with Rislan brushes and scrapers (right)



### 3.2.4. In-water inspection

In-water inspection must be preceded by a thorough risk assessment of a rig's history since it was last thoroughly cleaned. The risk assessment will identify species of concern for the country the rig is travelling to. The in-water inspection searches all underwater niche areas and surfaces for these species of concern (Figure 6). If none are found, the rig may be classified as sufficiently low risk of introducing species of concern and permitted entry without cleaning. However, if species of concern, or potentially invasive marine species, are found the rig may have to be cleaned anyhow.

In-water inspection is relatively cheap and provides a rapid outcome. It can provide additional confidence should follow-up cleaning be undertaken. However, as with in-water cleaning, it

relies on good communication between divers and inspectors and can only assess a limited number of sample sites, not the entire underwater surface. This is a risk assessment option, not a risk reduction method. There are difficulties with detecting some species and many species that cannot be positively identified on site. Some species can only be confirmed by experts in museums or universities and some require DNA analysis. Also, microscopic larval forms can be missed during an in-water inspection.

Figure 6 A diver conducting an in-water inspection of an oil rig pontoon



### 3.2.5. Enclosure treatment

Although still in its developmental phase, enclosure treatment is expected to provide a system which can be carried on board a rig or its associated supply boats and be used to quarantine or kill biofouling. It can be used in sheltered waters along the route and potentially during well completion operations before commencing an international relocation. It requires no on-shore facilities, only two work boats, few additional personnel and may be conducted with or without addition of chemical accelerants. It requires little input from divers, primarily as observers, and confirmation inspection is only required to confirm complete mortality of all biofouling has been achieved. All contaminated water and dislodged biofouling can be collected for suitable treatment and safe disposal at sea.

### 3.3. ECONOMIC COMPARISON OF VARIOUS OPTIONS

The main economic benefits from using an IMProtector enclosure treatment rather than other options to quarantine or kill biofouling on an oil rig come from it saving time and being cheaper to conduct. It is not, however, an option for physically removing biofouling.

The IMProtector system is designed to be packed into standard 40 ft freight containers so it can be transported with the rig or separately to where the rig is to be treated. Therefore the rig does not have to make any major diversion from its route between countries to treat biofouling and no onshore facilities are required. Enclosure treatment can be conducted in any calm or reasonably sheltered waters, subject to consent from Government regulatory authorities. It can be managed so there is no discharge of toxins or viable biological material into inshore waters so permission to conduct treatments is expected to be relatively easy to obtain. This contrasts with making long detours to dry docking facilities or waters where in-water cleaning using water blasters and scrapers is allowed. Regulations relating to discharge of treatment solutions are covered in Section 4.7.

Once the developmental research is completed it is expected that all biofouling on the pontoons of a rig can be killed by an overnight treatment. This will require 2 days in sheltered waters to deploy and retrieve the IMProtectors. It will require the use of 2 boats, presumably the rig's supply boat and standby boat, and a dive team for the 2 days. Accelerants for the treatment are expected to cost around NZ\$195,000 per treatment. The simple Set-n-forget treatment, which works because the biofouling organisms consume the oxygen in the enclosed water, requires up to 15 days so is only practical when stacking a rig or conducting periodic refitting or major maintenance. However, in these circumstances it requires no allocated rig time and progresses quietly by itself at no additional cost. Dry dock cleaning requires up to 10 days plus any time spent waiting for the facility to be available. It also costs for the hire of the facility and the labour involved. In-water cleaning using divers with water blasters and scrapers takes around 21 days of rig time plus the cost of the divers.

Comparisons of indicative costs of various biofouling management options for two international rig relocations are presented in Table 1 and Table 2. These are very simplistic because day rates and availability of dry docks and heavy lift vessels change constantly depending on a multitude of factors. Also, various drilling contractors and petroleum companies own or have discounted access to all types of vessels and services which affect the cost of the options listed. However, what is clearly shown in these tables is that IMProtector treatment is between NZ\$8 M and NZ\$22 M cheaper than in-water cleaning and dry docking respectively for short or long rig relocations. For long relocations the cheapest method is dry-tow on a heavy lift vessel due to the time saved in making the voyage. However, the voyage duration must be at least 14 days to be reasonably sure of killing the majority of the biofouling, and heavy lift vessels are not always available. The IMProtector cost of NZ\$1,800,000 used in the table is the total purchase price of a system to treat a rig, including two IMProtectors. However, this system can be reused over a 5 year period, assuming proper handling, so the cost of repeated use will be considerably lower.

Time is very valuable in the offshore industry and the IMProtector treatment for biofouling saves 19 days compared to in-water cleaning and 16 to 20 days compared to dry docking for rigs coming to north-western Australia from Venezuela or the Philippines. For rigs moving back and forth between say Bass Strait, Australia and the Taranaki Basin, New Zealand, in-water cleaning is not an option as it is banned in both countries, and the nearest dry dock

suitable for a semi-submersible oil rig is in Singapore. In this case IMProtector treatment is vastly more time- and cost-effective, making it virtually the only feasible option.

Cost details related to IMProtector manufacture and deployment are presented in section 6.4.

**Table 1. Indicative costs of biofouling management options for a rig relocation from Venezuela to Dampier, Western Australia**

MODU operating near Venezuela relocating to Dampier	Units
<b>Option 1 - Dry-tow (heavy-lift vessel) straight to Dampier</b>	
Rig rate/day	\$ 500,000
Heavy Lift Vessel mob/demob	\$ 500,000
Heavy Lift Vessel/day	\$ 100,000
Duration/days	37
<b>Estimated total cost</b>	<b>\$ 22,700,000</b>
<b>Option 2 - Wet-tow via Singapore for dry docking</b>	
Rig rate/day	\$ 500,000
Farstad vessels x 2/day	\$ 150,000
Duration/days to Singapore	90
Dry dock duration/days	10
Dry dock costs	\$ 10,000,000
Duration/days to Dampier	14
<b>Estimated total cost</b>	<b>\$ 77,600,000</b>
<b>Option 3 - In-water clean and wet-tow</b>	
Rig rate/day	\$ 500,000
Cleaning costs/day	\$ 50,000
Cleaning duration	21
Farstad vessels x 2/day	\$ 150,000
Duration/days to Dampier	90
<b>Estimated total cost</b>	<b>\$ 70,050,000</b>
<b>Option 4 - Wet-tow and IMProtector</b>	
Rig rate/day	\$ 500,000
Farstad vessels x 2/day	\$ 150,000
Duration/days to Dampier	90
IMProtector system	\$ 1,800,000
Treatment accelerant	\$ 195,000
Application duration	2
<b>Estimated total cost</b>	<b>\$ 61,795,000</b>

**Table 2. Indicative costs of biofouling management options for a rig relocation from the Philippines to Dampier, Western Australia**

MODU operating in Sulu Sea, Philippines to Dampier	Units
<b>Option 1 - Dry-tow (heavy-lift vessel) straight to Dampier</b>	
Not long enough duration to kill biofouling	
<b>Option 2 - Wet-tow via Singapore for dry docking</b>	
Rig rate/day	\$ 500,000
Farstad vessels x 2/day	\$ 150,000
Duration/days to Singapore	11
Dry dock duration/days	10
Dry dock costs	\$ 10,000,000
Duration/days to Darwin	16
Estimated total cost	\$ 34,050,000
<b>Option 3 - In-water clean and wet-tow</b>	
Rig rate/day	\$ 500,000
Cleaning costs/day	\$ 50,000
Cleaning duration	21
Farstad vessels x 2/day	\$ 150,000
Duration/days to Darwin	13
Estimated total cost	\$ 20,000,000
<b>Option 4 - Wet-tow and IMProtector</b>	
Rig rate/day	\$ 500,000
Farstad vessels x 2/day	\$ 150,000
Duration/days to Darwin	13
IMProtector system	\$ 1,800,000
Treatment accelerant	\$ 195,000
Application duration	2
Estimated total cost	\$ 11,745,000

### 3.4. IMPROTECTOR CONCEPT

The IMProtector concept is based on the wrapping or enclosure method of killing biofouling. It involves an impermeable barrier which completely encloses the underwater surface of vessels and isolates them from the surrounding water. Typically it is used to enclose the hull of a monohull vessel or each hull of a multihull vessel (Coutts 2006; DPIFM 2006; Coutts and Forrest 2007; Pannell and Coutts 2007). In the case of semi-submersible oil rigs, it is only practical to treat the hulls of the pontoons when the rig is ballasted up. The IMProtector enclosure treatment has been trialed successfully on small vessels (

Figure 7) and this project is intended to provide sufficient information to underpin a trial on an oil rig.

Figure 7 An IMProtector on a fishing boat



Treating oil rigs requires a different approach than conventional vessels due to their normally heavy levels of biofouling, multitudes of corroded anodes and projections such as waste water pipes which are present on the outside of the hulls. This requires specifically manufactured fabric which is very tough and highly resistant to cutting, tearing and abrasion. A large rectangle of this fabric is fitted with floatation collars and longitudinal ballast chains so that, when towed through the water behind a U shaped frame, it takes the shape of the pontoon. One IMProtector is towed into position on each pontoon. This will be conducted using winches on the stern of the rig supply vessel (

Figure 8) with no requirement for divers other than for observation. Once in position the IMProtector will be tied off to the bollards on the pontoon decks, using a folding configuration, so that all biofouling trapped inside. The IMProtectors can be left in place throughout the rig's stay in port and all biofouling will eventually be killed by anoxia. Alternatively an accelerant such as acetic acid or chlorine may be added to enable all biofouling to be killed within 24 hours.

IMProtectors for oil rigs have been designed so they can be re-used many times and should last about 5 years depending on how well they are handled. Due to their generalised shape, they can be used on various rigs of similar size and similar sized vessels. At present the maximum size of an IMProtector is about 100 to 120 m long by 30 to 35 m wide. This limit is fixed by the maximum dimensions of standard shipping containers and the thickness of the floatation collar material. Once these dimensions are exceeded the transportation of the IMProtector becomes more problematic, but not impossible. We have investigated making IMProtectors in sections but have not found a suitable waterproof method of joining the sections yet.

Figure 8 A typical oil rig supply vessel which has sufficient beam to accommodate the IMProtector across its work deck and tank capacity for collecting treatment waste water



## 3.5. USES FOR IMPROTECTOR SYSTEMS

### 3.5.1. Quarantine

The IMProtector is constructed of impermeable fabric and has a floatation collar that extends 0.5 m above the water. Once it is installed around a hull, all biofouling organisms and their propagules are trapped inside. Therefore, if a rig which is intended only to work off-shore has to make an unscheduled entry into port, the IMProtector can be used to isolate the pontoon hulls from the surrounding water and thereby provide effective quarantine. The enclosure procedure is quick, simple, safe and cost-effective and removes the need for pre-emptive cleaning of off-shore rigs.

MAFBNZ has indicated in principle support for enclosure as a quarantine measure, subject to acceptable evidence that it meets their requirements. For each case, specifics of the methodology will need to be agreed between parties.

### 3.5.2. Treatment

Enclosure treatment can remove the need to clean the rig prior to entry into coastal waters. The IMProtector provides an enclosed water volume which can be modified to kill all biofouling organisms while not affecting the surrounding environment. The enclosed treatment solution can be pumped into drill water tanks on the rig supply vessel for safe disposal at sea. Dislodged dead biofouling can be collected and disposed of safely according to local requirements.

MAFBNZ has indicated it will accept this type of treatment, followed by verification inspection, to satisfy biofouling entry requirements subject to acceptable evidence that it is an effective method of meeting their biofouling requirements. For each case, specifics of the methodology will need to be agreed between parties.

### 3.5.3. Maintenance

A routine maintenance program can enable free movement between countries and coastal regions without need for other more expensive biofouling management procedures. It is expected that an overnight treatment every 6 months will keep the rig free of most biofouling organisms. However, more research is required to perfect rapid treatment methods. Ideally, the rig could be treated during well completion operations without requiring any down time. Such a maintenance regime would suit a rig moving back and forth between New Zealand and Australia.

New Zealand has indicated it will accept this type of routine maintenance regime, followed by verification inspections, to satisfy biofouling entry requirements subject to acceptable evidence that it is an effective method of meeting their biofouling requirements. For each case, specifics of the methodology will need to be agreed between parties.

## 3.6. LIMITATIONS OF IMPROTECTOR

The IMProtector enclosure treatment does not remove biofouling, it just kills it. Removal has to be done mechanically. However, once enclosure treatment has been completed, hull cleaning can be done with minimal risk of dispersing NIMS.

## 4. Deployment

### 4.1. DEPLOYMENT

The IMProtector is stored rolled up on a reel inside a top opening 40 ft container (Figure 9). It is deployed from a demountable reel drive mounted on the aft deck of the rig supply boat (Figure 10). This operation could also be conducted from a suitably prepared wharf. About 10 m is unrolled and a U shaped tow frame is fitted. The tow frame is articulated to enable it to fold to fit on a typical 12 m wide supply boat deck during attachment to the IMProtector. It is then locked into its deployment configuration and lowered over the stern of the supply boat. A smaller vessel such as a fishing vessel is used to tow the IMProtector off the roll and anchor it nearby so it is ready to fit to the rig (Figure 11). The frame is allowed to fill with water so it sinks to its towing draft. Towing bridles on each side ensure the IMProtector will conform to the pontoon's U shape as it is towed. The second IMProtector is then unrolled and anchored. It is anticipated this would be done before the rig enters coastal waters to minimise the time required to enclose it once it arrives.

Figure 9 IMProtector rolled on a reel (left) and packed inside a 40 ft container (right)

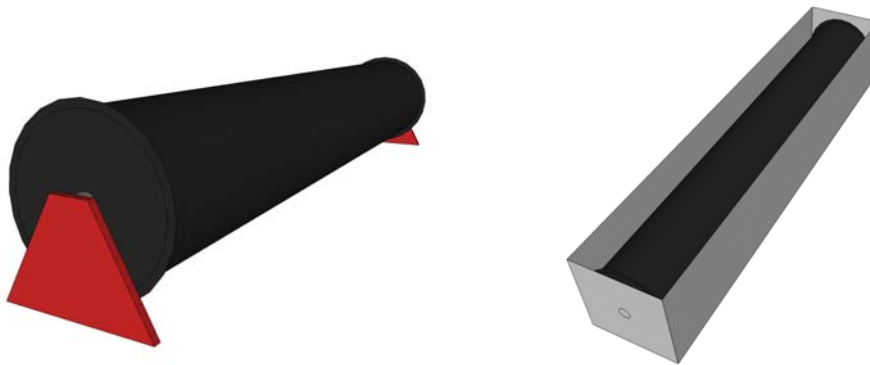


Figure 10 Two IMProtectors and their containers on a typical supply vessel. One IMProtector is being deployed

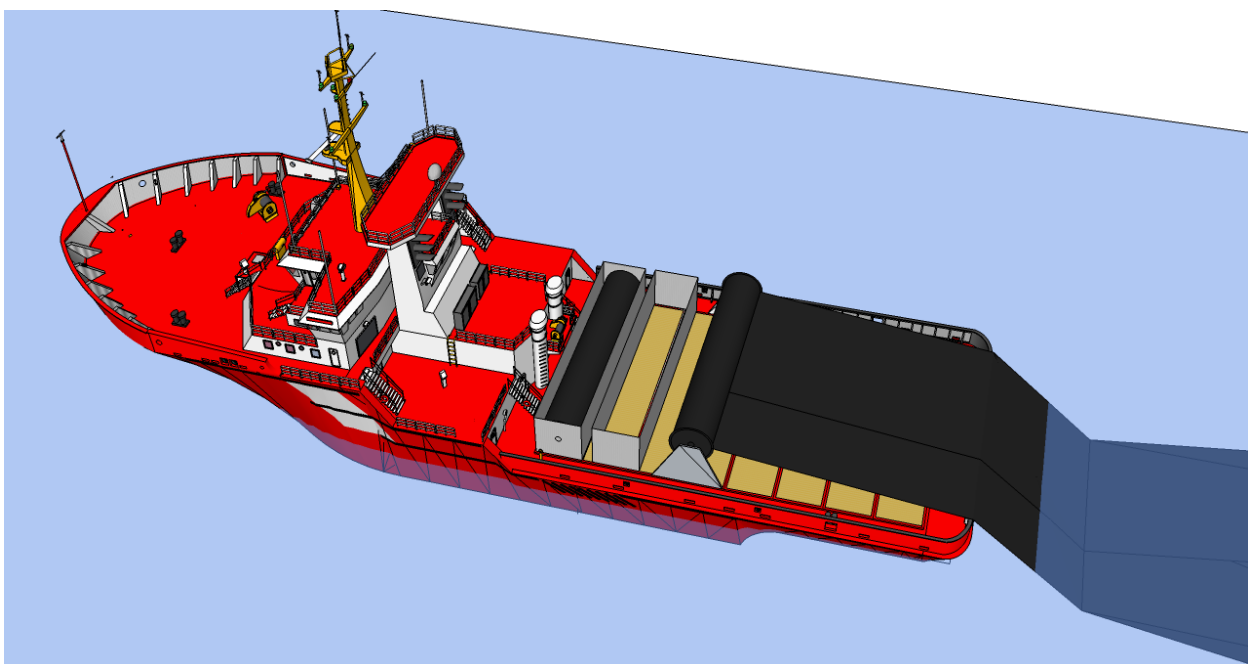
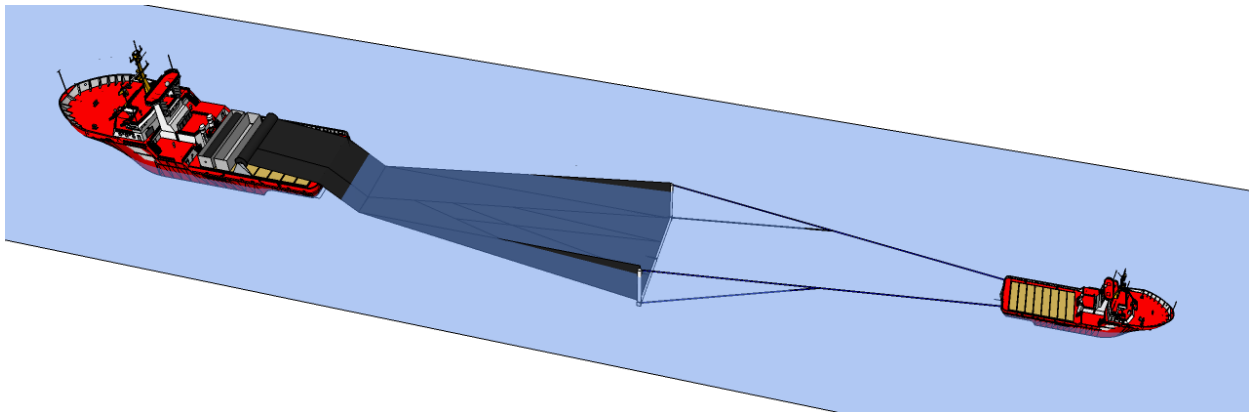


Figure 11      Tow boat towing an IMProtector off a supply boat – note tow bridles and frame



## 4.2. RIG PREPARATION

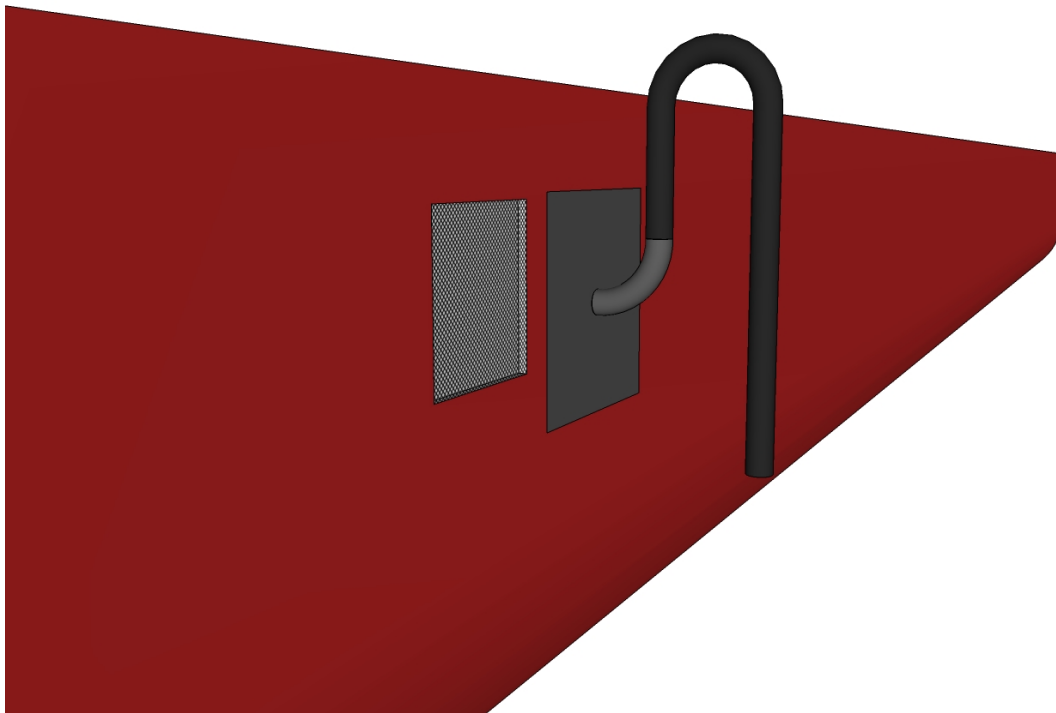
The present stage of development requires the rig to be anchored in calm or sheltered waters, where the maximum wave height is expected to be 0.5 m and the maximum current is 1.5 knots. The main reasons for this are safety of personnel assisting in deployment and the need to test a simple design in these early stages. Personnel will need to work on the pontoon decks to tie off the IMProtectors. It is intended that systems that can be deployed in calm to moderate weather at sea will be developed in the future.

MAFBNZ has not discounted it could allow rigs in to sheltered waters to be enclosed immediately after arrival subject to acceptable evidence that it is an effective method of meeting their biofouling requirements. For each case, specifics of the methodology will need to be agreed between parties. In many tropical locations calm seas prevail for months on end and IMProtectors could be deployed in open seas during such calm periods.

Prior to enclosing the pontoon hulls all rig propulsion systems must be disabled. Seawater intakes and outlets must have diverters attached so the rig and its fire fighting systems can function as required during enclosure. In the simplest configurations this would be a cover over the sea chest grates with a 90° bend and flexible pipe held above water level in a snorkel like curve (

Figure 12). This work will involve divers initially, but for a rig intending to use enclosure treatment for regular maintenance, a diversion line and Y valve system could be installed so divers will not be required.

Figure 12 A sea chest cover and inlet diverter which could be fitted to an oil rig sea chest to enable water inflow during treatment with an IMProtector

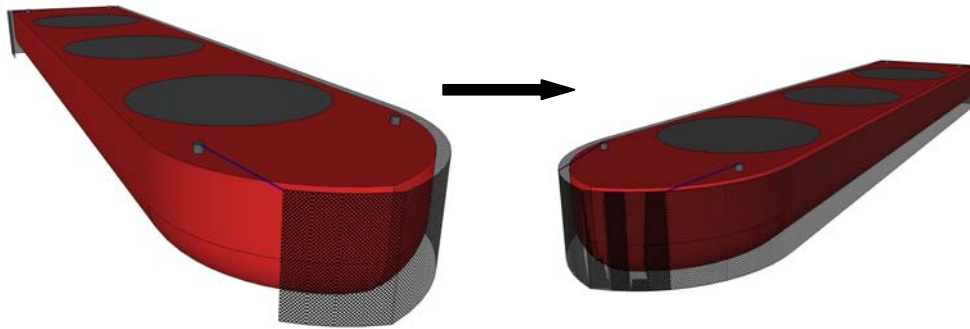


#### 4.3. PROTECTION

The main risk to the IMProtector during deployment is being cut or torn by sharp projections on the pontoons. These include biofouling such as large barnacles and sharp corals, and infrastructure such as anodes, external piping and propulsion systems. Divers will be required to wrap protective material around problematic infrastructure. Sharp biofouling and anodes will be blanketed using netting curtains deployed from the tow boat and tied off to bollards on the pontoons (Figure 13).

The netting curtains will be made from fish farm smolt netting, which has small squares but is made of relatively thick mesh or heavy cargo net. They will have a drop 1 m greater than draft of pontoons so they protect the turn of the bilge. They will be fitted to pontoons before the IMProtectors by allowing them to float down the sides of the pontoons then pulling them into place and tying them off. The type and configuration of netting curtains will depend on the type of fouling present. It could just require a cargo net hung over the bow and stern of each pontoon or a curtain for each side of each pontoon, or both. The smolt netting curtains extend around bow and stern providing double thickness for these wear areas.

Figure 13 Netting curtains fitted to an oil rig pontoon



#### 4.4. FITTING THE IMPROTECTORS TO THE RIG

Each IMProtector should be winched into position from a vessel positioned at the bow of the pontoon (Figure 14). This will give better control than towing and the flow of water generated by its thrusters will help fill the IMProtector and keep it out from the pontoon surfaces. The vessel (which will probably be the supply boat) will need to have a bow thruster to be able to maintain its position in wind and currents. Tow lines, which must be buoyant, will be floated or swum by divers down the inside and outside of the pontoon then fastened to the towing bridles on the IMProtector frame. Once the IMProtector is in position aft of the pontoons the tow lines will be winched in. Dock wheels on the inside of the frame will ensure there is a uniform layer of water between the hull and the IMProtector, provided the forward motion is maintained or there is a current present. The tow vessel (or backup vessel) will follow the aft end of the IMProtector with a line attached so it can pull it into line if required. The whole operation would be best managed from the deck of the rig.

**Once each IMProtector is in place and tied off to the bollards on the bow of the pontoon the tow frame is purged with compressed air so it floats horizontally on the surface. The hinged joints are unlocked and the frame is folded across the pontoon bow, folding the IMProtector to conform to the pontoon shape while retaining its edges above water level** (

**Figure 15).** The aft end of the IMProtector is then folded around the stern of the pontoon at tied off in the same way truck tarpaulins are folded ( Figure 16). Finally, divers will inspect the IMProtectors for damage.

Figure 14 IMProtector being winched into place

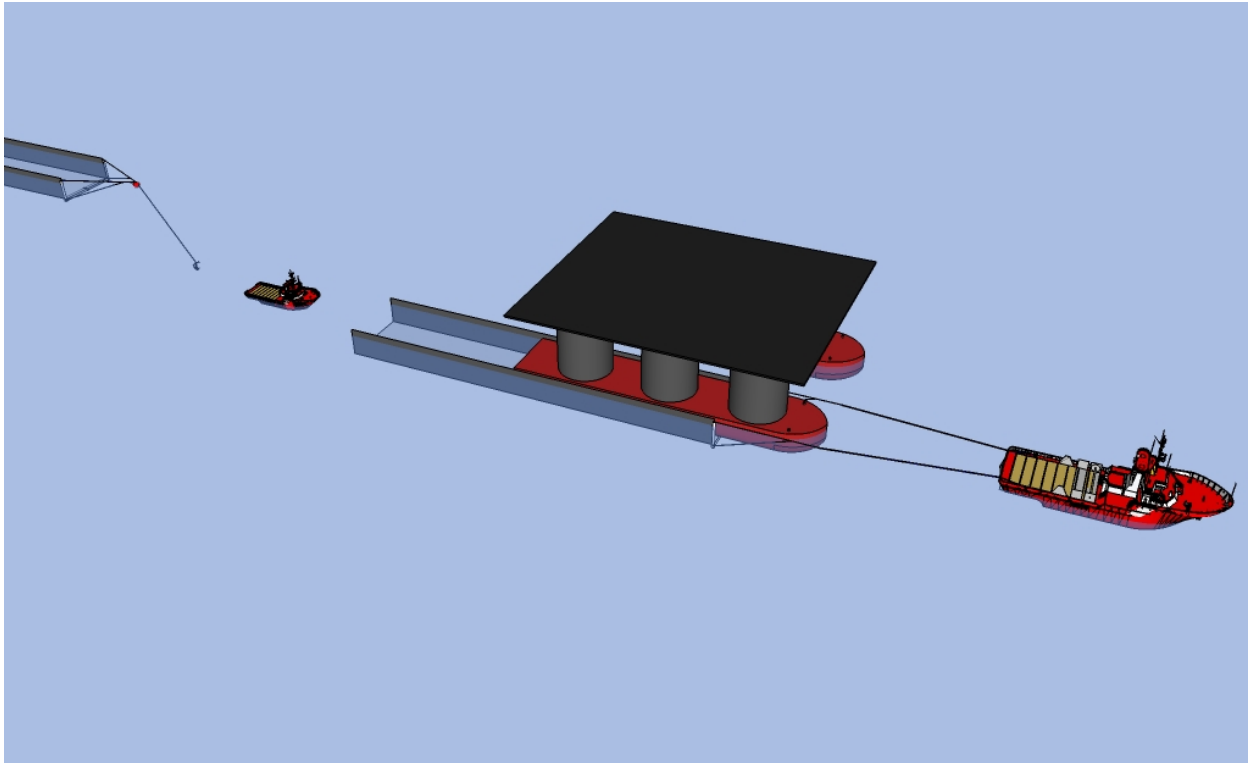


Figure 15 Sequence showing bow view of fitting an IMProtector to an oil rig pontoon

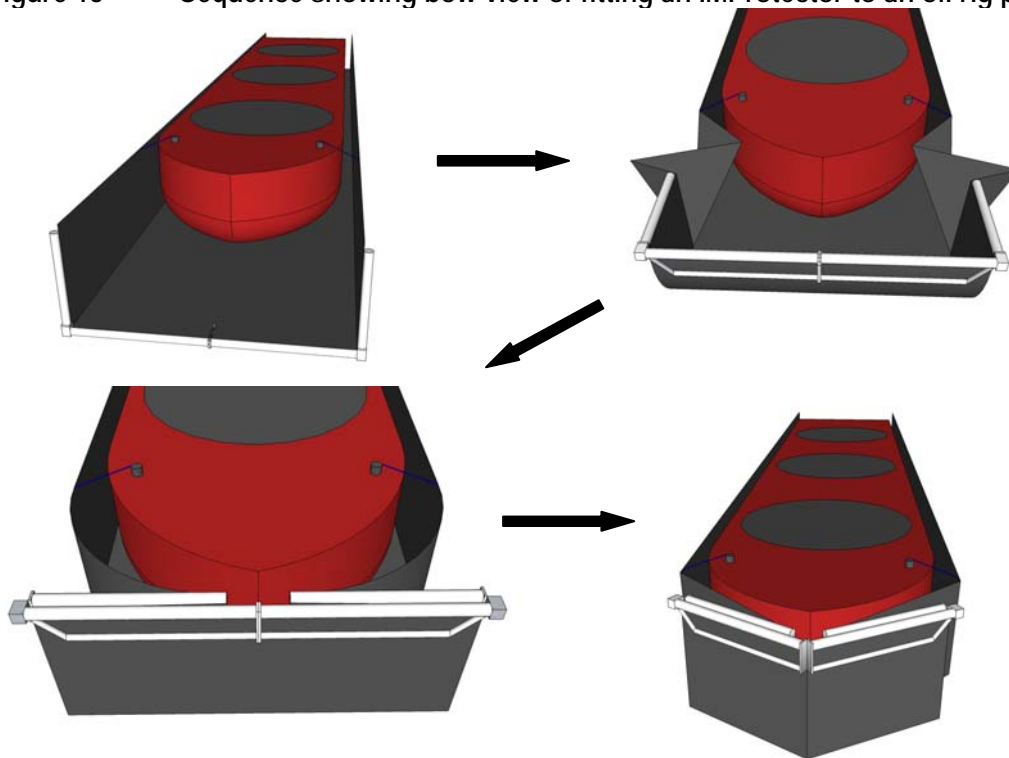
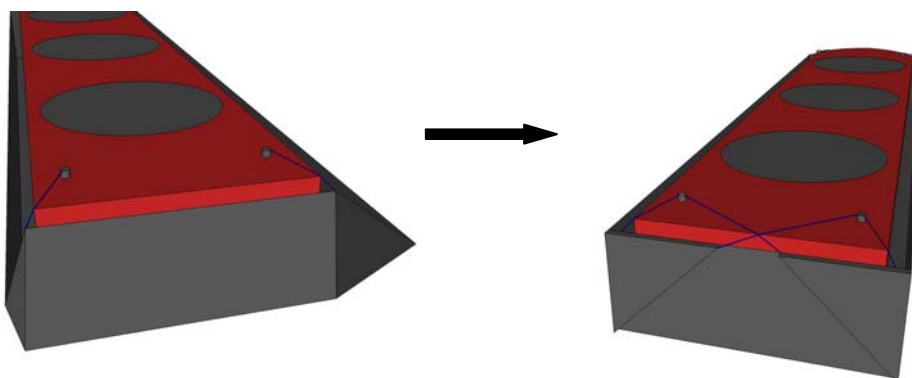


Figure 16 The IMProtector is folded around the stern of the pontoon



#### 4.5. PUMPING OUT

To increase and accelerate the toxic effects of enclosure and to reduce chafing movement between the IMProtector and the hull of the pontoon, water is pumped out from inside the IMProtector until it is pressed against the hull. Tying off the forward end before folding up the stern allows any current to “squeeze” much of the excess water out and reduces the volume to be pumped. Evacuation of the water is achieved using a large pump and filter system which can be mounted on a barge tied alongside the stern of each pontoon. During this stage filtered seawater can be discharged into the port initially as its properties will not have been altered.

#### 4.6. TREATMENT

The type of treatment chosen will depend on time available and rig circumstances.

##### 4.6.1. Anoxia or Set-n-forget

This method requires no addition of accelerants (e.g. Coutts 2006; Coutts and Forrest 2007; Pannell and Coutts 2007). The IMProtector is simply left in place for up to 2 weeks. Most

organisms are killed in the first day or two, but some hardy species such as mussels and barnacles have been observed to survive up to 15 days. This treatment suits rigs which are intending to have a long stay in port, such as for refit, maintenance or stacking.

#### 4.6.2. Addition of accelerants

Addition of accelerants such as acetic acid (vinegar), chlorine or disinfectants can greatly decrease the time required to kill biofouling (e.g. Bax et al. 2002; Rajagopal et al. 2003; Coutts and Forrest 2005; Pannell and Coutts 2007; Lewis and Dimas 2007; Denny 2008). Our tests have found treatments which are effective within 1 hour in the laboratory. However, field trials have been inconsistent and we need to conduct further tests to confirm the best treatments. It is likely that it will take at least an overnight treatment to kill the mass of biofouling expected to be present on semi-submersible oil rigs.

Accelerants are pumped into the IMProtector at the stern, where the rig's thrusters' shape helps disperse them. The seawater/accelerant mix is pumped out at the bow and circulated to maintain the required concentrations all around the hulls.

### 4.7. TREATMENT WATER DISCHARGE

Anoxic water generated from the set-n-forget treatment will contain by-products of decaying organic matter, and treatment solutions will typically contain accelerants such as acetic acid or chlorine. These solutions will rapidly become diluted to non-toxic levels and will leave no lingering toxins in the environment once discharged into the open sea. However, in small bays, ports or confined waters they may cause some harm so they should be pumped into the drill water tanks of the rig's supply vessel for discharge at sea.

The water volume within the IMProtectors is kept as low as possible to increase the efficiency of treatments. Therefore the volume of anoxic water typically should be less than 100 m<sup>3</sup> per pontoon and treatment solution should be approximately 100 to 200 m<sup>3</sup> per pontoon, depending on pontoon size. These volumes can be accommodated by most offshore supply vessels in their drill water tanks which normally have capacities exceeding 1000 m<sup>3</sup>.

Regulations relating to discharge of treatment water into the sea vary greatly from country to country, and often from jurisdiction to jurisdiction within countries. Within Australia and New Zealand the following paragraphs summarise the relevant regulations.

The *ANZECC Code of Practice for Antifouling and In-water Hull Cleaning and Maintenance 1997* applies in Australian and New Zealand waters and is applicable to all commercial vessels. According to this code no part of a vessel's hull treated with antifoulant is to be cleaned in Australian or New Zealand waters without the written permission of the Harbour Master, local government or state environmental protection agency (administering authority). This code is currently being updated and the revised code is expected to include provisions relating to enclosure treatment.

The International Convention for the Prevention of Pollution from Ships (MARPOL) will also apply. This convention categorises types of wastes and how and where they can be disposed. The categories range from liquid wastes that have a very harmful impact on environment to those with no impact. How the waste from the IMProtector is classified will determine how and where it can be discharged. Medium impact wastes are allowed to be discharged at 15nm offshore underwater whilst the vessel/rig is moving.

#### 4.7.1. Discharge in Victorian waters – coastal (3 nm zone)

Any discharges into Victorian waters must be in accordance with the *State Environmental Protection Policy (Waters of Victoria)* and its schedules. Where no standards are defined, the ANZECC Guidelines may be applied or the Environmental Protection Authority of Victoria may define alternate guidelines.

#### 4.7.2. Discharge in Australian waters – outside 3nm

Discharge from offshore installations is governed by a range of legislation in Australia, including:

- [\*Petroleum \(Submerged Lands\) Act 1967 \(PSLA\)\*](#) ↗
- [\*Environment Protection and Biodiversity Conservation Act 1999 \(EPBC Act\)\*](#) ↗
- [\*Environment Protection \(Sea Dumping\) Act 1981\*](#) ↗
- [\*Protection of the Sea \(Prevention of Pollution from Ships\) Act 1983\*](#) ↗

The Commonwealth Department of Resources, Energy and Tourism is the regulatory agency responsible for discharges from offshore installations.

As part of the PSLA, offshore operators are required to have an approved Environmental Plan which specifies agreed environmental performance objectives and standards. This will include discharge of solid and hazardous materials and waste to sea.

#### 4.7.3. Discharge in New Zealand – coastal (12 nm zone)

Rules and regulations for the coastal marine area (up to 12 nautical miles from land) are covered under the *Resource Management Act*. Regional councils are responsible for administering and enforcing these regulations.

#### 4.7.4. Discharge in New Zealand – outside 12nm

Marine protection rules beyond the 12 mile limit are supported by the *Maritime Transport Act* in conjunction with the *Marine Pollution Regulations*. Maritime NZ is responsible for the administration and enforcement of these.

Additionally, discharges relating to offshore installations are covered under the *Marine Protection Rules Part 200 – Offshore Installations – Discharges 2009*. Part 200 provides rules for offshore installations to prevent pollution of the marine environment by substances used or produced in offshore mineral exploration and exploitation. This part is concerned with discharges of oil, other harmful substances and garbage. It introduces the concept of a discharge management plan, a form of environmental management plan, which must be approved for all offshore installations and promotes the application of “best practicable option” to prevent or minimise adverse effects on the environment arising from discharges.

Every offshore installation must have an approved discharge management plan (which can be modified by approval).

### 4.8. REMOVAL OF IMPROTECTORS

The IMProtectors are then removed in reverse sequence to the installation procedure. The stern is untied and unfolded. The tow frame is tied off to the tow boat then unfolded and locked open then allowed to fill with water and sink to its towing orientation. Water is allowed to flow inside between IMProtector and pontoon until there is a reasonable buffer between the two. The tow boat then tows the IMProtector forwards off the pontoon hull.

The supply boat will pick up the stern of each IMProtector, fasten it to the reel and roll it up.

A folding mechanism has been designed incorporating water jets to wash down both sides of the IMProtector as it is rolled up. This mechanism is designed to ensure the IMProtector is folded flat and distributed evenly across the reel so it will fit back into its container. Any material, including dislodged, dead biofouling, can be retrieved from within the IMProtector as it is rolled up by means of a net fastened across the tow frame. Finally, the tow frame is detached and folded up, the IMProtectors on their reels are stowed and the reel drive dismantled and everything is stored again in 40 ft containers.

#### **4.9. STORAGE AND TRANSPORT OF IMPROTECTORS**

Once stowed, the IMProtectors and their deployment equipment can be stored in their containers ashore or transported with the rig. The shipping containers are standard 40 ft freight container so will fit on conventional trucks for road transport and can be handled by standard shipping infrastructure.

#### **4.10. REPAIR**

The IMProtectors will be constructed in a series of 1800 mm wide strips welded together. For major damage, all or part of the damaged strips can be replaced. This will require similar work space to the original fabrication. Minor damage can be repaired by welding a patch directly to the existing material using a hot air welder. This could be conducted on any relatively large, dry, flat area. Small patches can also be glued on to clean, dry fabric.

It is possible for damage to occur during the fitting process if the fabric becomes snagged on a projection from a hull but if proper care is taken the likelihood of major damage should be low. Minor to moderate damage can be temporarily repaired once the IMProtector is in place using patches of fabric and strong, underwater adhesive tape. The edges of a large tear can be pulled together by stitching then pumping out of the internal water should commence. Once the fabric has been drawn in against the hull a patch can be positioned over the tear and the water pressure will hold it in place. The patch can then be further attached and sealed with tape. Given the pressure differential and calm water such a patch should stay in place for the duration of the treatment. Once the treatment is finished, permanent repairs can be completed ashore.

We are currently testing commercially available tapes and appear to have found a suitable double sided tape that we may be able to stick to patches prepared on the surface that can be carried by divers to the damaged area and applied underwater.

## 5. Conceptual Drawings and Scale Model

### 5.1. CONCEPTUAL DRAWINGS AND DESIGNS

Many theories and conceptual drawings have been made and rejected or developed through discussions with Bartlett's engineer and fabricator, a naval architect, commercial divers, commercial boat operators and oil rig operators. Those that appeared feasible were further investigated, engineering estimates made and once again rejected or further developed. Examples of the conceptual drawings are presented throughout this report.

### 5.2. TEST MODELS

A scale model of one of the pontoons of the Kan Tan IV was constructed at a scale of 1:70 (Figure 17). Schematic drawings of the Kan Tan IV were provided for this purpose by her owners. The model was ballasted to achieve a similar waterline to that of the Kan Tan IV when deballasted. Various versions of the IMProtector were made from sheet polyvinylchloride to the same scale and tested. Ballast options were tested and attached chain in longitudinal pockets along the two bilge lines with foam rubber floatation strips along the longitudinal edges provided the best shape and load distribution.

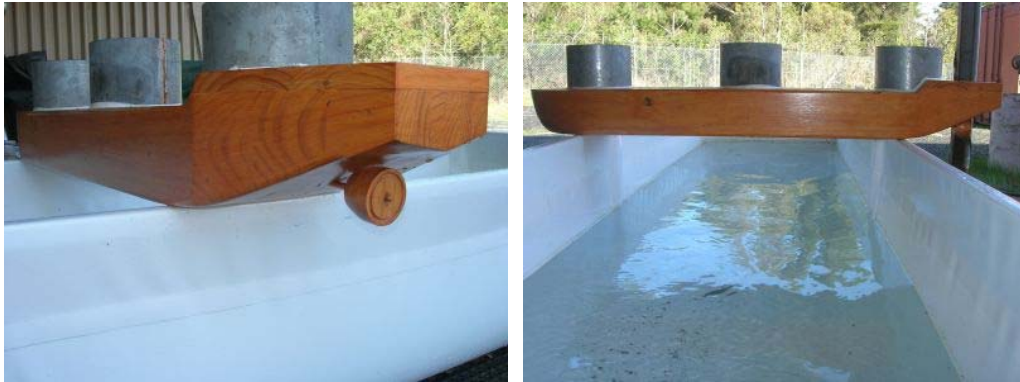
Various configurations of folding and closing the ends were tested and a simple rectangular shaped sheath with a folding square "U" shaped tow frame produced the best results. The hydrodynamics of towing the IMProtector behind the tow frame were observed and the IMProtector was observed to assume its desired shape in approximately 1 to 1 ½ times its own length of tow (

Figure 18, top 4 photos).

The behaviour of the IMProtector and the entrained water were studied during fitting of the IMProtector to the model pontoon (

Figure 18, bottom 4 photos) and a buffer effect was observed between the two provided the tow frame was help out from the side of the pontoon. We therefore designed the tow frame with dock wheels fitted to it and orientated inwards to provide the necessary clearance.

Figure 17 Scale model (1:70) of oil rig pontoon and test tank



## 6. Design and Manufacture

### 6.1. DESIGN AND CONSTRUCTION OF IMPROTECTORS FOR RIGS

#### 6.1.1. Materials

For this application a fabric has to be custom made in Japan. Its base weave is high tenacity polyester which was developed for architectural shade structures and designed for strength and stability. It will be coated with polyurethane both sides to get the best flexibility and abrasion resistance. The colour chosen is bright yellow to make it easier to see what is happening during deployment. The roll width will be approx 1890mm, the thickness about 0.8mm, and the weight about 1050gsm. Tensile strength is 5700 N/50mm in both warp and weft directions. Tear strength is 800N (warp), 700N (weft). From our research, this fabric offers the best trade-off between weight, strength and abrasion resistance while still using commercially available base weave. Laboratory samples were received mid September and are currently being tested.

Floatation will be in the form of high strength, closed cell foam sheet (75 kg/m<sup>3</sup> Ethylene Vinyl Acetate). This will be fixed along the upper edge of the IMProtector inside the fabric in a 1 m wide strip. It is designed to absorb wave generated abrasion and protect the integrity of the IMProtector fabric. It is flexible to enable it to fold around anchor racks etc. while retaining sufficient height above water to prevent waves splashing over. The sheet configuration is designed to be rolled up with the IMProtector.

#### 6.1.2. Structure

The IMProtector for oil rigs is a simple, flat, rectangular sheet ballasted with longitudinal chains to form a U shape. It is constructed of longitudinal strips welded together to form a waterproof membrane. Longitudinal webbing is incorporated to provide strength and distribute the forces involved in towing and rolling up. Attachment of the tow frame is by a folded flap which is lashed to distribute the load evenly. Rolling up utilises bolt ropes in welded longitudinal pockets and webbing to control the folds and distribute the strain.

Figure 18 Sequence showing how the scale model IMProtector takes shape when being towed behind the tow frame and how it forms around a pontoon hull



The tow frame is designed to form the IMProtector into the U shape required to fit around the pontoon. It is fabricated from tubular steel and engineered to withstand and distribute the towing strain. The main cross beam is sealed so it can be filled with water ballast to sink and

provide the U shape then be purged with air to float and bring the IMProtector leading edge to the surface for folding. It is hinged and braced so divers can unlock and re-lock its shape and it can be used to control the shape and folding of the forward end of the IMProtector. It can also be folded to fit inside a 40 ft container so it can be readily transported.

## 6.2. MANUFACTURE

Management and staff of CE Bartlett Ltd in Ballarat, Victoria, Australia have played an integral part in the design and manufacture of the small vessel IMProtectors we have commissioned to date. They have also provided invaluable support in the design and engineering of the IMProtector for oil rigs and in designing and commissioning samples of the fabric from one of their suppliers in Japan. Bartletts have the skills, personnel, equipment and premises to manufacture a 1/3 scale trial IMProtector and can hire a suitable building for the full scale trial units (Figure 19). Bartletts presently manufacture many types of tarpaulin like products ranging from blinds and awnings to covers for huge grain bunkers in the wheat belt of Australia ( Figure 20). Their web page at [www.bartlett.net.au](http://www.bartlett.net.au) gives a good indication of their innovativeness and capabilities.

Figure 19 C E Bartlett's factory in Ballarat



Figure 20 Examples of large fabric structures made by Bartletts – grain bunker covers (left) and a shade sail (right)



Bartletts are prepared to consider setting up a permanent manufacturing facility should the trials be successful and the petroleum industry decides to take up this method of biofouling management.

### 6.3. TIMELINES

The lead time to make and ship the fabric from Japan is 11 weeks from order. The first full scale IMProtectors could be ready for use approximately 12 months from placement of an order, assuming there will be one interim trial version built as discussed below. Subsequent units could be built in a few months depending on order numbers and fabric supplies.

### 6.4. COSTS

The set-up cost for IMProtectors to fit a rig such as the KAN TAN IV, with hulls 84 m long by 16 m wide by 7.6 m deep is estimated to be about NZ\$650,000 each and the total system including reel drive, net curtains, pumps and filters is expected to cost about NZ\$1,500,000 to NZ\$2,000,000. However, this cost can be distributed over several rigs, 5 years and probably 10 to 20 uses depending on the state of the pontoon surfaces and the care taken during deployment and retrieval.

Each use of the system involves deployment costs of 2 boats for 2 days. These could be rig's own supply boat and standby boat. For Set-n-forget there are no further major costs if the rig is in port for maintenance or stacking. As part of a voyage the cost of rig day rates must be included. However, the long term goal is to design IMProtectors that can be fitted while the rig is at anchor offshore during well completion operations, and therefore requiring no down time. If this becomes part of regular (6 monthly) biofouling maintenance using accelerants we expect the main additional cost will be about NZ\$195,000 for accelerant for overnight treatment.

## 7. The Future

### 7.1. FIELD TRIALS OF SCALE VERSIONS

#### 7.1.1. Build 1/3 scale version for trial on a suitable barge or ship

The next step is to fabricate a 1/3 scale system and trial it on a barge or ship. This will include all aspects of the system including reels, reel drive mechanism, folding and washing mechanism, tow frame, net curtains, IMProtectors and underwater repairs. Assuming all the design work is completed within the 11 weeks material supply time, and no other component has longer lead time, then we would start fabrication immediately on receipt of the fabric. We estimate 3 weeks fabrication time, dependent on design details. It would be wise to allow 2 weeks extra time to allow for unforeseen issues with the handling system, given that it is experimental. Therefore we expect that we could have a trial version ready in 16 weeks from date of order.

The IMProtectors can be constructed in an existing Bartlett's factory with existing equipment (Figure 21). The reels, reel drive mechanisms and tow frame can be built in local marine engineering works.

Net curtains can be made by an aquaculture net manufacturer near Aquenal's office in Tasmania.

Costs for a 1/3 scale trial model are estimated to be NZ\$100,000 to NZ\$150,000. This is based on using the special fabric, and the conceptual design details we have developed. If there is sufficient interest to conduct this testing we will commission detailed designs and obtain fixed quotes to pass back to a potential funding body.

The equipment developed in this trial can be reused either as the basis for the full scale version or to treat rig work boats and supply vessels.

Figure 21 The bunker cover manufacturing table in Bartlett's factory which could be used to build a 1/3 scale IMProtector



### 7.1.2. Build a full scale version and trial on a stacked rig

Assuming the 1/3 scale trials are successful and there is the interest and funding to conduct a full scale trial, we think this could be conducted in 12 months from now. This timeframe takes into account all the work needed to trial the 1/3 scale version and the follow-on learning from that, plus the time we would need to set up facilities for manufacturing, plus time to manufacture 2 very large IMProtectors. This probably works out to about 6 months from order, assuming the order comes after all the trialling of the 1/3 scale version. That timing puts fabrication during winter which is normally a quiet time for Bartletts, which gives them better staff and equipment availability.

Manufacturing capability – Bartletts consider it would be best to rent and prepare separate premises. There is potential to make the enclosure in manageable pieces in their existing premises, but it would slow the project down because it would have to fit around Bartlett's normal work. Also it would impose very strict limits on the amount of detail allowed. Given the large number of unknowns in the design, we can only give ballpark figures of cost at this stage. We estimate that the large IMProtectors would cost from NZ\$650,000 to NZ\$975,000 each, depending on the design. There will also be the cost of the deployment equipment, net curtains etc. so the total cost will probably be in the range of NZ\$1,500,000 to NZ\$2,000,000. If the trials are successful this system can be used to treat oil rigs for the next 5 years or so to defray the costs. Within that period they should have "paid for themselves" several times over, assuming the cost savings outlined in section 3.3.

## 7.2. SCIENTIFIC DEVELOPMENT

Further testing is required to better understand the concentrations and exposure times for various accelerants for rapid treatment of biofouling. Research has been and is being conducted by scientists around the world and Aquenal has invested in months of trials to build on this work. We are also collaborating with scientists in Singapore and Hawaii for input from tropical waters. It is our intention to focus on accelerants that are environmentally friendly in that they are readily neutralised and contain no long-lasting, toxic components.

Although the effects of anoxia (Set-n-forget) are obvious in that in the absence of oxygen all aerobic organisms will die, further study of the progressive efficacy and time frames is required for various species and levels of biofouling is required.

Once the efficacy of Set-n-forget and Rapid treatments are understood we need to demonstrate our recommended methods to the satisfaction of Government regulators so they agree to permit their use to satisfy their biofouling regulations.

## 7.3. DESIGN DEVELOPMENT

Once a calm water system has been proven to be successful and Government regulators have accepted the treatment methods the next step is to develop an enclosure system that can be deployed during mild weather at sea. This will enable maintenance treatment to be conducted during well testing and completion operations, thereby requiring no downtime from normal operations.

## 7.4. INPUT REQUIREMENTS

Aquenal, through our subsidiary company Biofouling Solutions Pty Ltd, and Bartletts are keen to progress with the development and testing of the IMProtector enclosure treatments for managing biofouling. However we have come to the limit of our seed research resources. To progress further we need encouragement and financial and in kind support from industry and Government.

MAFBNZ has provided funding to conduct this feasibility study and has given in-principle support for the concept of enclosure treatment. They are waiting now on proof of the concept before they can take further steps. The Australian Government regulators through DAFF and AQIS are aware of our work and watching with interest but see it as a commercial enterprise so are not willing to get involved. Hopefully we can demonstrate the environmental and economic benefits of the system to them and convince them to take a more proactive role.

Now this feasibility study is complete we will approach the Australian Petroleum Producers and Exporters Association, the Australian Drilling Industry Association, the International Association of Drilling Contractors the large rig owners and operators such as Diamond Offshore, Maersk and Transocean and Government funding sources in New Zealand and Australia for support to get to the next stage of testing.

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