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# A REGIONAL STRATEGY TO ADDRESS MARINE POLLUTION FROM WORLD WAR II WRECKS

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***SOPAC***

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# 1. INTRODUCTION

## 1.1 Background

Marine pollution is widely recognised as one of the three major threats to the world's oceans, along with habitat destruction and over-exploitation of living marine resources. Spills of oil and other chemicals into the marine environment, both from ships and land-based sources, is a significant source of pollution.

The importance of coastal and marine environments to every aspect of the lives of Pacific Islanders cannot be overstated, and the impacts of marine spills constitute a major concern for Pacific Island peoples. On a global scale the land area of Pacific Island Countries and Territories are insignificant. However the Pacific Islands maintain resource rights and management responsibilities over 30 million square kilometres of ocean. This is equivalent to the combined land areas of Canada, China and the USA and is essentially our only "globally significant" resource.

The lack of major land-barriers throughout the Pacific, combined with the complex pattern of trans-oceanic currents means that the Pacific Ocean is perhaps the most highly connected and continuous ocean, in terms of water circulation. It is these characteristics of the Pacific Region that compound the seriousness of marine pollution within the region. Pollution incidents in one area have potentially serious implications for other areas.

There are a number of agreements, conventions, instruments, policies and other initiatives that require countries to work co-operatively to address marine pollution and protect the marine environment. At the international level these include; - *the United Nations Convention on Law of the Sea* (UNCLOS); *Agenda 21* arising out of the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 and the *Barbados Programme of Action on the Sustainable Development of Small Island Developing States* arising out of the Global Conference on the Sustainable Development of Small Island Developing States, held in Barbados in 1994. At the regional level they include the *Convention for the Protection of the Natural Resources and Environment of the South Pacific Region* (the SPREP Convention) and associated Protocols and the *Action Plan for Managing the Environment of the South Pacific Region 2001- 2004* (SPREP Action Plan).

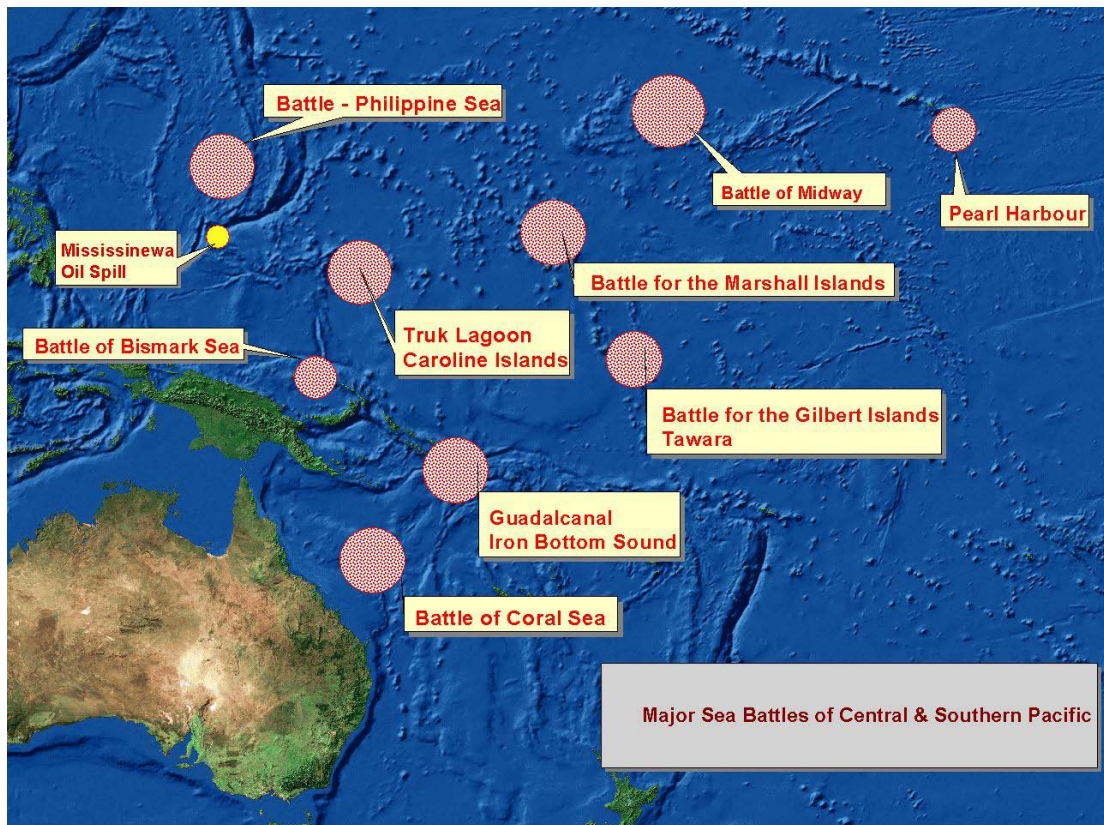
Pacific islands have agreed to work together, through regional arrangements, in order for marine pollution to be addressed effectively. No single country in the region can address this problem in isolation. The *South Pacific Regional Environment Programme* (SPREP), as part of its role to assist island members to address environmental issues and in accordance with the SPREP Action Plan, has developed a comprehensive programme to address marine pollution from ship-based sources. This is called the *Pacific Ocean Pollution Prevention Programme* (PACPOL).

## 1.2 World War II - The Legacy of the Pacific Theatre

The 7 December, 1941 was a “*day that will live on in infamy*” according to United States President Roosevelt. A naval taskforce of the Japanese Imperial Navy attacked the United States Naval Base at Pearl Harbour, Hawaii signalling the entry of the United States into the Second World War. This War would rage for almost 4 years until 1 October, 1945.

The islands of our region suddenly became important strategic prizes of World War II. To the United States, possession of these islands was a stepping-stone towards the final assault on the Japanese Islands. To the Japanese, possession of these islands meant an opportunity to isolate Australia and New Zealand and ultimately expand their empire into a position to assault the mainland United States.

Our region became the stage for the “Pacific Theatre.” Pearl Harbour, Midway, the Coral Sea, Guadalcanal, Truk Lagoon, Betio and Iwo Jima were previously unheard of names that were immortalised as places where the main battles of this theatre were fought. Our people were caught in the crossfire and many are the sad and heroic tales of what they had to endure.



*Major Sea Battles of WWII in the Pacific*

More than 55 years have passed since the end of World War II and the protagonists have long since returned to their homes and countries. We in the region, have rebuilt our lives and our nations. However, every once in a while we are reminded of that War by the unwanted legacy it left behind. This legacy is the abandoned machinery of war – tanks, weapons, unexploded ordnance, abandoned fuel and other hazardous material sites and lurking in the deep, the wrecks and cargoes of vessels sunk.

In the sea battles around the Solomon Islands of Guadalcanal and Savo, hundreds of vessels were lost and the straits between the islands renamed Iron Bottom Sound because of the number of WWII shipwrecks littering the bottom of the straits. In the Federated States of Micronesia's Truk lagoon, over 60 vessels were sunk in a 40-mile wide lagoon. These are the two main concentrations of wrecks but they are distributed throughout the region with a significant number still lying undiscovered.

The oil, chemicals and unexploded ordnances still on board many of these vessels pose a grave and imminent danger to the people, marine and coastal environments and fisheries of the region.

### **1.3 The USS Mississinewa – Catalyst for Calls for a Regional Strategy**

The USS Mississinewa was an oil I tanker (Auxiliary Oiler) supplying a range of aviation fuel and heavy marine fuel oil to the US Pacific Fleet anchored off Ulithi Atoll, Yap State, Federated States of Micronesia in November, 1944. On 20 November, 1944 the vessel was attacked by a manned Japanese torpedo and sank with more than 50 personnel in 40 metres of water.

In early July, 2001 a tropical storm passed through the area disturbing the 57-year old wreck and causing an oil spill that was not contained until late August, 2001. The leak was estimated as occurring at a rate of 300 – 400 US gallons per day, an estimated total of 18,000 – 24,000 US gallons (68,000 – 91,000 litres) over the 60-day period. **The US Navy contracted dive team, estimates volume of oil remaining on the wreck at approximately 9.6 Million US Gallons (36 Million Litres).**

Response from all parties involved with responding to this incident, in particular from the Yap, FSM and US agencies was both swift and efficient considering the remoteness of the site and also the weather conditions the parties had to contend with. However, it was recognised by all parties that the plug placed on the leak was a temporary measure. It was acknowledged that in the case of the USS Mississinewa it was no longer a question of, will it leak again but rather, when will it leak again. These fears were later substantiated in late December, 2001 when the USS Mississinewa again leaked oil under a similar scenario as the initial incident - disturbance of the wreck by a passing tropical storm.

In September, 2001 the issue of the USS Mississinewa was raised by the FSM delegation to the 12SM. They voiced their concern on the potential environmental impacts from WWII wrecks and that this issue should be addressed. A number of other delegations, in particular the Solomon Islands delegation who also have a large number of World War II wrecks in their waters, urged the Meeting to take steps to address the issue. The Meeting decided that the SPREP Secretariat be requested to work with other regional agencies to come up with a draft strategy to address the issue.

The issue was also raised at the SOPAC Governing Council Meeting in October, 2001. The SOPAC Council made a similar decision that SOPAC be requested to work with other regional agencies to develop a regional strategy.

#### **1.4 Legal Mandate – the SPREP Convention’s Pollution Emergencies Protocol**

At Noumea, New Caledonia on 25 November 1986, the Members of SPREP adopted the *Convention for the Protection of the Natural Resources and Environment of the South Pacific Region* (the SPREP Convention), with associated Protocols. The Convention includes a *Protocol Concerning Co-operation in Combating Pollution Emergencies in the South Pacific Region* (SPREP Emergencies Protocol). The Protocol provides a formal framework for co-operation between Pacific Island Countries and Territories to prevent and respond to pollution incidents such as marine spills. The SPREP Emergencies Protocol requires Parties to:

- take initial action at the national level to respond to pollution incidents (marine spills).
- co-operate with other Parties in the response to pollution incidents.
- establish and maintain, within their respective capabilities, the means of preventing and responding to pollution incidents, including;
  - enacting relevant legislation.
  - developing and maintaining contingency plans.
- designate a responsible authority.
- exchange information with each other and report all pollution incidents to relevant authorities and other Parties likely to be affected.
- provide assistance, within their capabilities, to other Parties who request such assistance.
- facilitate the movement of personnel and materials needed for the response to a pollution incident into, out-of and through its territory.
- develop and maintain, where appropriate, sub-regional and bilateral arrangements for preventing and responding to pollution incidents.

The SPREP Convention's Emergencies Protocol is the legal instrument for co-operative arrangements within the region to prevent and combat pollution incidents. Article 3 of this Protocol provides the legal mandate for this Draft Strategy. This Article states: -

1. *"The Parties to this Protocol shall, within their respective capabilities, co-operate in taking all necessary measures for the protection of the South Pacific Region from the threat and effects of pollution incidents.*
2. *The Parties shall, within their respective capabilities, establish and maintain, or ensure the establishment and maintenance of, the means of preventing and combating pollution incidents, and reducing the risk thereof. Such means shall include the enactment, as necessary, of relevant legislation, the preparation of contingency plans, the development or strengthening of the capability to respond to a pollution incident and the designation of a national authority responsible for the implementation of this Protocol."*

## **1.5 Other Legal Instruments and Customary International Law**

Internationally, there is currently no multi-lateral legal instrument governing the ownership of sunken warships or military aircraft. However there is a well-developed body of customary international law governing the treatment of sunken warships and military aircraft.

The Law of the Sea Convention, Articles 95 – 96 and also the 1958 High Seas Convention Articles 8-9, state that warships, naval auxiliaries, and other vessels owned or operated by a state and used at the time they sank only on government non-commercial service, are defined as "state vessels." International Law recognises that state vessels, and their associated cargoes, whether or not sunken, are entitled to sovereign immunity.

Precedents under international law indicate that there are only three ways through which ownership of a warship or state vessel can be transferred:

- if the vessel is captured or surrendered during battle (prior to sinking);
- by an international agreement;
- by an express act of abandonment, gift or sale in accordance with relevant principles of international law and the law of the Flag State governing the abandonment of government property.

Once hostilities have ceased, protagonists do not acquire any title to vessels through the act of sinking them. Likewise title to the vessel is not lost by the mere passage of time.

A Coastal State does not acquire ownership of a sunken state vessel by reason of its being located on, or embedded in, land or the seabed over which it exercises sovereignty or jurisdiction. However, access to such sunken state vessels within a Coastal State's archipelagic waters, territorial sea or contiguous zone, is subject to Coastal State control under international law. Access to sunken vessels beyond the limits stated in the preceding sentence is subject to Flag State control even though they may be still within a Coastal State's Exclusive Economic Zone.

Once hostilities have ceased, no person or State may salvage or attempt to salvage sunken state vessels, wherever located, without the express permission of the sovereign Flag State. Sunken state vessels that contain crew remains are entitled to special respect and must not be disturbed without the explicit permission of the Flag State.

**It is clear from the above assessment of customary international law and also precedents under international law that any action that disturbs sunken state vessels can only be undertaken with the consent of their Flag States.**



## **2. STRATEGY FRAMEWORK**

### **2.1 Aims**

The Aims of this regional strategy are:

- to prevent/minimise damage to marine and coastal environments and resources as a result of marine spills from World War II Wrecks.
- to ensure that any action taken will retain the sanctity of these sites as they are often also war memorials and gravesites.

### **2.2 Objectives**

The Objectives of the strategy are to:

- facilitate the implementation of the provisions of the SPREP Emergencies Protocol in order to address potential pollution incidents from World War II wrecks.
- undertake an initial Hazard Assessment through the identification of WWII wrecks, their location and cargoes potentially still on board.
- identify appropriate environmental impact assessment mechanisms that can be applied to these sites.
- identify risk assessment mechanisms whereby these wrecks can be assessed and level of risk determined.
- identify potential mitigation/remedial actions that can be prescribed.
- outline a process through which the prescribed treatment is to be carried out.
- act as a catalyst for the drawing up of bi-lateral or multi-lateral arrangements to address marine pollution issues related to these sites.

### **2.3 Underlying Principles**

- Parties will be guided by the provisions of the SPREP Emergencies Protocol.
- Parties may chose to implement the strategy as a bi-lateral or multi-lateral arrangement as prescribed under Article 8 of the Protocol but be mindful of the requirement to notify other Parties to the SPREP Convention.
- the principle of “Prior Informed Consent” will be applied to all Flag States prior to any action being taken on any site.
- the Strategy will adopt the principle of prevention as the first option. However, in so doing, apply the most cost-effective and practicable mitigation measures and response options available.
- the sanctity of the sites is to be respected at all times.

## 2.4 Technical Scope

The strategy will address the removal or minimisation of the risk of marine spills of oil, petroleum products and other hazardous materials from World War II wrecks.

This strategy will complement the approved regional marine spill response framework as outlined by the “Pacific Islands Regional Marine Spill Contingency Plan (PACPLAN).”

## 2.5 Geographical Scope

The geographical scope of the strategy is according to Article 2 of the SPREP Convention. This excludes the internal and archipelagic waters of Parties and is defined as 200 nautical mile zones as established in accordance with international law. It includes the 21 Pacific island countries and territories that are members of SPREP (SPREP island members), New Zealand and Australia (East coast and islands to eastward including Macquarie Island).

SPREP island members are grouped into two categories, the 14 independent countries (Pacific Island countries) and the seven territories (Pacific island territories).

**Table One: SPREP Pacific Island Member Countries and Territories**

SPREP Island Members	
Pacific Island Countries	Pacific Island Territories
Cook Islands	American Samoa (US)
Fiji Islands	Northern Mariana Islands (US)
Kiribati	French Polynesia (France)
Marshall Islands	Guam (US)
Federated States of Micronesia	New Caledonia (France)
Nauru	Tokelau (NZ)
Niue	Wallis and Futuna (France)
Palau	
Papua New Guinea	
Samoa	
Solomon Islands	
Tonga	
Tuvalu	
Vanuatu	

## **2.6 Parties to the Strategy**

The strategy takes its mandate from the SPREP Convention and in particular its Emergencies Protocol. Parties to this Protocol are bound to implement the strategy according to their obligations under the protocol. Members of SPREP that are not Parties to the Emergencies Protocol are urged to apply the strategy.

## **2.7 Modalities for Implementation**

This draft regional strategy has been prepared due to a request tabled at the 12 SPREP Meeting by the Federated States of Micronesia, endorsed by Samoa and supported by the Solomon Islands. SPREP Members who are Parties to the Emergencies Protocol in practice, may chose two options to meet their protocol obligations:

- on a bi-lateral basis, provided the Party informs other Parties and the SPREP Secretariat of its arrangement and outlines the provisions of this arrangement. The SPREP Secretariat may be involved in assisting the Party in this arrangement, but only upon the submission of a request to it by that Party.
- on a multi-lateral (regional or sub-regional) basis, with the SPREP Secretariat assisting upon the submission of a request by a Party(ies). Again, there is the requirement to keep all Parties informed of the intended arrangement and its provisions. This is the option taken by the FSM in requesting the draft strategy.

The provisions under international law as outlined in Section 1.5 clearly indicate that the Flag State of any sunken state vessel must be a partner to any bi-lateral or multi-lateral arrangement.

The request to draft this regional strategy does not preclude any Party(ies) from taking either option in future when making arrangements to meet their protocol obligations to address the marine pollution risks posed by sunken World War II vessels. The SPREP Secretariat urges Parties to use this Draft Strategy as a framework for any arrangement to meet their obligations.

### **3. STRATEGY IMPLEMENTATION**

Irrespective of which of the options outlined in Section 2.7 Parties chose to take when making arrangements to address the marine pollution issues related to World War II wrecks, the following key activities would need to be undertaken.

#### **3.1 Preliminary Site and Hazard Identification**

The Secretariat has concentrated its effort in conducting the desk study to establish a regional database of World War II wrecks. This preliminary work has carried out the following:

- collation of existing historical data of Pacific WWII wrecks (military and private sources).
- identification of the ownership (sovereignty) of individual wrecks and in which jurisdictional responsibility the vessel is located e.g. international waters, EEZ, territorial waters etc.
- confirmation of locations of sunken vessels in the region and production of maps of vessels on a GIS system.
- confirmation of identity of vessels and cargo quantities and types.
- determination of whether any reports of previous oil releases have occurred from the vessels.

The desk study has drawn on, and added to, past work carried out by SOPAC in Iron Bottom Sound. The records have large data gaps in a number of areas in particular, location and cargoes on board merchant vessels, sunk during the war.

A summary table outlining the data that has been collected to date appears in Attachment 2.

The data is incorporated into a Geographic Information System that maps the wreck location and also delineates Exclusive Economic Zones and Territorial Sea limits. This database will be made freely available to all SPREP Members.

#### **3.2 Environmental Impact Assessment**

Environmental Impact Assessments will need to be carried out on the potential environmental impacts posed by wreck sites. These assessments are to:

- determine what exists at each site.
- determine what pollution incidents are likely to occur at each site.
- determine what the likely impacts are.
- formulate recommendations on mitigation and response measures that need to be applied.

The volume of oil or other hazardous material lost during a spill incident is not necessarily the most important factor in determining the seriousness of an oil spill event or possible risk posed by a sunken vessel. The location of the incident/vessel, how the oil/material behaves and weathers, the prevailing sea and weather conditions, as well as the sensitivities of the environmental resources it impacts upon, are often the important considerations.

Therefore, there is a need to undertake shoreline assessments of the areas under threat and determine the resources at risk and the nature of the regional environment. From this a better understanding of the consequences of any spill event can be estimated along with possible spill response strategies, contingency arrangements and cleanup operations.

We must take two approaches in this activity. One is to undertake environmental pre-assessments for determining the potential impacts of a release of oil from a shipwreck. The other is to gather vital information required to undertake and manage any spill response in the event of an incident occurring before pollution mitigation of the wreck has taken place.

In the international spill response community a standardised survey technique called SCAT has been widely adopted. It was originally referred to as Shoreline Cleanup and Assessment Teams (SCAT), but is now gaining a more widespread use as a Shoreline Contamination Assessment and Treatment process.

The basic concepts of a SCAT survey are:

- a systematic assessment of all shorelines in the affected area;
- a division of the coast into geographic units or “segments”;
- a set of standard terms and definitions and documentation;
- determination of the most environmentally acceptable cleanup options and techniques.



*Fuel oil on beach – Jody F Millennium oil spill New Zealand (photo T.Gibert)*

The main steps involved in SCAT are:

1. Aerial reconnaissance to define the overall scale of the problem.
2. Detailed aerial surveys to develop local/regional strategies.
3. Systematic ground surveys to document shoreline type, sensitivity to oil contamination and conditions in the individual segments.
4. Follow up spot ground surveys.

The information on shoreline conditions provided by the SCAT survey would:

- identify oiled and non-oiled areas.
- describe location, character, and amount of stranded oil.
- evaluate operational and logistical factors.
- establish shoreline treatment priorities.
- establish treatment standards or criteria.
- propose treatment or cleanup methods.

## **Biological and Other Impacts from Oil Spills from WWII Shipwrecks**

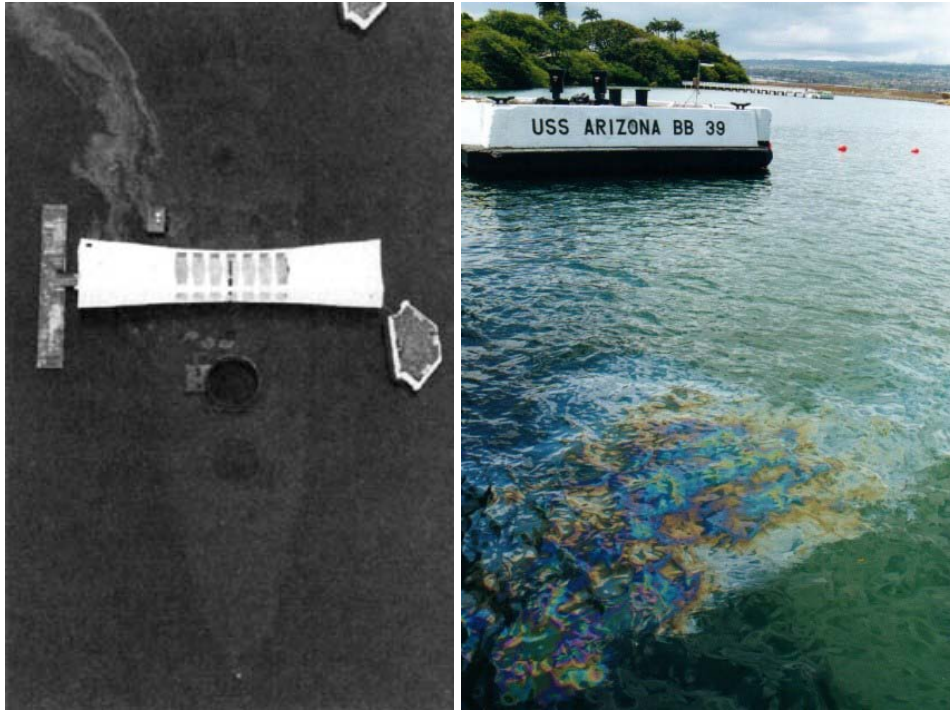
In assessing the potential risk posed by an individual wreck, we must examine the potential impacts of the spill.

The general terms the range of oil impacts during and after an oil spill can range from:

- physical and chemical alteration of natural habitats, both short and long term e.g. resulting from oil absorption into/onto sediments.
- physical smothering effects on wildlife (fauna) and plants (flora).
- lethal and sub-lethal toxic effects on fish, fauna and flora.
- short and longer term changes in biological communities resulting from oil effects on key organisms (e.g. food chain interruptions).
- tainting of edible species, notably fish and shell fish.
- loss of use of amenity areas such as sandy beaches.
- loss of market for fisheries and tourism.
- fouling of boats, fishing gear, boat ramps, jetties etc.
- temporary interruption of any marine based industries.

### *Assimilation of Oil into the Environment*

Most oils will eventually be assimilated by the marine environment. However, the rate at which this occurs, depends on the chemical and physical properties of the oil, the amount spilled, the prevailing climatic and sea conditions, whether the oil remains at sea or is washed on shore and the type of shore it is washed onto.



Fuel Oil leaking from the battleship USS Arizona Sunk Pearl Harbour, Hawaii

### **Oil Types Expected in Sunken WWII Vessels**

It is expected the majority of oil within the large sunken WW II vessels will be heavy fuel oil along with diesel, lubrication oils and some aviation fuels and gasoline. Vessels such as submarines would be mostly diesel driven and have smaller quantities of fuel on board whereas large carriers, battle ships, destroyers etc are likely to have large quantities of heavier fuel oil. The range of oil impacts during and after an oil spill can range from:

- physical and chemical alteration of natural habitats e.g. resulting from oil absorption into/onto sediments.
- physical smothering effects of fauna and flora.
- lethal and sub-lethal toxic effects on fish, fauna and flora.

- short and longer term changes in biological communities resulting from oil effects on key organisms (e.g. food chain interruptions).
- tainting of edible species, notably fish and shell fish.
- loss of use of amenity areas such as sandy beaches.
- loss of market for fisheries and tourism.
- fouling of boats, fishing gear, boat ramps, jetties etc.
- temporary interruption of any marine based industries more persistent fuel oil.

In considering the fate of spilled oil at sea and the likely impacts, a distinction has to be made between persistent and non-persistent oils. In most of the larger vessels during the Pacific war, the fuel oil was a blend of non-persistent as well as persistent oils. It appears to be a blend of bunker oil (No#6 fuel oil) and marine diesel (No#2 fuel oil).

## **Oil Spill Fate and Weathering**

Diesel oil from WWII wrecks would weather relatively quickly with the majority of any diesel spill in tropical waters being dispersed into the water column or evaporated within 12-24 hours. This does not mean there would not be ecological impacts on aquatic life, coral reefs or possible wildlife impacts but that it would be 'removed' from the water surface within a short time after release. Once dispersed or dissolved within the water, column diesel oil could still have significant impacts on inter-tidal life and fisheries.

When the heavier fuel oil mixtures are released into the marine environment, some of the oil will naturally disperse and dissipate as the slick spreads; some components will dissolve into the water; other amounts onto sediments, which can settle into inter-tidal zones if near shore. The heavier persistent components can form emulsions in rough seas or end up as tar balls and mats on shorelines or travel long distances at sea.

To assist the understanding of the weathering and fate of oil in the marine environment, it is necessary to have a good understanding of the oil type and environmental conditions.

The environmental factors that affect the fate and removal of oil are:

- area of slick exposed, which changes rapidly.
- wind speed and water surface roughness.
- air temperature and exposure to sunlight (solar radiation).
- formation of emulsions, which dramatically slows evaporation.

The high water and ambient temperatures of the lagoon as well as high winds accelerate the evaporation rate of the oil spilled. Average Pacific air and water temperatures are high between 25-32 C degree with often less than 10 C degree variance between night and day.



Under the spill conditions in most central and southern Pacific locations, the released fuel oil after weathering would behave in a manner similar to conventional #6 fuel oils. This heavy oil has a slightly lower density than full-strength seawater at tropical temperatures. Many heavy fuel oils are likely to float and remain liquid during the early stages of a spill. The light fractions will be lost by evaporation, and the floating oil will initially form contiguous slicks. Eventually the slicks will break up into widely scattered fields of pancakes and tar-balls, which can persist over large distances and concentrate in convergence zones. Because of the higher viscosities of these oils, the tar balls may be more persistent than expected for conventional crude oils.



*Fuel Oil Residues on beach of Island in Ulithi Lagoon – Spill from sunken USS Mississinewa  
August 2001*

### **3.3 Risk Assessment**

A two-step risk assessment approach is recommended.

#### **Relative Risk Evaluation Framework**

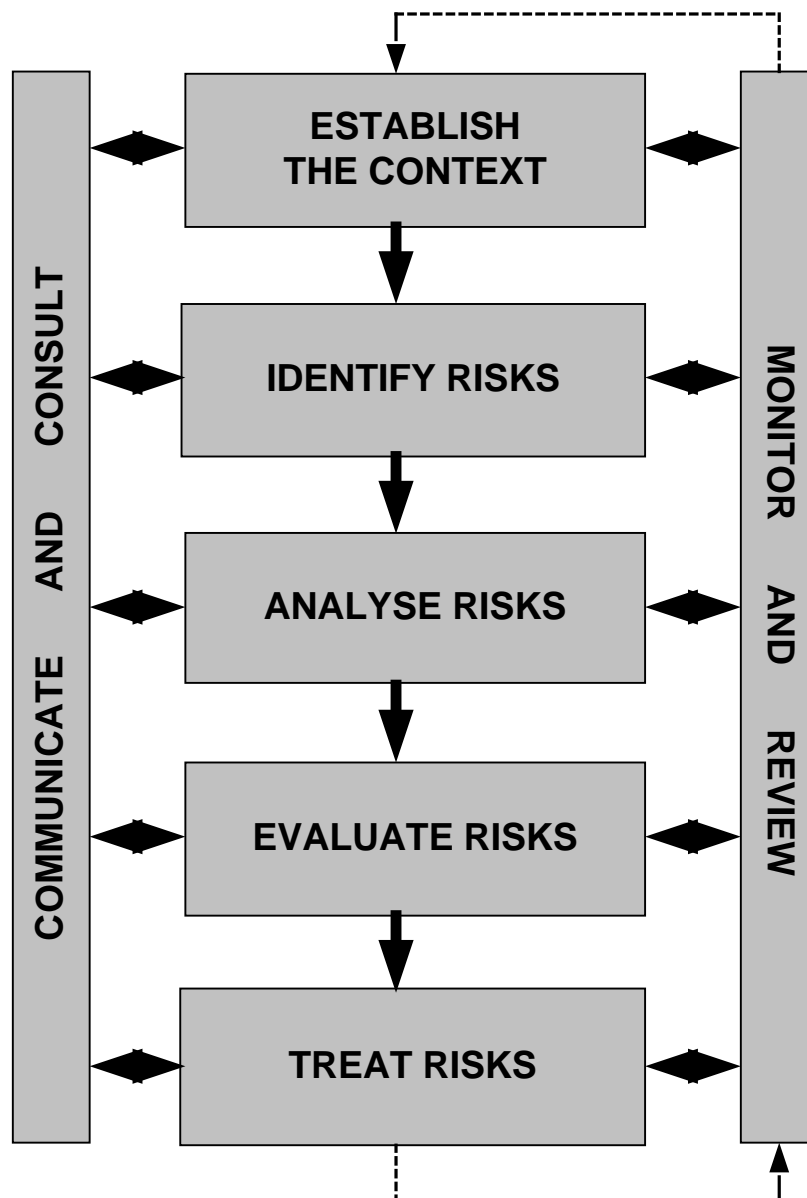
A rapid comparative desktop assessment of wrecks based on data readily available. This framework allows for a crude assessment of risks looking at a few key hazards and potential impacts. It compares wreck sites against each other and allows for the categorising of wrecks by risk levels. It is recommended that three basic indicators of risk be used – high, medium, low. The relative risk evaluation can be carried out either on a country or regional basis. This assists in the justification, prioritisation and allocation of scarce resources when planning expensive field validation and assessment activities.

United States Department of Defence has developed a tool, in conjunction with the Parsons Corporation, in its Defence Environmental Restoration Programme (DERP) to carry out such assessments. The tool is currently applied to terrestrial sites but is able to be modified to sites within the marine environment. Three main factors are used to evaluate sites through this tool: the hazard factor, the migration pathway factor and the receptor factor.

### Site Specific Risk Assessment

Once the comparative assessments have been carried out then site-specific risk assessments can be undertaken. These would initially focus on the high-risk sites then progressively be applied to other sites. There are various tools for site-specific risk assessment and Parties can decide which suits their situation. However, the Secretariat recommends that the following generic approach be followed.

### Risk Management Framework



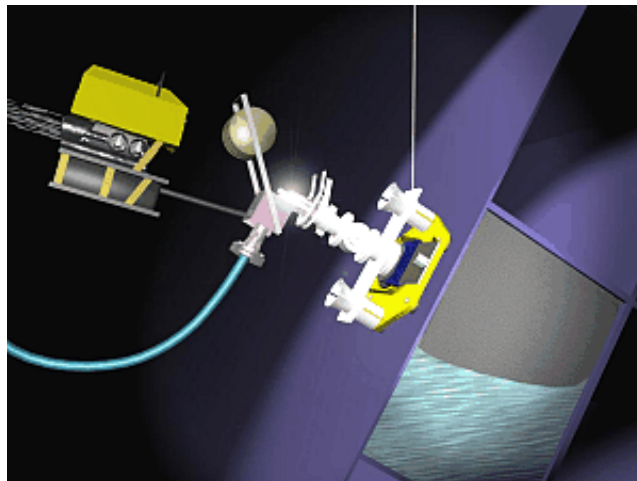
### 3.4 Treatment Options

There are three main categories of intervention that can be directly related to the high, medium and low risk categories.

#### High Risk – Direct Intervention

In the high-risk sites such as the USS Mississinewa, the level of risk is so high that the hazard has to be eliminated or minimised through a direct intervention. This would consist of either the salvage of the vessel or the removal of the hazardous cargo and bunkers from the wreck. The most common method of removal of oil from submerged wrecks is through the “hot tapping” technique.

The “hot tapping” technique for the removal of liquid cargos from the hulls of sunken vessels is carried out by the securing/fixing of a valve to a high point of the tank/hull surface prior to the surface metal being drilled or pierced. Usually the hull/tank surface has to be cleaned of all foreign matter to allow the valve to mate effectively to the surface. The tank is then drilled/pierced through the valve assembly and, once open, the bit is retracted, valve closed and a hose can be attached to the valve for the transfer of oil to the surface. It may be necessary sometimes to heat the transfer line of the pump steam into the oil tank to melt the oil and make it mobile and reduce its viscosity. Other systems incorporate vacuum systems to remove the oil. Once on the surface the oil/water mixture is separated in an oil/water separator or fractionation tank where clean seawater is returned to the ocean.



**Typical underwater hot tapping technique – photo - Taifun Engineering**

All High Risk sites should have site-specific contingency plans. The Secretariat has Guidelines on Marine Spill Contingency Plans.

## **Medium Risk – Management/Contingency Plan**

Medium risk sites have a level of risk that is deemed “acceptable”, subject to a management plan to ensure the risks remain at an acceptable level. These management plans would either focus on:

- isolating the hazards.
- excluding any transmission medium.
- minimising the impact on the environment.

All management plans of medium risk sites should include a monitoring programme and also a contingency plan.

## **Low Risk – Leave alone and monitor**

These low risk sites are where hazards are absent. These sites require no risk management activity apart from occasional monitoring.

### **3.5. Checklist of Activities to be undertaken at each Site**

A generalised methodology for the assessment of any environmental risk posed by WWII shipwrecks in the Pacific region is outlined below. Many activities can be carried out concurrently whereas others will need to be carried out consecutively:

- collation of existing historical data of Pacific WWII wrecks (military and private sources).
- identify the ownership (sovereignty) of individual wrecks and in which jurisdictional responsibility the vessel is located e.g. international waters, EEZ, territorial waters etc.
- confirm locations of sunken vessels in the region and produce maps of vessels on GIS system.
- confirm identity of vessels and cargo quantities and types.
- determine if any reports of previous oil releases have occurred from the vessels.
- determine the resources at risk in the area of the spill and any ecological damage which has already occurred.
- estimate the ecological importance and sea/coastal/land use and management in the region of wreck.
- document the physio-ecological character (and any oiling) of the surrounding shorelines.

- determine and assess the impacts of oil on any wildlife and fisheries in the region.
- assess likely scenarios for impact of any released oil e.g. possible release scenarios, spill trajectory modelling, oil fate and oil weathering patterns.
- determine possible consequences of oil release scenarios e.g. environmental, economic risks, impacts on subsistence fishing, timing for recovery of resources etc.
- crosscheck existing information on vessel history e.g. damage prior to sinking, environmental sensitivities.
- selection of priority sites or wrecks to employ mitigation strategies and oil cargo salvage.
- determine which sites/wrecks require regular pollution surveillance or monitoring by local or remote techniques e.g. satellite imagery for spills.
- site investigations, inspections and assessments of vessel integrity and tank soundings, where possible. E.g. integrity of hull, ships fastenings, metal thickness measurements, pipe-work deterioration.
- assess accessibility to wreck and potential oil cargo off-loading strategies.
- determine contingency arrangements for offloading of oil cargos e.g. spill containment, recovery and disposal options.
- assess any physical or ecological constraints on salvage activities or cleanup operations.
- provide an overall recommendation on any necessary actions related to the remaining oil e.g. salvage options.

### **3.6. Cost Estimates**

The only two activities that we can provide a cost estimate for, at this stage, are the completion of the initial hazard assessments and Relative Risk Site Evaluation. The other activities will need a decision from the Meeting on whether Members wish to continue to address the strategy on a multi-lateral basis or whether some Members want to address it directly on a bi-lateral basis, in consultation with the Flag State.