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“Marine responses to hazardous and noxious substances, dealing with the difficulties of the distressed cargo on the container ship MSC Napoli”

Marine responses to HNS and dealing with the MSC Napoli contaminated cargo.

By

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and

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Introduction

Braemar Howells ltd, is the ISO 9000 and ISO 14000 registered incident response, accredited training and environmental consultancy division of Braemar Shipping Services plc, has been in existence for 60 years, and involved with marine oil spills for the past 50 years, following its first marine oil spill in 1958 in the UK oil port of Milford Haven. In 1992 the company started to be aware of the need to handle HNS spills, and responded accordingly, the company invested in training, equipment and facilities to meet this HNS challenge and now provides the UK National response capability with marine response teams for handling HNS incidents, that threaten the UK coast and/or shipping within UK waters, being on contract to the UK's Maritime and Coastguard Agency. Further details can be found at www.BraemarHowells.com

To understand what are Hazardous and Noxious Substances and how did an HNS Protocol get to Australia, we need to go back to the beginning of the various conventions that have been enacted at the International Maritime Organisation (IMO).

Starting with the first Oil pollution convention in 1954, but it was not until the highly visible spills of the Torrey Canyon (119,000 tons, 7th largest) in 1967 and Amoco Cadiz (223,000 tons, 4th largest) in 1978 that a convention on the prevention of Pollution by shipping in 1973 and its subsequent protocol in 1978, known as MARPOL 73/78 came into being..

The MARPOL convention and its protocol related to the prevent of pollution at sea from shipping, it took the Exxon Valdez incident (37,000 tons, 35th largest spill, but most expensive clean up to date) in 1989, for attention to turn to being better prepared and able to response effectively to an oil spill. It was recognised that if a 37,000 ton spill could not be cleaned up effectively by the US with all of its resources, then what chance had the rest of the world when potentially spills of over 200,000 tons were possible. The American Authorities responded by enacting their own legislation, the Oil Pollution Act 1990 commonly known as OPA90.

The rest of the world however meet at the IMO in 1990 and the Oil Pollution Preparedness and Response Co-operation Convention of 1990 was passed at the IMO, its key objectives of international co-operation and mutual assistance together with developing national and local response capability for dealing with oil spills, note oil spills, it was a conscious decision to leave out HNS at that time, known as OPRC 90.

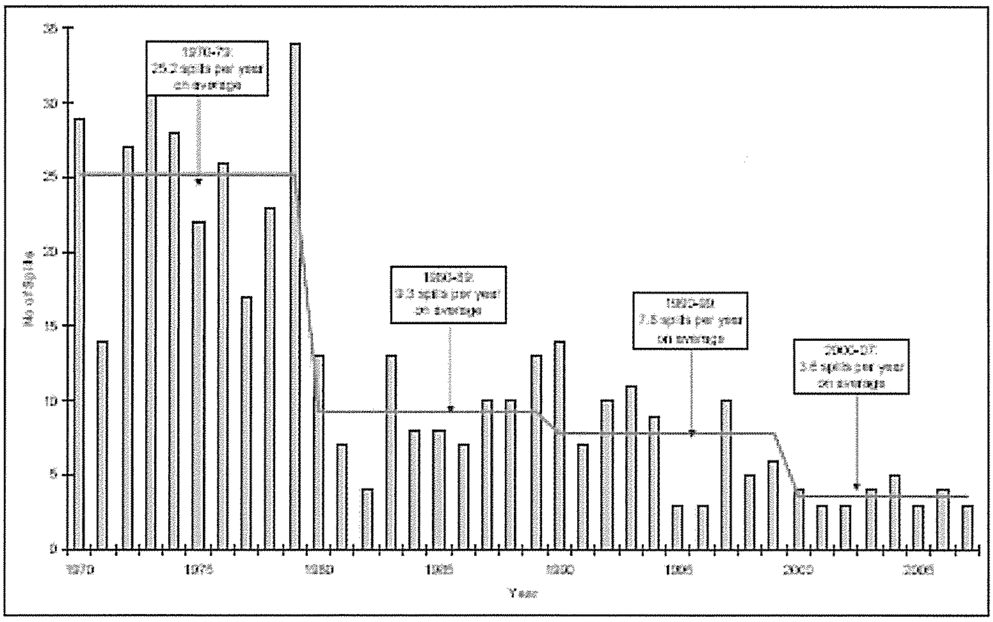
To come into force a set number of member states must ratify each IMO convention. OPRC 90 took until 13th May 1995, six years after Exxon Valdez, to come into force.

OPRC 90's purpose, is to mitigate the consequences of major oil pollution incidents involving, in particular, ships, offshore units, sea ports and oil handling facilities, by countries having a National, Regional and Local capability to deal with oil spills..

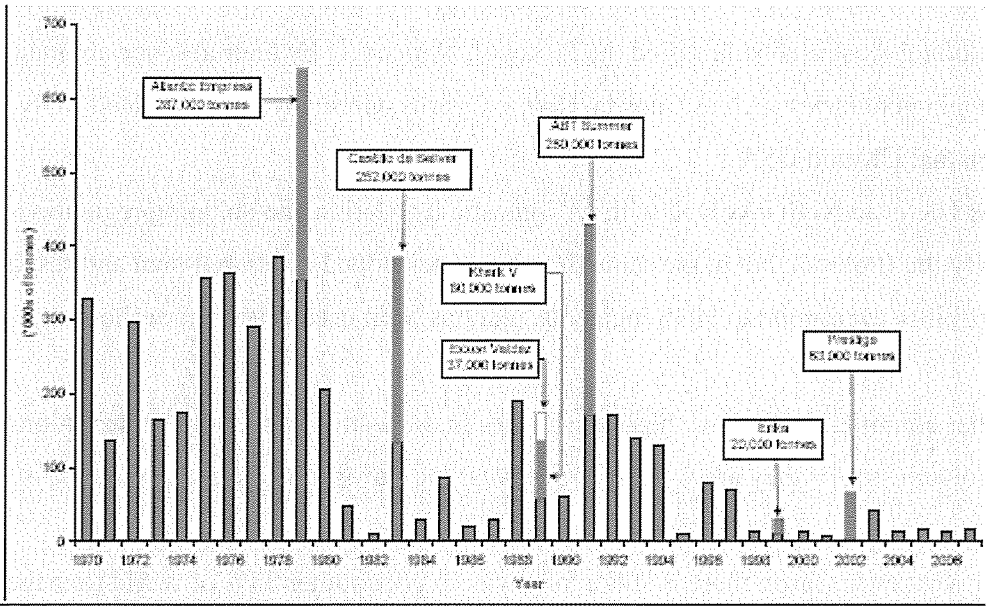
To date 96 member states of the IMO have ratified OPRC 90, which represents 67% of the worlds shipping tonnage.

As a member of the maritime community I can advise that MARPOL 73/78 and its 1978 Protocol together with OPRC 1999 have been successful, this is well illustrated by the overall fall in the severity and number of spills since their introduction.

I am grateful to the International Tanker Owners Pollution Federation (ITOPF) for their data, shown below, on the number spills per annum and the stepped reduction in the 10 year spill average and the amount of oil spilt per annum over the past 45 years.



Number of spills per annum and 10 year average spills per annum



Quantity of oil spilt per annum with specific noticeable spills per annum

The OPRC-HNS Protocol (the bit OPRC 90 missed out)

Resolution 10 of the 1990 OPRC Conference invited the IMO to initiate work to develop an appropriate instrument to expand the scope of the OPRC 90 convention to apply, in whole or in part, to pollution incidents by hazardous substances other than oil and prepare a proposal to this end.

The IMO Marine Environment Protection Committee adopted in principle, in November 1998, a draft protocol on preparedness, response and co-operation to pollution incidents by hazardous and noxious substances. An International diplomatic conference was held at the IMO headquarters from 9th to 15th March 2000 where the Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000, was adopted. This is known as the OPRC-HNS Protocol.

To come into force it needed to be ratified by 15 member states that were already party to the OPRC 1990 Convention, this took until June 2007 with Portugal being the 15th country to ratify the Protocol.

As of 30th Sept 2008, 24 countries representing 30% of the worlds shipping tonnage, including Australia had ratified the Protocol, Noticeable by their absence are major shipping countries such as Canada, China, Cyprus, Germany, India, Ireland, Italy, Panama, UK and USA.
The UK is actively involved with its domestic legislation and shipping regulations to ratify the Protocol, but at the same time it has developed a national plan and response capability to respond to HNS incidents, that has been used several times to date.

Other countries either have higher priorities in domestic legislation or international involvements, or they are waiting to see what the European Community stance is.

For what ever reason there is still a long way to go, another 35% of world tonnage before the success of OPRC 90 can be applied to the OPRC-HNS Protocol.

The OPRC-HNS 2000 Protocol should not be confused with the 1996 HNS Convention. The Protocol deals with preparedness and response to HNS pollution incidents. Whereas the Convention, aims to ensure adequate, prompt and effective compensation for damage that may result from shipping accidents involving HNS. The HNS Convention will come into force 18 months after 12 member states have ratified it. To date 11 states have done so, but only Liberia, Slovenia and Syria have signed into the Convention and Protocol.

What are Hazardous And Noxious Substances

When considering hazardous cargoes we should define what we mean, many cargoes can be hazardous, for example, logs or sawn timber can deplete the oxygen level in a ship's hold. without the cargo itself having dangerous properties.

Hazardous and Noxious Substances, known as HNS, are broadly speaking, those substances that due to their intrinsic properties may, if released, endanger human life, the environment or property.

For the purpose of the OPRC-HNS Protocol, HNS means any substance other than oil which, if introduced into the marine environment is likely to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

For the purists HNS include but are not limited to:

Noxious liquid substances described in the annex 2 of MARPOL 73/78 and the International Bulk Chemical Code (IBC Code),

Dangerous goods, described in the International Maritime Dangerous Code (IMDG Code), and Solid Cargoes covered by the Code of Safe Practise of Solid Bulk Cargoes (BC Code).

There are well over a million hazardous substances, materials and articles produced worldwide and some 50,000 are shipped commercially, and in ever increasing numbers.

Specific substances should not be stowed in certain places nor in certain combinations next to each other. The IMDG Code gives more than 3000 United Nations Numbers for the purpose of substance identification, about 200 of these are for "Generic" or "Not Otherwise Specified (N.O.S) substances, and these numbers are the most commonly used in shipping goods, commonality can lead to inappropriate stowing

For all goods shipped as "NOS", a recognised chemical name in current use and readily available in scientific and technical handbooks should be given, whilst trade names alone should not be used, again misinformation can give a dangerous stowage.

As a result of these procedures not being followed by all, Ships crews, salvors and responders are being put at risk in normal operations and during an incident..

Examples of Hazardous and Noxious Substances according to the IMDG Code

Class number	Description	Examples
1	Explosives	Trinitrotoluene (TNT)
2	Gases	Acetylene
3	Flammable liquids	Ethyl alcohol
4	Flammable solids(including self-reactive solids & liquids) Substances liable to spontaneous combustion and those which in contact with water, emit flammable gases	Calcium carbide
5	Oxidising substances and organic peroxides	Sodium Chlorate
6	Toxic and infectious substances	Sodium cyanide
7	Radioactive substances	Radium
8	Corrosives	Caustic soda
9	Miscellaneous dangerous substances and articles	Polychlorinated biphenyls

In recent years, there has been a rapid growth in the transport of HNS, if allowed to escape these substances can present a significant danger to the vessel, its crew, coastal and harbour populations, and the surrounding environment.
There are many ship types, which can and do carry NHS:-

- Dry bulk carriers:- solid bulk cargoes e.g. ores, fishmeal, manufactured powders.
- Oil/bulk/ore or combo carriers:- multi purpose carriers of solid or liquid cargoes.
- Containerships:- boxes for dry cargo, powders and / or liquids in portable ISO tanks.
- General cargo ships: cargo in consignments e.g. crates, boxes, drums, sacks, bags.
- Roll on Roll off ferries:- vehicles carry internally unitised, package or bulk cargoes.
- Chemical carriers:- specialised vessels designed to carry bulk liquid chemicals.
- Gas carriers:- specialised vessels designed to carry liquefied gas.

The top ten of chemicals shipped and being involved in an incident according to USCG records are:- Sulphuric Acid, Toluene, Sodium Hydroxide, Benzene, Styrene, Acrylonitrile, Xylene, Hydrochloric Acid, Vinyl Acetate Monomer and Phosphoric Acid.

The International Maritime Dangerous Goods Code (IMDG) Code describes how to pack, label, document, transport, stow and segregate dangerous goods in packages.

The types of vessel and how the cargo is carried can give problems, but also in the port areas with tank farms, container storage and transportation there can be problems, fortunately infrequent but the consequences can be profound on life or continuation of the business itself, due to incidents requiring isolation and evacuation procedures.

Many incidents involving HNS are relatively minor: leaking drums, broken glass, failed packaging and such like. In cases like these the local fire brigade or response contractor tends to be called in to make the site safe, contain the suspect package and then remove it in an overdrum or tranship it into another suitable package.

Marine spills involving HNS are thankfully not as frequent as oil spills and generate less publicity, whilst "Oscar" the Equity card carrying oiled cormorant, regularly appears at marine oil spills, ensures that oil spills are always in the public's eye.

We must never underestimate how serious an HNS incident, small or large, can be. Oil spills are visible and kill birds and fish but not generally humans, whilst chemical spills are not easily visible but they can potentially kill many humans.

The general press tends not to report incidents involving HNS until something really major happens, eg:- Flixbourgh, Bhopal, Seveso, Oklahoma City and Neishabour.

The following are examples of HNS incidents, fortunately the loss of life is reducing as time goes on and we learn from incidents, so hopefully becoming better prepared.

On a global basis, marine incidents involving HNS are not rare, in fact there can be expected to be two or three major incidents each year and these can be expected to increase as the level of HNS transported globally increases annually, ship numbers increase and standards decrease.

The following are examples of HNS incidents over the years.

Location and year	Vessel	HNS	Quantity involved	Incident consequences
Halifax, 1917	Montblanc	Explosives	2,600 tons	Explosion, 3000 killed 9000 injured
Texas City 1947	Grandcamp	Ammonium Nitrate	2,200 tons	Fire and explosion, 468 killed, 2nd vessel caught fire and exploded carrying sulphur and ammonium nitrate
Italian Coast 1974	Cavtat	Tetraethyl lead Tetramethyl lead	150 tons in drums 120 tons in drums	Collision and sinking
Landskrna Sweden, 1976	Rene 16	Ammonia	180 tons	Hose rupture, 2 dead showered by ammonia
North Sea 1979	Sindbad	Chlorine	52 one ton flasks	Flasks lost at sea due to rough weather
Adriatic coast 1984	Brigitta Montanari	Vinyl Chloride	1300 tons	Sinking
Mogadishu port 1985	Ariadne	62 IMDG classed chemicals	Over 750 tons in teus	Grounded, fires, local population at risk. Sunk
North Sea 1987	Herald of Free Enterprise	Undeclared ro-ro freight packages	Over 500 tons	Capsized, hazards to salvage divers
Cape Finisterre 1987	Cason	Mixed dangerous cargo in packages	1,000 tons	Fire and grounding, 23 crew members perished
Dutch Coast 1988	Anna Boere	Acrylonitrile, Dodecylbenezene	547 tons 500 tons	Collision and sinking
Italian Coast 1991	Alessandro Primo	Acrylontrile, Dichloroethane	550 tons 1000 tons	Sinking

Greek Islands 1994	Tus	Sodium Hydroxide (Caustic Soda)	4,200 tons	Grounding
Chinese coast 1995	Chung Mu	Styrene	310 tons	Collision
English Channel, 1995	Grape 1	Xylene	4000 tons	Sinking
North Scottish Coast, 1999	Multitank Ascania	Vinyl Acetate	1750 tons	Fire, left abandoned, threat to villages
Thames Estuary 1999	Ever Decent	Sodium cyanide, Potassium cyanide	Various teus in vicinity with other flammables	Collision with pax ship, fire, extensive fire fighting, coastal threat
English Channel 2000	Iveoli Sun	Styrene, Methyl Ethyl Ketone, Iso-Propylic Alcohol	4000 tons, 1027 tons, 997 tons	Sank under tow, sunken cargo recovered following year
North Sea 2001	AB Bilbao	Ferro Silicon	3300 tons	Cargo hold explosion
Bristol Channel 2001	Dutch Navigator	Hydrofluorosilicic acid	2 damaged ISO tanks	Damaged in hold during storm
South Africa Sept 2002	Jolly Rubino	Fungicides, Phenol, Voronate, ethyl acetate, methyl iso-butyl ketone	Various tons in containers	Eng Room fire spread to ship, abandoned, then grounded. Fire, oil and chemical incident
English Channel Sept 2002	Wester Till	Various chemicals adjacent to hold fire	Approx 200 tons	Fire threat to adjoining hold with chemicals
Japan October 2002	Eiwa Maru	Xylene	500 tons	Sank after collision with container ship

Location and year	Vessel	HNS	Quantity involved	Incident consequences
Sri Lanka 2002	Hanjin Pennsylvannia	Fireworks and other hazardous cargo caught fire near superstructure	4000 teu container ship	Burned 5 days, CTL, 2 crew dead
Italy 2003	Cape Horn	14,000 tons Methanol	1500 tons in Stb tank	Tank explosion, 9 injured on ship and tug
Durban 2003	Sea Elegance	Calcium Hypochlorite and Herbicide "Atrazine"	2 teus of 15 ton	Heat to CaHCL exploded, set fire to herbicide
UK 2007	Napoli	Various TEU's not declared as hazardous, Sea water damaged	1500 teu's	Significant waste, Hazardous cargo washed ashore

Summation of HNS

There is a Protocol, for preparedness and response to an HNS incident, there is a Convention for compensation from an HNS incident, whilst the UK has ratified the OPRC-HNS protocol it has in place a National response capability. Once ratified ports will be expected in their contingency plans a tier 2 response contractor, but only for those ports handling HNS. If it can not be shown that adequate training, correct equipment and procedures were in place prior to an accident happeninf, then there is the opportunity for individuals and directors of a company to be prosecurted under Corporate Manslaughter legislation.

As Australia has ratified the HNS-OPRC Protocol, how prepared is the Australian Maritime industry, ports, State and Federal Governments, if there is an HNS fatality, the lawyers will be busy but a family will be without a priceless family member, and someone will have to be held accountable.

Fate and effects of a spilt HNS

The obvious visible effect from an HNS incident is explosion and fire, this can be the immediate effect, however it is the long term effect that can be the more profound and detrimental to human life and the environment.

Depending on the substance spilt and its properties, the substance will initially do one or more or all of the following physically:-

Evaporate

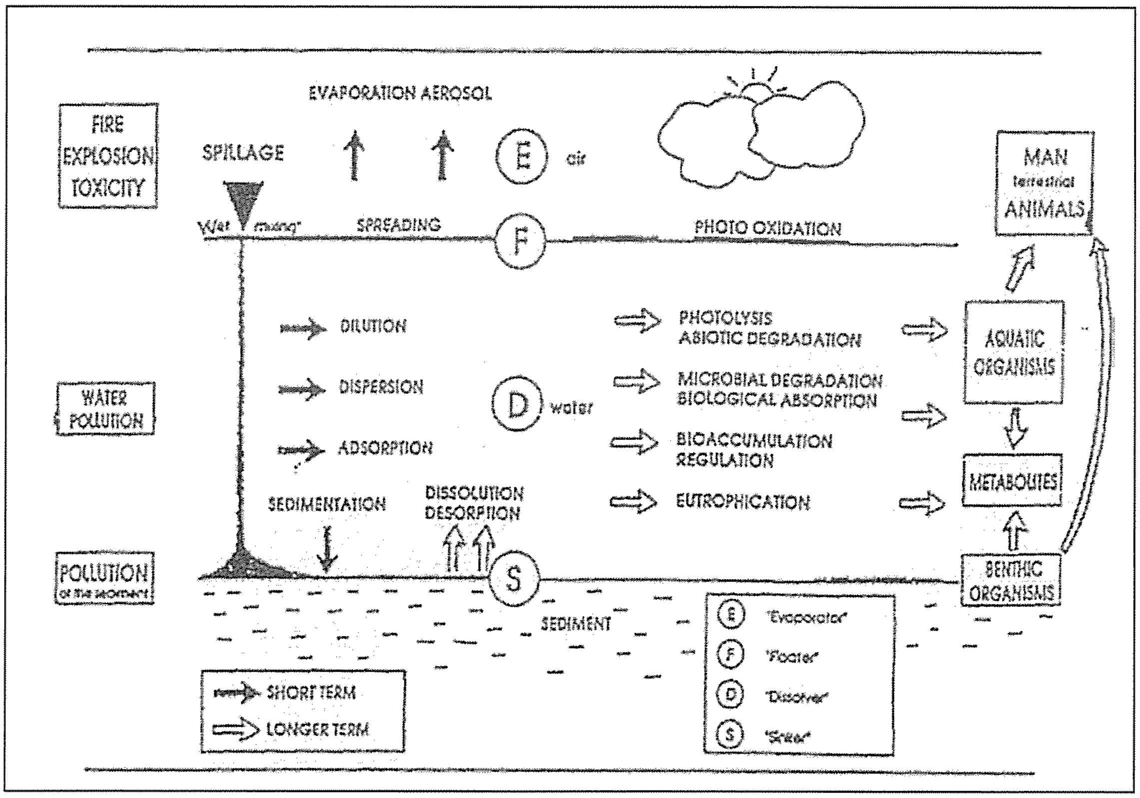
Float

Dissolve

Sink

These in turn can rapidly spread the risk of the consequential effect of the spilt substance.

The following diagram shows the short and long term effects of an HNS spillage.



Environmental groups quite rightly, repeatedly advise society on the long term effects it is having on the environment, but as we have seen from history it is only by an acute incident that minds are concentrated on the problem at hand and then respond effectively.

The four reactions an uncontrolled release of a Hazardous and Noxious Substance can produce, in order of severity are:- Explosion, Fire, Reaction and Toxicity.

Taking them together we have the acronym EFRT, can I suggest that the Maritime Community remembers to use every EFRT in being prepared to respond to a HNS spill.

I will conclude the first part of my presentation here, time allowing I will follow on with the problems associated with dealing with the MSC Napoli salvaged cargo.

MSC Napoli

Not a small ship, in fact in 1991 at 4419 teu's and 275 metre loa with 38792 kw of main engine power capable of 24 knots, she was the worlds largest container vessel. Had 2318 containers on board of which 1351 were below deck, 159 were on the dangerous goods manifest, 114 were lost overboard, 32 never recovered but now of the missing were of HNS, Approximately 45,000 tons of cargo had to be removed from the vessel and brought ashore. Due to the ships list it was dangerous removing containers as they swung free or pulled out from their cell racks, the majority submerged and some jammed in place needing to be cut out underwater by divers.

A flat top barge with a 75 and 120 ton lfit cranes on board brought between 30 to 90 containers into the port daily sometimes up to 3 trips in a 24 hour period, with an average of 50 per day to be dealt with.

To handle this number of boxes and have sufficient lay down area to work on them away from the unloading quay was a major challenge, the height of boxes on the ship were on average 11 high, but in the port 3 high was maximum and for loaded boxes it was only 2 high. The calculated footprint on the ship to take all of the boxes stacked 11 high was 5785 sq meters, but by turning the boxes around quickly after devaning, cleaning and either scraping into metal pieces or reusing the boxes, the final foot print was approximately 20,000 sq meters at 2 to 3 high.

The point at landing the boxes ashore was no longer counted by the Environmental Agency as an emergency procedure but one of a planned action, as such all the operations thereafter had to conform to the EA regulations, which required no pollution to the water or into the ground. Fortunately the a jetty was used that had an enclosed drainage system, and a solids interceptor was used together with drip trays that were on the ground to receive the containers and mounted on the trailers to move the contaminated containers from the jetty to the cleaning stations.

In addition the wetted containers were coming in very heavy soaking wet, upto 75 tons in weight, sometimes bursting the container with the weight.

There were logistic problems handling and lifting the heavy boxes, heavy container handlers had to be brought from away via narrow roads, the goods once exposed to sea water were classed as waste, this in turn brought a significant logistic challenge in getting rid of the waste, which required a temporary waste transfer station to be designed and built with all official environmental approval within is 3 weeks.

Braemar Howells had previous experience with designing and building the world's largest wash down facility for the Sea Empress incident in Milford Haven in 1996, and as fortune would have it, the General Manager at Portland Port had been the GM in the Port of Pembroke in 1996 when we built the Sea Empress facility, only this time it was decontaminating the cargo not solely pollution equipment.

The new waste transfer station took its name from a former military hospital that had been demolished leaving an open space. The temporary wash down facility was built in accordance with the UK Waste transfer regulations, with ground contamination surveys and soil samples before building and after dismantling to show the condition upon completion of the work and restitution of the site 5 months later.

The waste management was extensive, with the throughput equivalent to that of a small town, transport away into the mainland from the South Western English peninsular, sourcing the relevant final EA approved disposal places, storage of unidentified mixtures of liquids after immersion in oil and sea water awaiting sampling and testing, providing cradle to grave tracing under duty of care requirement, extensive documentation and various forms of non and hazardous waste transfer and accompanying notes were some of the challenges the team had to undertake to satisfy the environmental regulator.

The incident started 19th January 2007, by end of November 2007 all boxes had been dealt with, the site tided and returned to normal vacant land, in some places better than when first occupied, with praise from the environmental regulators.

Whilst this general handling of waste which had turned to hazardous waste through immersion in oil and sea water was going on, very visibly to all, there was another team from Braemar Howells working away in isolation dealing with HNS loaded tank containers or HNS loaded containers or where there was an unknown substance, which they had to make safe and dispose of, or neutralise so the waste handling team could then take over.

Their location was remote, away from water course, sea and sources of ignition, being summer and to keep cool and ensure as few persons as possible were about, sometimes working at night for coolness.

Sometimes due to the water ingress and weight increase the containers had to be dealt with on the jetty, then every precaution was taken to ensure the place was cordoned of for safe working. Wherever possible mechanical lifting gear was used to reduce risks to the staff devaning containers when dealing with the internal contents.

Small packages in boxes, barrels, IBC's and ISO containers were dealt with, sometimes with interesting ways of getting safe access or to minimise the pumping of the product under transfer.

Three cases in particular were dealt with that required extensive risk assessments, preparatory work and the right equipment, these were:- Ethylenediamine, Methyl Methacrylate and Epichlorohydrin, the last one require a Nitrogen inerted certificated ISO tank to receive the product and plenty of bottle by the response team in the rain, as the product reacts badly in contact with water.

Which brings me to the final part of the essential ingredients for a safe HNS transfer:-
Plenty of open working space and appropriate facilities including forklifts and cranes.
Trained and experienced personnel with carefully selected and appropriate equipment.
Written risk assessment with proper task planning followed by team briefing on the work to be undertaken.
Collective prayer for good weather and always have a plan "B", because handled right with the respect it deserves, HNS can be a piece of cake or if you are not careful leave more than a bad taste in your mouth.

Thank you

Should it be required, I can be reached on simonrickaby@braemarhowells.com

Acknowledgments

Inter Tanker Owners Pollution Federation Limited (ITOPF)

Braemar Howells staff

IMO - Publications and Library

IMarEST – Marine Information Centre

ITOPF provided data on historical size of spills and the types of incidents

Shipname	Year	Location	Oil lost (tonnes)
Atlantic Empress	1979	off Tobago, West Indies	287,000
ABT Summer	1991	700 nautical. miles off Angola	260,000
Castillo de Bellver	1983	off Saldanha Bay, South Africa	252,000
Amoco Cadiz	1978	off Brittany, France	223,000
Haven	1991	Genoa, Italy	144,000
Odyssey	1988	700 nautical. miles off Nova Scotia, Canada	132,000
Torrey Canyon	1967	Scilly Isles, UK	119,000
Sea Star	1972	Gulf of Oman	115,000
Irenes Seranade	1980	Navarino Bay, Greece	100,000
Urquiola	1976	La Coruna, Spain	100,000
Hawaiian Patriot	1977	300 nautical. miles off Honolulu	95,000
Independenta	1979	Bosphorus, Turkey	95,000
Jakob Maersk	1975	Oporto, Portugal	88,000
Braer	1993	Shetland Islands, UK	85,000
Khark 5	1989	120 nautical. miles off Atlantic coast of Morocco	80,000
Aegean Sea	1992	La Coruna, Spain	74,000
Sea Empress	1996	Milford Haven, UK	72,000
Katina P.	1992	off Maputo, Mozambique	72,000
Nova	1985	Off Kharg Island, Gulf of Iran	70,000
Prestige	2002	Off Spanish coast	63,000
Assimi	1983	55 nautical. miles off Muscat, Oman	53,000
Metula	1974	Magellan Straits, Chile	50,000
Wafra	1971	off Cape Agulhas, South Africa	40,000
Exxon Valdez	1989	Prince William Sound, Alaska, USA	37,000