PCBs (Polychlorinated Biphenyls)
These are chemicals made by humans and do not occur naturally. For 50 years (1929 - 1979) they were made in the US, then their production was outlawed. Because they exhibit non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including Electrical, heat transfer and hydraulic equipment, plasticizers in paints, plastics and rubber products, pigments, dyes and carbonless copy paper and other industrial applications. They can accumulate in different organisms some of which are used for food by people, hence bio-magnification is a possibility. They may be cancer producing. There is evidence to suggest they impact the immune system as well as the reproductive systems among other things.

Heavy Metals (Not the music groups)

Heavy metals include cadmium, mercury, lead and arsenic, all of which appear in the World Health Organization's list of 10 chemicals of major public concern. Other examples include manganese, chromium, cobalt, nickel, copper, zinc, selenium, silver, antimony and thallium
Thallium had been claimed a “Wonder Drug” for pregnant women who were suffering from insomnia and morning sickness. However a large number of children (over 10,000) whose mothers had used the drug were born with birth defects which included being born with shortened arms and/or legs, or no arms or legs at all. Many died young and only fewer than 3,000 were still alive in 2011.

Minamata

The other major event had to do with mercury poisoning (methylmercury) in Minamata in Kumamoto Prefecture, Japan.
(SEE Prefecture map of Japan below)

There the Chisso had been releasing this chemical into the water from 1932 to 1968. It took several years to identify the cause of the illness and many more get legal compensation for the damage. The symptoms of the illness include ataxia, numbness in the hands and feet, general muscle weakness, loss of peripheral vision, and damage to hearing and speech. In extreme cases, insanity, paralysis, coma, and death follow within weeks of the onset of symptoms. A congenital form of the disease can also affect fetuses in the womb.

Kumamoto is the light purple on the island furthest south. Niigata is on the west coast of Japan, on the main island (Honshu) and is marked light green – the fourth prefecture down from the top of the main island. The single green island on the top is Hokkaido. Toyama prefecture (see below) is just below Niigata and is shown in purple on the

map Mie Prefecture (see below) is located on the main island on the large peninsula next to the island of Shikoku which lies just south of the main island and east of Kyushu (the island on which Kumamoto is found). Mie is indicated by a green color.

Toyama prefecture (see below) is just below Niigata and is shown in purple on the map

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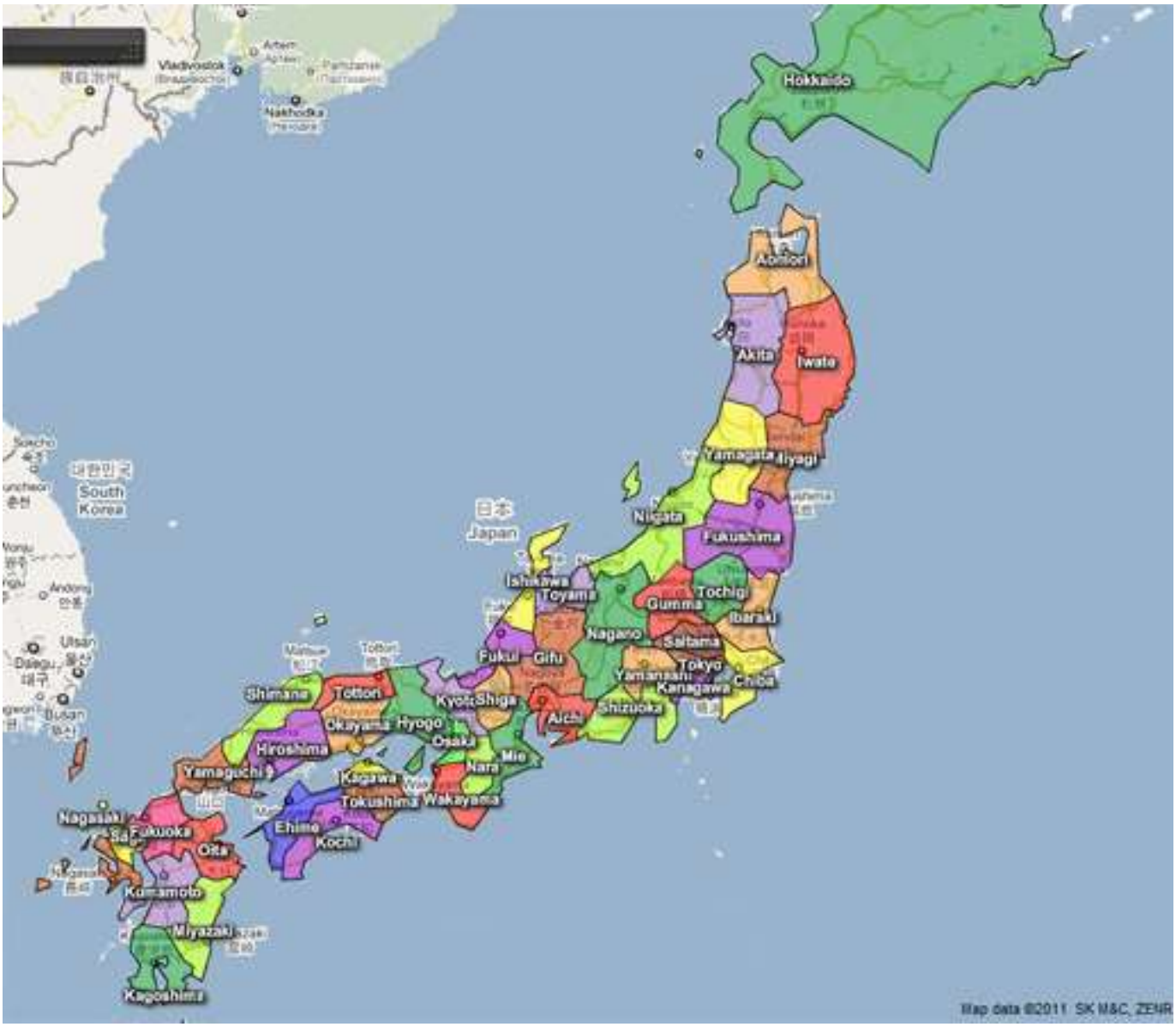


Of the 2265 people affected by the disease, 1784 have died.
In 1965 a second outbreak occurred in Niigata prefecture
Of the four major pollution disasters (all caused by improper handling of industrial waste), three involved water. Itai -
Itai (“itai” is Japanese for “it hurts”) disease was caused by cadmium poisoning in rivers, the

Minamata and Niigata Minamata disease were involved with the sea. Only the Yookaichi Asthma disease in Mie Prefecture was air pollution

Name of disease	Japanese prefecture affected	Cause	Source	Year
Itai-itai disease	Toyama Prefecture	Cadmium poisoning	Mitsui Mining & Smelting Company	1912
Minamata disease	Kumamoto Prefecture	Methylmercury	Chisso Corporation	1956
Niigata Minamata Disease	Niigata Prefecture	Methylmercury	Showa Denko	1965
Yokkaichi Asthma	Mie Prefecture	Sulfur dioxide	Air pollution within Yokkaichi	1961

Problems of Minamata disease and relation to A-bombs and ETA. People from these pariah groups have problems in marrying because of fear of genetic mutations.

Radiation

There are questions about the impact of radiation on life in the ocean. From the A-bomb tests on Bimini through the problem of radiation from the Dai ichi Nuclear plant in Fukushima that was heavy damaged by the recent tsunami

there have been questions about how much radiation has occurred and what impact it has had on life in the ocean.

The idea of radiation impacting life in the ocean has been common in popular culture in post WWII films. Godzilla is a prime example. The original Japanese film (not the altered American version with Raymond Burr) raises questions about the social responsibility of scientists (dutifully removed from the American release)

Radiation is not only possible from nuclear plants, but also from atomic powered vessels like atomic powered submarines. One Russian submarine had gotten into trouble and there was some question as to whether there would be a nuclear melt down in the ocean.

OIL

There is always some concern about ships rupturing and spilling oil, or oilrigs breaking down and pouring huge amount of oil into the sea. Not all ships that run aground spill oil.
Oil can come from tankers transporting it or from the fuel used to power the ship.

Most pollution including oil comes from the land.

There are oil seeps in the ocean where oil pours out through underwater vents with no help at all from people.

Generally the oil is blocked from spreading by the use of “boomers”. They don’t always in rough seas since the oil on

the surface of the water can wash over the boomers and escape into the water from which it is being blocked. It is picked up by skimmers or vacuums.

Costa Concordia

This huge cruise ship ran aground with the death of about 32 people. Given the number of people on board this was almost miraculous. The ship nearly sank because of the captain's improper behavior. As a result he was charged and convicted of 32 counts of manslaughter. He is serving 16 years in prison.

There was great deal of concern about the rupturing of the fuel tanks in an effort to remove it. All went fine and there was no oil released into the water.

HOW DOES THE OIL GET INTO AND OUT OF THE WATER?

While most people think of the major oil spills like the Exxon Valdez or the BP Deep Water Horizon as the major polluters, oil, often in larger quantities enters the ocean in many ways. There are natural oil seeps in which oil from under the ocean comes out of the earth into the ocean. There is much run off for the land. Some people estimate that there is 4 times as much oil entering the ocean every year as a result of the oil dripping or leaking out of cars and washing into the ocean as was spilled in the EXXON VALDEZ spill in Alaska. There is much work that needs to

be done in determining just how much oil enters the water from these sources. The figures are often controversial and misleading. Some figures give the amounts of oil spilled from the amount carried in the ship that leaked minus the amount left on board. Others claim the amount spilled is the amount left on the ship + the amount or oil recovered. This can be as much as 15% less, since the amount recovered is not considered to have been spilled. Oil spills cause a great deal of damage to the life in the ocean and this is the major concern since it impacts many things – especially food supplies.

The recent oil spill from Con Ed was one of 37,000 gallons of "dielectric fluid," or transformer oil, which may contain PCBs. This is transformer oil which is used for insulation and is mineral oil based. When I examined the spill on Wed. most of the oil appeared gone. There was some sheen near the shore, which is probably oil that adhered to plants and rocks and is being slowly washed away with each tide.

The Coast Guard requires that all oil spills be reported. Failure to report can result in serious fines depending on the size of the spill it can be up to $45,000 a day or three times the cost of the clean-up.

DAMAGE is to plant and animal life in the water. Oil gives birds problems in they can lose their ability to fly, ability to stay warm; gets into gills of fish so they can't get O2 Gets into shellfish

What follows is from the web page by Michelle Rivera at

https://animals.mom.me/effects-exxon-valdez-oil-spill-alaskan-wildlife-5478.html

The Exxon-Valdez oil spill of March 24, 1989, had long-lasting effects on Alaska's environment, animals and way of life. At the time of the spill, hundreds of volunteers stepped forward to clean up seabirds and other animals drenched in oil. Their work helped a modest number of animals, but many still died, and recovery efforts for a number of species continue after 24 years.

Sad Statistics

According to the National Wildlife Federation, the death toll of individual species of native Alaskan wildlife is still being tallied as of 2013. In the days immediately following the spill -- which, at the time was the worst in U.S. history -- many animals died including upwards of 100,000 and possibly as many as 250,000 seabirds. More than 2,800 sea otters and 12 river otters immediately expired . At least 300 harbor seals and almost 250 bald eagles were also instantly destroyed. Orcas living in the area at the time, 22 in number, were killed, as were countless fish. Small organisms were killed by the trillions, leaving those animals who prey on them with nothing to eat, causing even more deaths. In the following days and weeks, these numbers climbed much higher.

How They Died

Aside from the reef fish and other animals nearby when the Exxon Valdez ran aground, millions of animals died as a direct or proximate cause of the spill. Animals covered in oil

tried vainly to clean their bodies by licking themselves, only to be poisoned by the toxins in the oil. Birds weighted down by the heavy oil were unable to fly. Otters depend upon the unique design of their fur to help them tolerate extreme cold climates. When covered in oil, their fur is unable to act as a protective covering, so otters die of hypothermia. Whales are killed when they eat fish covered in oil or when their blowholes are plugged with oil, making it impossible for them to breathe.

Ten Years After

Ten years after the Exxon Valdez oil spill, scientists from the University of North Carolina at Chapel Hill reported in the journal "Science" that many animal species were still recovering and the damage to their habitats had not significantly decreased. It was once thought that the number of animals killed acutely -- that is, immediately following the spill -- would be much higher than any subsequent numbers. But Chapel Hill's researchers reported in 2009 that Alaska's coastal ecosystem continues to show toxins that affect wildlife.

Twenty Years After

In 2007 -- two decades after the oil spill -- the National Oceanic and Atmospheric Administration reported that 21,000 gallons of crude oil still pollutes the ecosystem within a 450-mile radius -- and the oil continues to kill animals within its sphere. The problem persists because the spill is contained within the Prince William Sound, so it doesn't biodegrade as it would in the open ocean. The orca pod affected by the spill never recovered. Sea otters and ducks,

who forage for food in the beaches, need only scratch the surface to find layers of oil soaked into the sand. The oil remains toxic to these animals. Oceana, a conservation organization, reports that some species of loons, salmon, seals, ducks, herrings, pigeons, mussel and clam populations have never fully recovered. Commercial fishing, a $286 million industry, has not completely resumed in the area.

The slick stretched from Bligh Reef to the village of Chignik on the Alaskan Peninsula. 250,000seabirds, 2,800 sea otters, 300 harbor seals, 250 bald eagles, 22 killer whales, and billions of salmon and herring eggs……the 'best' estimate of how many animals died outright from the spill. Mar 24, 1989

The Deep Water Horizon Disaster was even greater. Here is a web site from the Center for Biological Diversity Report in April of 2011.

https://www.biologicaldiversity.org/programs/public_lands/energy/dirty_energy_development/oil_and_gas/gulf_oil_spill/a_deadly_toll.html

A DEADLY TOLL: THE GULF OIL SPILL AND THE UNFOLDING WILDLIFE DISASTER A Center for Biological Diversity Report — April 2011 The BP Deepwater Horizon catastrophe in 2010 spilled 205.8 million gallons of oil and 225,000 tons of methane into the Gulf of Mexico. Approximately 25 percent of the oil was recovered, leaving

more than 154 million gallons of oil at sea. In addition to the oil, nearly 2 million gallons of toxic dispersants were sprayed into the Gulf's waters. This did not actually reduce the amount of oil left in the ocean, but merely broke it into smaller particles, which may actually make the oil more toxic for some ocean life and ease its entry into the food chain. A year after the April 20, 2010, explosion that caused the well to leak oil for months, the ultimate toll on people and wildlife is still not fully understood. But one thing is clear: The number of birds, sea turtles, dolphins and other animals sickened or killed and tallied as part of the government's official count represents a small fraction of the total animals harmed by this disastrous spill. The toll on wildlife continues to mount. Dead turtles, marine mammals, birds and fish are still washing up on beaches. Dolphins are miscarrying, and pelicans are attempting to nest on beaches polluted with tar balls and subsurface oil. The impacts of previous oil disasters show that wildlife in the Gulf will continue to be affected by this spill for decades. Lingering pollution from a 1969 spill in Massachusetts, for example, is still affecting fiddler crabs. Likewise, oysters and mangroves in Mexico are still affected by pollution from the 1979 Ixtoc spill in the Gulf, and oil remains on Alaskan beaches from the 1989 Exxon Valdez spill with continuing impacts on birds and fish. In order to comprehensively assess the likely impacts of the Gulf oil spill to date, the Center for Biological Diversity has combed government figures, news reports and scientific articles. To provide a more accurate estimate of the death toll, we used multiplication factors identified by leading scientists that estimate how many more animals are killed than are actually observed or collected. In total, we found that the oil spill has likely harmed or killed approximately

82,000 birds of 102 species, approximately 6,165 sea turtles, and up to 25,900 marine mammals, including bottlenose dolphins, spinner dolphins, melon-headed whales and sperm whales. The spill also harmed an unknown number of fish — including bluefin tuna and substantial habitat for our nation's smallest seahorse — and an unknown but likely catastrophic number of crabs, oysters, corals and other sea life. The spill also oiled more than a thousand miles of shoreline, including beaches and marshes, which took a substantial toll on the animals and plants found at the shoreline, including seagrass, beach mice, shorebirds and others.

BIRDS

More than 82,000 birds may have been harmed by the spill. At least 102 species of birds are known to have been harmed by the BP oil spill, including black skimmers, brown pelicans, clapper rails, common loons, laughing gulls, northern gannets and several species of terns. Oiled birds have been collected from west of Galveston, Texas, to south of Fort Myers, Fla. The number of birds reported by the government as being injured by the spill represents only a portion of the total affected. The official number represents only the number of birds collected by wildlife officials, and does not include oiled birds that were seen but not collected or birds that vanished undetected. Biologists on the scene say that the official count greatly underestimates the number of birds actually harmed. Scientific research indicates that mortality can be assumed to be four to 11 times higher than the number of birds retrieved, and that a common "rule of thumb" estimate is that the actual mortality was likely 10 times higher. To date more than 8,200 birds have been

collected, indicating that more than 82,000 may have been harmed by the spill. Of particular concern are brown pelicans and federally threatened piping plovers. Brown pelicans were removed from the endangered species list just five months before the Gulf disaster. Since the spill, 932 brown pelicans have been collected, so it can be assumed that more than 9,300 have likely been harmed. Scientists are reporting that oiled pelicans are still being found a year later. Despite good intentions, cleaning oiled pelicans doesn't necessarily save their lives, and cleaned pelicans that do survive may never be able to reproduce. Only one dead piping plover has been collected, but oil pollution has soiled the bird's critical habitat on the Chandeleur Islands.

SEA TURTLES

Approximately 6,000 sea turtles have likely been harmed by the spill. The five sea turtles species found in the Gulf (green, Kemp's ridley, hawksbill, leatherback and loggerhead) are all federally listed as endangered or threatened, and all have been harmed by the spill. Oiled turtles have been collected from Port Arthur, Texas, to Apalachicola Bay, Fla., and seaside residents are reporting that dead turtles continue to wash up on a daily basis. The official tally of collected turtles underestimates total mortality because it does not include turtles that perished undetected, and includes only turtles collected last winter. The official number of turtles collected and attributed to the spill is 1,146. The government is not adding turtles that are washing ashore this spring to the total due to an ongoing federal criminal investigation of the spill's effects. The media has reported that at least 87 dead turtles have washed onto beaches this spring, though some of these deaths may be

attributable to drowning in shrimp trawls. Scientists estimate that at least five times as many turtles die as wash up on shore, indicating that between 5,730
and 6,165 sea turtles have likely been harmed by the oil spill to date.

MARINE MAMMALS

As many as 25,900 marine mammals may have been harmed by the oil spill to date. At least four species of marine mammals have been killed by the oil spill, including bottlenose dolphins, spinner dolphins, melon-headed whales and sperm whales. Oiled marine mammals have been collected from west of Cameron, Texas, to Port St. Joe, Fla. Researchers are reporting that carcasses are washing up daily, and that half of the dead animals are stillborn or dead infant dolphins. The oil spill could impair marine mammal reproduction in the Gulf for decades, as some orca whales that were exposed to the Exxon Valdez oil spill have not been able to reproduce since that spill in 1989. As with birds and sea turtles, the number of marine mammals reported as harmed by the spill grossly underestimates the true number affected. Scientists estimate that the number of marine mammals harmed may be up to 50 times higher than the number that have been collected. The government has collected 128 dead or affected dolphins and whales whose harm was attributed to the BP spill, indicating that at least 6,400 marine mammals may have actually been harmed. Though oil on some of the dolphins that have washed ashore this spring has been traced to the BP disaster, the government is not adding those dolphins to the official tally because of the ongoing

criminal investigation. The media has reported 390 strandings this spring. If these animals are included in the tally, then it can be estimated that up to 25,900 marine mammals may have been harmed by the oil spill to date.

FISH

It is difficult to conceive of how many fish have been killed by the Gulf disaster. The widespread pollution from the BP oil spill caused fishing closures across 88,500 square miles. The Gulf of Mexico is home to more than 500 fish species, with new species continuing to be discovered. Oil and dispersed oil are toxic to all life stages of fish, and oil spills affect fish reproduction for at least decades. The BP disaster particularly threatens species that are already at risk of extinction such as Atlantic bluefin tuna, Gulf sturgeon, smalltooth sawfish and the dwarf seahorse. The oil spill occurred during the peak spawning months for the bluefin tuna, pushing this severely overfished species closer to the brink of extinction. The spill could extirpate our nation's smallest seahorse, the one-inch long dwarf seahorse, from much of its range, as both oil and dispersants are toxic to seahorses and the seagrass they need to survive.

INVERTEBRATES

Oil and dispersed oil are toxic to marine invertebrates such as corals, lobsters, crabs, oysters, clams, zooplankton, starfish and sand-dwelling organisms. It is impossible to tally how many invertebrates have been harmed by the BP oil spill. The government has stated that resources that invertebrates rely on have been injured, ecological services have been disrupted, and that the potential for invertebrate recovery is limited. Researchers have observed dead and

dying corals in deep waters southwest of the BP well, reporting that the corals have been covered with a brown substance. Fishermen have reported vanishing oysters, and oiled crabs are being found on beaches. In November, fishermen reported pulling up tar balls in their shrimp nets, and the closure on royal red shrimp fishing lasted until February. Oil pollution will persist for decades or longer in the Gulf, resulting in continued disruption to invertebrate life. Scientists tracing the fate of the dispersed oil in the water column have found that oil particles are being transferred within the food web, which poses ongoing risks to all marine life in the Gulf. Forty years after an oil spill off the coast of Massachusetts, fiddler crabs are still being harmed by persistent pollution.

PLANTS

Oil, dispersed oil and dispersants are all toxic to marine and onshore plants such as seagrasses, mangroves and wetland vegetation, which provide habitat and food for many species. Oil pollution can have long-term negative effects on plants, and oil trapped in plant roots can become re-suspended in the water column during storms. Pollution from the BP spill oiled more than 1,000 linear miles of shoreline and contaminated marshes and mangrove habitats that support nesting birds. Seagrass beds that support sea turtles and seahorses were also harmed by the spill.

TERRESTRIAL MAMMALS

Tarballs and subsurface oil on beaches threaten terrestrial mammals such as federally protected beach mice, including the Alabama, Choctawhatchee, St. Andrews and Perdido

Key beach mice. Mice can ingest tar balls and subsurface oil when constructing burrows, putting them at risk of tumors and lowered immune response.

CONCLUSION The price paid by wildlife in the Gulf for the BP oil spill will continue to rise. Although it is the largest to date, the Gulf oil spill was simply the latest in a string of ongoing and inevitable spills produced in the Gulf. More than 320 known spills involving offshore drilling have occurred there since 1964. Spills massively degrade ecosystems and all of the wildlife dependent on those ecosystems in the Gulf. Clean-up efforts only remove a fraction of the persistent oil and gas spilled. The remainder of the oil, including millions of gallons remaining in the Gulf, will continue to poison wildlife for generations. Besides the direct harm to wildlife, the spill impoverishes the people of the Gulf and the nation, who depend on this rich body of water for food, culture, environmental enrichment and recreation.

More recently, a technique has been developed by which magnetite (a naturally occurring mineral) can be put onto the oil and magnets can be used to attract it. The magnetite drags the oil with it and it can be lifted out of the water, and then separate it with magnets. This leave the water clean of oil and the oil clean enough of water to processes it in a refinery.

https://www.youtube.com/watch?v=ZaP7XOjsCHQ

SOME TERMS

Absorbtion: something is taken into some material

Adsorbtion: something attaches to the outside of some material

Booms: There are different kinds, but the main point is that they are used to contain and absorb some of the material

Pompoms: They look like the pompoms used by cheer leaders. The streamers are plastic strips like old audio cassettes. Oil is absorbed by most of these.

Skimmers: Machines that move around in an oil spill and the oil on the surface spills over the edge of the skimmer and into it.

Vacuums: pretty much like the machine at home. This lifts oil off of the water, with some water comping up as well.

UNITED STATES COAST GUARD

Some small history and functions

The Coast Guard was formed on August 4th 1790 by Alexander Hamilton as the Revenue Cutter Service. During its career, it has been merged with other agencies such as the U.S. Lighthouse Service. Over the years at has been

moved through different departments – Treasury, Transportations, Navy, Defense and Homeland Security. The shifting nature of its missions has caused these shifts in alignment There are about 30,000 active duty Coast Guard members across the nation - about 6,000 fewer than there are members of the NYPD. When the NY marathon starts from the CG Base at Ft. Wadsworth Staten Island there are more runners than there are members of the active duty Coast Guard (more than 50,000 finish the race!)

Currently there are four basic missions the Coast Guard carries out – military, law enforcement, Marine Safety and Environmental Protection. Their environmental concerns are not recent, but go back to 1822 when they were tasked with protecting US timber from poaching!

The USCG is the only one of the 5 military agencies not under the department of defense, but is under Homeland Security. Its marine safety missions involving rescues at sea makes it the only one of the military organizations more interested in saving people than killing them. Its role in oil spills is well known. It is important here perhaps to note that a great job is declared if 10% - 15% of the oil is recovered. The Authority for its environmental action comes from several federal laws.

The Coast Guard does not, per se, do the clean ups of the oil, but rather acts to track down culprits and oversee the actions. Clean ups are actual done by other companies. The USCG also notifies those agencies which try to deal with animals that have been impacted by an oil spill, but the

USCG does not deal with the animals themselves that have been impacted by the oil.

There follows a list of the more important laws concerning the environment. Following the list is information on aquatic nuisance species and invasive species and steps to be take to protect against them

MARPOL In 1973, the International Convention for the Prevention of Pollution from Ships at Sea (MARINE POLLUTION) was drafted and signed by a number of seafaring nations. In 1978, it was updated to include five annexes on ocean dumping. In 1997, an annex on air pollution by ships was added. The annexes cover the following:
Annex I Oil
Annex II Hazardous liquid carried in bulk
Annex III Hazardous substances carried in packaged form
Annex IV Sewage
Annex V Garbage
Annex VI Air Pollution

By ratifying MARPOL 73/78, a country automatically adopts annexes I and II; the remaining annexes are optional. The United States has ratified optional annexes III and V. For a summary of MARPOL, see

http://www.epa.gov/OWOW/OCPD/marpol.html

MPPRCA
Marine Plastic Pollution Research and Control Act

(1987) – MPPRCA implements the International Convention for the Prevention of Pollution from Ships, Annex V (MARPOL 73/78) and restricts the overboard discharge of plastic and other garbage. For a summary, see

http://www.cmcocean.org/mdio/marpol.php3

CWA
Clean Water Act (1972) – focuses on the use, discharge, and disposal of sewage, oil, and hazardous substances including dispersants. For a summary of the CWA and a link to the full text of the Act, go to

http://www.epa.gov/region5/defs/html/cwa.htm

OPA
Oil Pollution Act (1990) – requires reporting and cleanup of all oil and hazardous substance spills. For a summary of the OPA and a link to the full text of the Act, see http://www.epa.gov/region5/defs/html/opa.htm

OAPCA
Organotin Antifouling Paint Control Act (1988) – regulates the use and application of antifouling paints for some marine vessels. For the full text of the Act, see

http://www4.law.cornell.edu/uscode/unframed/33/2404.html

CVA
Clean Vessel Act (1992) – designed for the construction of pumpout facilities through financial incentives to local marinas.

For a summary of the CVA, see

http://fa.r9.fws.gov/cva/cva_info.html#CVA .

For the details of the Act, see

http://www.fws.gov/laws/digest/reslaws/clenves.html

FWPCA
Federal Water Pollution Prevention and Control Act (1997) – establishes goals and policies for the restoration and maintenance of the chemical, physical, and biological integrity of our nation's waters. A summary of the FWPCA can be viewed at:

http://www4.law.cornell.edu/uscode/33/ch26.html .

For FWPCA (section 1322) information on the use of marine sanitation devices:

http://www.uscg.mil/hq/gm/mse/regs/FWCPA.html

ESA
Endangered Species Act (1973) –provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. For a summary of the ESA and a link to the full text of the Act, see

http://www.epa.gov/region5/defs/html/esa.htm

MMPA

Marine Mammal Protection Act – establishes a moratorium on taking and importing marine mammals, their parts, and products. The Act provides protection for polar bears, sea otters, walruses, dugongs, manatees, whales, porpoises, seals, and sea lions. For a summary of the MMPA, see

http://www.lab.fws.gov/lab/cargo/mmp.htm

CZMA
Coastal Zone Management Act – encourages states to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. For a summary of the CZMA, see

http://tis-nt.eh.doe.gov/oepa/law_sum/CZMA.HTM

CAA
Clean Air Act – regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.
For a summary of the CAA, see

http://www.epa.gov/region5/defs/html/caa.htm
RCRA
Resources Conservation and Recovery Act – addresses the issue of how to safely manage and dispose of the huge volumes of municipal and industrial waste generated nationwide. For more information on the RCRA, see

http://www.epa.goepaoswer/hotline/rcra.htm

PWSA
Port and Waterways Safety Act – states that navigation and vessel safety and protection of the marine environment are matters of major national importance. It Insures that the handling of dangerous articles and substances on the structures in, on, or immediately adjacent to the navigable waters of the United States is conducted in accordance with established standards and requirements. For details, see

http://www4.law.cornell.edu/uscode/33/1221.html

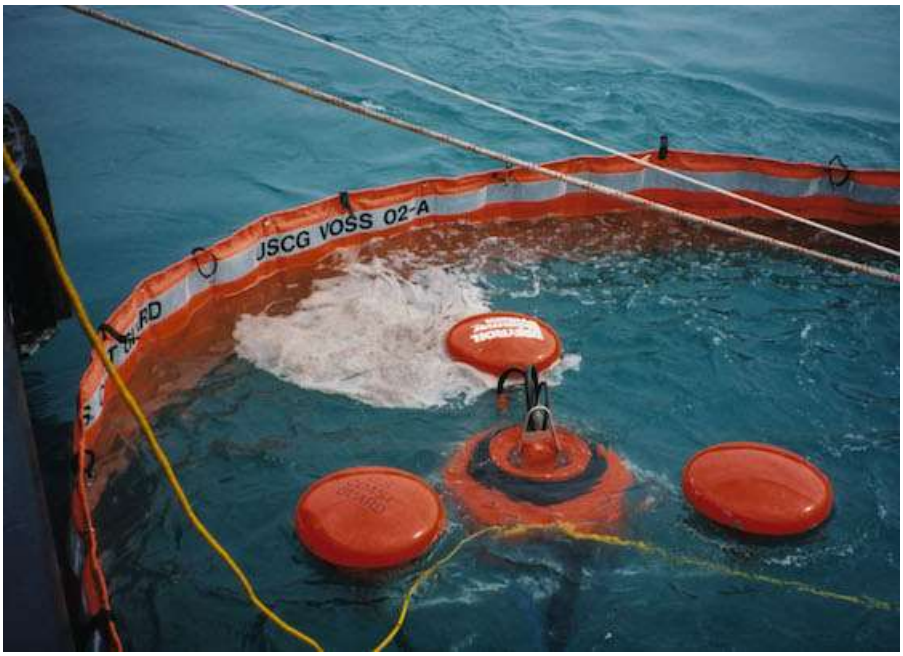
NMSA
National Marine Sanctuaries Act – protects special marine resources, such as coral reefs, sunken historical vessels or unique habitats, while facilitating all “compatible” public and private uses of those resources. For a summary of the NMSA, see

http://www.sanctuaries.nos.noaa.gov/natprogram/nplegislation/nplegislation.html

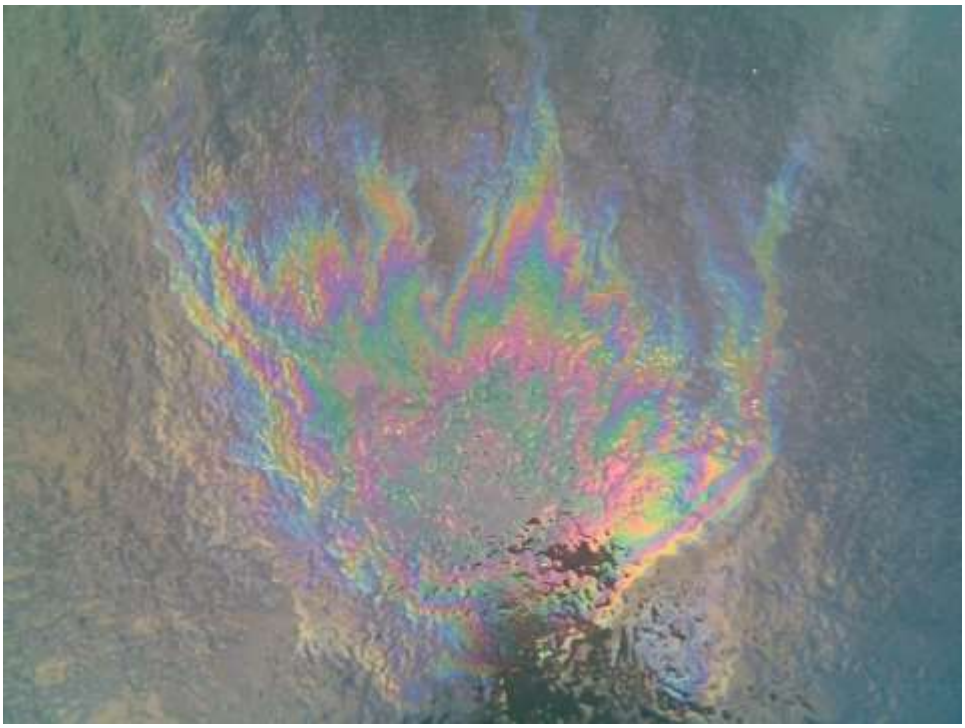
In addition to dealing with oil spills and other pollutants in the water, the USCG deals with the taking of fish and violations of laws which deal with over fishing and by-catches as well as the dangers of the transportation of Aquatic Nuisance Species into American Waters. These are life forms that arrive in bilge water and also just attached to the bottom of a vessel which become transplanted into

areas where they may have no natural predators and may drive native species out of existence. extinction. The spill could extirpate our nation’s smallest seahorse, the one inch long dwarf seahorse, from much of its range, as both oil and dispersants are toxic to seahorses and the seagrass they need to survive.

SOME INFORMATION



Skimmers



Sheen on the water

Pom poms (adsorb)

Pom poms on the beach (adsorb)

In Situ burning of oil

Booms (absorb)

Booms at work!

Vacuuming

Spill Containment Methods

Boom surrounds a set of floating net pens at a salmon hatchery in Prince William Sound, Alaska, to protect the pens from oil spilled from the Exxon Valdez.

During a spill response, sensitive locations threatened by an advancing oil slick can be protected with various kinds of equipment and tactics.

Booms are floating, physical barriers to oil, made of plastic, metal, or other materials, which slow the spread of oil and keep it contained. Skilled teams deploy booms using mooring systems, such as anchors and land lines. They commonly place boom:

- Across a narrow entrance to the ocean, such as a stream outlet or small inlet, to close off that entrance so that oil can't pass through into marshland or other sensitive habitat.
- In places where the boom can deflect oil away from sensitive locations, such as shellfish beds or beaches used by piping plovers as nesting habitat.
- Around a sensitive site, to prevent oil from reaching it.

There are three main types of boom. **Hard boom** is like a floating piece of plastic that has a cylindrical float at the top and is weighted at the bottom so that it has a "skirt" under the water. If the currents or winds are not too strong, booms can also be used to make the oil go in a different direction (this is called "deflection booming"). **Sorbent boom** looks like a long sausage made out of a material that absorbs oil. If you were to take the inside of a disposable diaper out and roll it into strips, it would act much like a sorbent boom. Sorbent booms don't have the "skirt" that hard booms have, so they can't contain oil for very long. **Fire boom** is not used very much. It looks like metal plates with a floating metal cylinder at the top and thin metal plates that make the "skirt" in the water. This type of boom is made to contain oil long enough that it can be lit on fire and burned up.

Skimmers are boats and other devices that can remove oil from the sea surface before it reaches sensitive areas along a coastline. In the photo below, oil is being skimmed from the sea surface by a "vessel of opportunity." Sometimes, two boats will tow a collection boom, allowing oil to concentrate within the boom, where it is then picked up by a skimmer.

A "vessel of opportunity" skims oil spilled after the Deepwater Horizon/BP well blowout in the Gulf of Mexico in April 2010. (NOAA)

If local authorities and response experts agree, other possible—but more controversial—measures responders might consider include:

NOAA worked with the Coast Guard and others to employ in situ burns during the 2010 Deepwater Horizon/BP oil spill in the Gulf of Mexico. (U.S. Coast Guard)

- **In situ burning** of an oil slick, or part of a slick, before it reaches the coast. To do this, responders corral some of the oil from the slick in a fire-proof boom, then ignite it (as has been done in the photo to the right). This technique works best when the oil is fresh and the weather relatively calm.
- Using aircraft or boats to apply **dispersants** (chemicals that disperse the oil into the water column, so that much less stays at the surface, where it could affect beaches and tideflats).

Spill response experts know that all of these methods are effective only when conditions are conducive to using them.

More Information about Spill Containment Methods

In Situ Burning: When conducted properly, in situ burning significantly reduces the amount of oil on the water and minimizes the adverse effect of oil on the environment.

In Situ Burning

In situ burning was employed extensively during the Deepwater Horizon/BP oil spill in 2010. (U.S. Coast Guard)

In situ burning, or ISB, is a technique sometimes used by people responding to an oil spill. In situ burning involves the controlled burning of oil that has spilled from a vessel or a facility, at the location of the spill.

When conducted properly, in situ burning significantly reduces the amount of oil on the water and minimizes the adverse effect of the oil on the environment.

More Information about In Situ Burning

SMART: SMART (Special Monitoring of Applied Response Technologies) is a monitoring protocol for both in situ burning operations and dispersant application. The ISB module of SMART provides guidelines for monitoring the smoke plume from ISB operations.

Residues from In Situ Burning of Oil on Water: Read a survey of current knowledge about the behavior and effects of ISB residues.

In Situ Burning Emissions Comparisons: The particulates released into the atmosphere by in situ burning are a concern to many people. Compare in situ burning emission rates and rates of emission from other kinds of sources.

Spill Response Reports and Documents

Guidance on Burning Spilled Oil In Situ [PDF, 12.7 KB]: A 1995 position paper from the National Response Team on the recommended limits for short-term human exposure to particulates measuring less than 10 microns (PM-10) while spilled oil is burned in situ.

Open-water Response Strategies: In Situ Burning [PDF, 36.4 KB]: Why conduct in situ burning? How is it done? What about the emissions that it produces? Where has in situ burning been conducted? What factors might prevent its use?

RRT VI Guidelines for Inshore/Nearshore In Situ Burn [PDF, 17.4 KB]: Advantages and disadvantages of in situ burning of oiled wetlands, safety and operational guidelines, and a checklist for in situ coastal wetland burns.

In Situ Burn Unified Command Decision Verification Checklist [PDF, 17.1 KB]: This checklist, created in 1997 with input from the Region II Regional Response Team, summarizes important information the Unified Command should consider when planning oil spill in situ burning in marine waters of Region II.

Health and Safety Aspects of In Situ Burning of Oil [PDF, 31.1 KB]: Presents health and safety considerations for response personnel, the general public, and the environment.

Sample Site Safety Plan for Marine In Situ Burn Operations [PDF, 65.3 KB]: A draft sample site safety plan that includes elements unique to ISB. The sample is not a standard but rather a suggested starting point.

SMART: Special Monitoring of Applied Response Technologies (SMART) is a cooperatively designed monitoring program for in situ burning and dispersants.

SMART

An aircraft releases chemical dispersant over an oil slick in the Gulf of Mexico in 2010. (U.S. Coast Guard)

Special Monitoring of Applied Response Technologies (SMART) is a cooperatively designed monitoring program for in situ burning and dispersants. SMART relies on small, highly mobile teams that collect real-time data using portable, rugged, and easy-to-use instruments during dispersant and in situ burning operations.

Data are channeled to the Unified Command (representatives of the responsible party and the state and federal governments who are in charge of the spill response) to address critical questions:

- **Are particulates concentration trends at sensitive locations exceeding the level of concern?**
- **Are dispersants effective in dispersing the oil?**

Having monitoring data can assist the Unified Command with decision-making for dispersant and in situ burning operations.

The SMART program is a joint project of these agencies:

- **U.S. Coast Guard**
- **NOAA**
- **U.S. Environmental Protection Agency**
- **Centers for Disease Control and Prevention**
- **Bureau of Safety and Environmental Enforcement (part of the agency formerly known as the Minerals Management Service)**

Dispersants

To monitor the efficacy of dispersant application, SMART recommends three options, or tiers.

Tier I: A trained observer, flying over the oil slick and using photographic job aids or advanced remote sensing instruments, assesses dispersant efficacy and reports back to the Unified Command.

Tier II: Tier II provides real-time data from the treated slick. A sampling team on a boat uses a monitoring instrument to continuously monitor for dispersed oil 1 meter under the dispersant-treated slick. The team records and conveys the data to the Scientific Support Team, which forwards it, with recommendations, to the Unified Command. Water samples are also taken for later analysis at a laboratory.

Tier III: By expanding the monitoring efforts in several ways, Tier III provides information on where the dispersed oil goes and what happens to it.

1. **Two instruments are used on the same vessel to monitor at two water depths.**
2. **Monitoring is conducted in the center of the treated slick at several water depths, from 1 to 10 meters.**
3. **A portable water laboratory provides data on water temperature, pH, conductivity, dissolved oxygen, and turbidity.**

In Situ Burning

For in situ burning operations, SMART recommends deploying one or more monitoring teams downwind of the burn, at sensitive locations such as population centers. The teams begin sampling before the burn begins to collect background data. After the burn starts, the teams continue sampling for particulate concentration trends, recording them both manually at fixed intervals and automatically in the data logger, and reporting to the

Monitoring Group Supervisor if the level of concern is exceeded. The Scientific Support Team forwards the data, with recommendations, to the Unified Command.

More Information about SMART

SMART has already been successfully tested in the field. SMART was used to monitor both dispersant applications and in situ burning operations in the Gulf of Mexico during the 2010 Deepwater Horizon/BP oil spill, and in February 1999 it was used to monitor the in situ burning of the New Carissa, a freighter grounded offshore of Coos Bay, Oregon. Spills and exercises like these help us to enhance SMART.

Special Monitoring of Applied Response Technologies (SMART) [PDF, 769.6 KB]: The SMART protocol, updated in August 2006.

SMART at the New Carissa Oil Spill [PDF, 387.0 KB]: A summary of how SMART was used during the New Carissa response in 1999.

Matrix Effects on Fluorometric Monitoring and Quantification of Dispersed Oil in the Open Ocean and Coastal Environment: Results of the 1999 R/V Ferrel Research Project [PDF, 519.0 KB]: A 2001 report on a 1999 research project aboard the NOAA Ship Ferrel, designed to identify the potential for matrix effects related to monitoring of dispersed oil.

In Situ Burning: Find more information about in situ burning and burn monitoring.

Dispersant Mission Planner: This is a tool that oil spill planners and responders can use to assess dispersant application system performance.

Dispersant Application Observer Job Aid: This is a field guide for those trained in observing and identifying dispersed and undispersed oil, describing oil characteristics, and reporting this information to decision-makers.

Response Techniques Photo Gallery: View photographs of a variety of ways first responders contain and clean up oil spills.

Response Techniques

All oil spill cleanup methods have some kind of environmental impact, so selection of a cleanup method inherently forces us to make a tradeoff of the effects of the oil versus the effects of the cleanup. Clean-up techniques range from physical removal (such as skimming boats) to chemical and biological treatment methods (for example, dispersants and oil-eating bacteria). View photos of some commonly used techniques for oil spill response and shoreline cleanup.

1.

Ship Skimming Oil After Deepwater Horizon Spill
A "vessel of opportunity" skims oil spilled after the Deepwater Horizon well blowout in the Gulf of Mexico in April 2010.
photo: NOAA

2

Cleaning the Banks of the Mississippi River After the M/V Westchester Oil Spill

Cleanup workers manually remove oil following the M/V Westchester spill in the Mississippi River near Empire, Louisiana, in November 2000.

photo: NOAA

Workers Assess the Shoreline after the Exxon Valdez Oil Spill

Workers conducting a shoreline assessment following the T/V *Exxon Valdez* oil spill in Prince William Sound, Alaska, in March of 1989. (NOAA)

photo: NOAA

Using Pom-poms to Absorb Oil

Workers clean oil from the beach in Port Fourchon, LA in June 2010, following the Deepwater Horizon/BP oil spill in the Gulf of Mexico in April. (NOAA)

photo: NOAA

Response to a Grounded Tanker in the Galapagos

A response vessel sprays dispersant onto an oil spill in the Galapagos. The tanker Jessica struck a reef off Puerto Baquerizo Moreno on San Cristobal Island on the night of January 16, 2001. The 260 foot vessel was carrying 160,000 gallons of diesel fuel oil and 78,000 gallons of intermediate fuel oil 120, and spilled a significant quantity of this oil.

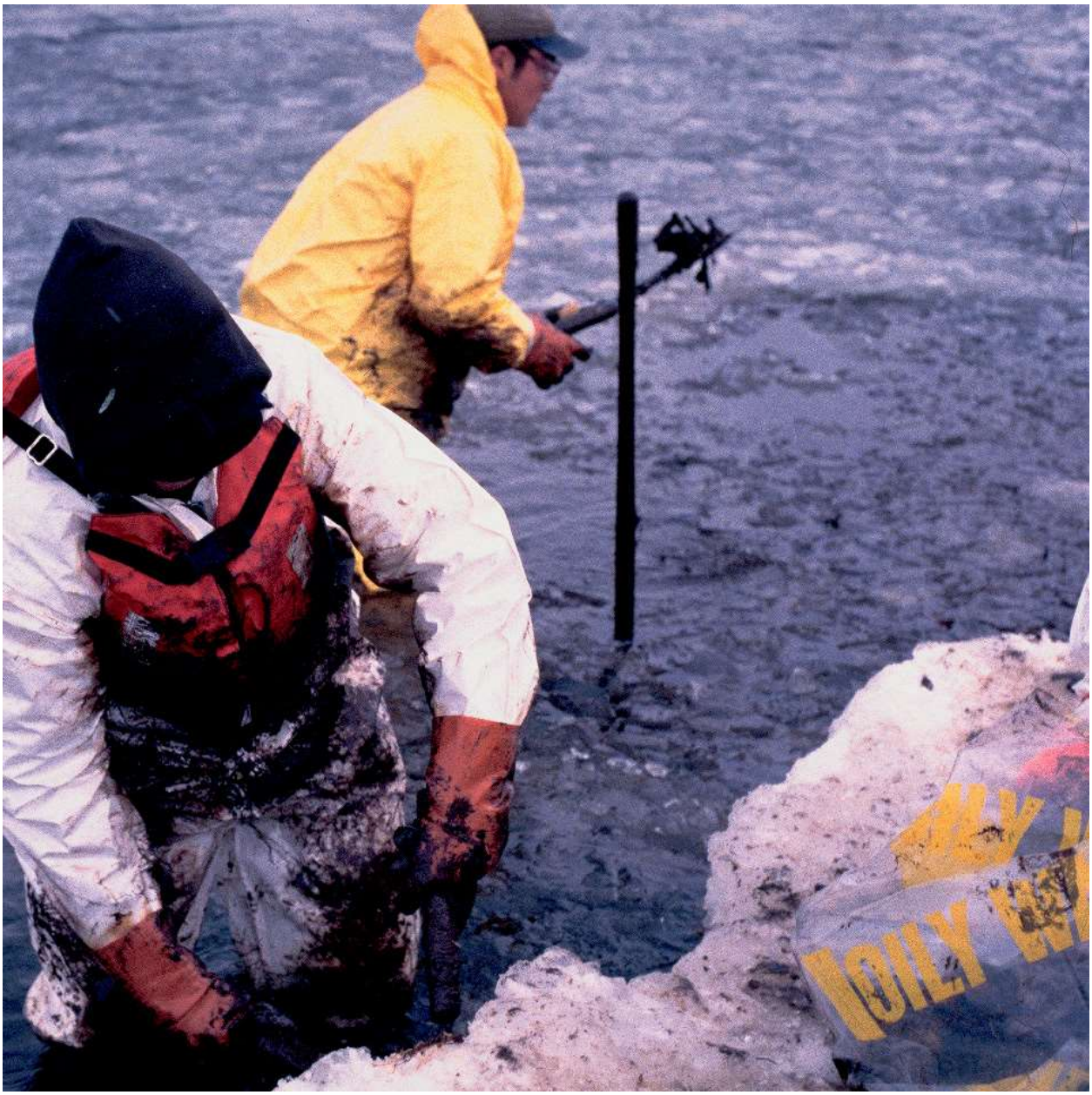
photo: Heidi Snell

Workers at the Tank/Barge DBL152 Oil Spill
Workers at the Tank/Barge DBL152 spill off of the Louisiana coast in November 2005. (NOAA)
photo: NOAA

Shoreline Survey following the Selendang Ayu Oil Spill
A worker conducts a shoreline survey following the M/V Selendang Ayu grounding and oil spill near the Aleutian Islands, Alaska, in December 2004. (NOAA)

photo: NOAA

8



Cleaning Oil Spilled When Freighter Kuroshima Ran Aground

Manual labor following a spill caused when the coastal freighter M/V *Kuroshima* ran aground on rocks near Dutch Harbor, AK, in November 1997. (NOAA)

photo: NOAA

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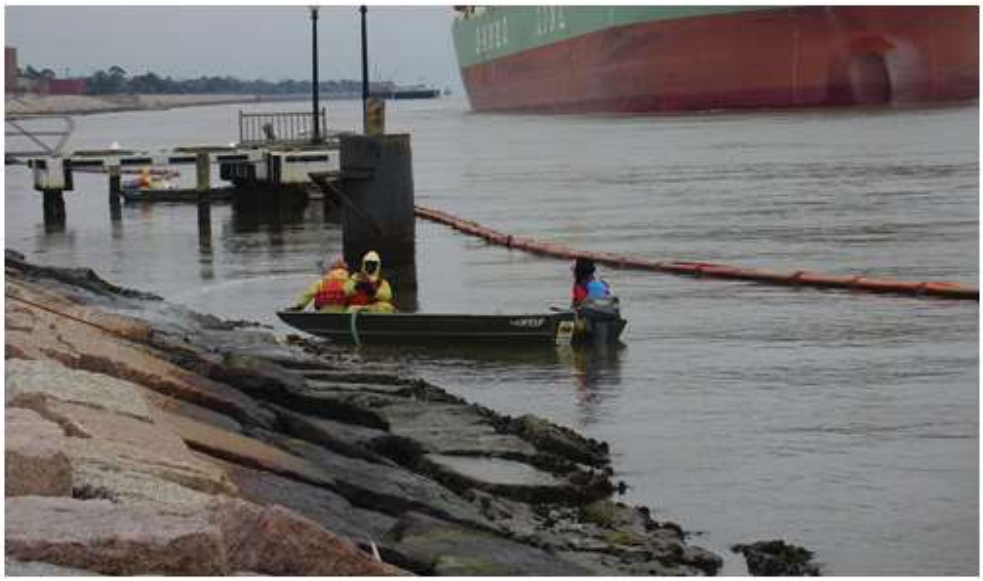

Washing Oil from Rocks after Eagle Otome Oil Spill

Workers cleaning oil spilled following a collision involving crude oil tanker *Eagle Otome* in Port Arthur, Texas, in January 2010. (NOAA)

photo: NOAA

Dispersant Application Near the Louisiana Coast

In November 2005, Tank/Barge DBL152 and the T/V *Rebel* allided with an obstruction approximately 32 miles from the Louisiana Coast, causing a spill. In the photo, dispersant is being applied to the oil. (NOAA)

photo: NOAA

Overflight After Cosco Busan Oil Spill

LCDR Elizabeth Jones conducting an overflight following the M/V *Cosco Busan* spill in San Francisco Bay in March of 2000. (NOAA)

photo: NOAA

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Skimming Oil After the M/T Athos Spill

Skimming the Delaware River in Philadelphia following the M/T *Athos I* spill on November 26, 2004. (NOAA)

photo: NOAA

13

Cleaning oiled marshes in Louisiana after 2010 Deepwater Horizon oil spill

After the 2010 Deepwater Horizon spill, a heavy layer of oiled vegetation mats were preventing the thick emulsified oil underneath from breaking down along Barataria Bay's marshes. Here a NOAA SCAT Team scientist monitors the progress of cleanup efforts in a test plot.

photo: (NOAA/Scott Zengel)

U.S. Coast Guard uses ERMA® (Environmental Response Management Application) at Hurricane Isaac Response

U.S. Coast Guard Recon/Hazards Branch using the NOAA online response mapping tool Gulf of Mexico ERMA® (Environmental Response Management Application) following Hurricane Isaac to plan next-day field activities. Gulf of Mexico ERMA was used as the Common Operational Picture for the response. Additionally, the USCG District 8 Command staff used ERMA to see where the Sector NOLA (New Orleans, Louisiana) folks were working and how that work was progressing.

In situ burn of oil spilled after Deepwater Horizon oil spill in 2010

After the Deepwater Horizon oil spill in the Gulf of Mexico in April 2010, in situ burning was used as one technique to remove oil form the water.

photo: NOAA

Sampling water after an oil spill in Louisiana swamp

In 2013, after controlled burns were used to remove oil spilled in a wooded swamp near Baton Rouge, Louisiana, a scientist takes samples of the water.

photo: NOAA

Controlled burn of an oil spill in a Louisiana swamp

A view of one of the controlled burns to remove oil spilled in a wooded swamp outside of Baton Rouge, Louisiana, on January 19, 2013.

photo: U.S. Coast Guard

Selendang Ayu Shoreline Assessment

Conducting a shoreline survey following the following the M/V Selendang Ayu spill of its fuel oil and cargo of soybeans near the Aleutian Islands, Alaska, in December 2004. (NOAA)

photo: NOAA

Buzzards Bay Overflight

A responder performs an aerial survey after the Bouchard Barge 120 oil spill in Buzzards Bay near Massachusetts and Rhode Island in 2003. (NOAA)

photo: NOAA

Mechanical Protection Guidelines [PDF, 996.4 KB]: A 1994 manual describing how to deploy booms, barriers, and other mechanical protection devices during a spill response.

FAQ: Microbes and Oil Spills: This report is based on the deliberations of over 20 of the nation's leading experts who came together for one day to develop clear answers to seven frequently asked questions regarding the role of microbes in an oil spill.

ANS – Aquatic Nuisance Species

ANS are nonindigenous aquatic species that pose significant ecological and economic threats to aquatic ecosystems. This can include fish, aquatic plants, algae, invertebrates, mussels, viruses, and other aquatic pathogens.

As per **Executive Order 13112** an "invasive species" is defined as a species that is:

1) non-native (or alien) to the ecosystem under consideration and

2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Invasive species come into the environment in different ways. Some, like those hitching a ride on diffent kind of vessels

- Ballast water operations
- Biofouling of ship hulls
- Transported on watercraft, fishing gear, and other recreational equipment/li>
- Escape from aquaculture facilities
- Escape from nurseries and water gardens
- Intentionally stocked as food or recreational sources
- Released as biological control of existing an existing invader
- Intentional release of unwanted pets
- Utilized for habitat restoration or erosion control efforts
- Accidental or intentional release of classroom and laboratory animals
- Fishing bait release

Accidentally released with other species in the plant and animal trade