OIL SPILL RESPONSE EQUIPMENT CACHING:
A WASHINGTON STATE CASE STUDY

by

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ABSTRACT

Oil spill response equipment caching:
A Washington State case study

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Oil spill response in the United States has evolved significantly over the past 50 years. In the past, the federal government oversaw spill response nationwide. At that time, spill response resources were spread across the nation and were often too far away to be effectively deployed during an oil spill. Several significant, large volume spills, such as the *Argo Merchant* and the *Exxon Valdez*, resulted in new environmental legislation that changed the way that oil spills were managed in the U.S. These laws improved the federal government's preparedness and ability to respond to oil spills, as well as delegated authority to state governments to handle response actions within their jurisdictions.

The Washington State legislature has set a "zero spills" goal for the state, a mandate that the Department of Ecology Spills Program takes very seriously. In order to meet this goal, the Spills Program has designed and implemented the Oil Spill Equipment Caching Grant, a unique, community-based, first responder program. The grant provided response equipment and training to local governments and tribes for use during the critical initial hours of a spill. Early intervention can be the difference between localized, minimal damage and a spill that severely impacts sensitive environmental, cultural, and economic resources.

The following paper will be a case study of Washington State community-based equipment caching program. A history of major spills, and the subsequent legislation, will be explained, as well as Washington State's role in spill response. To better understand the strategic planning that influenced the equipment-caching program, a brief overview of spill response decision-making will be provided, followed by an in depth examination of Washington's equipment caching program. Examples of similar programs in effect in Alaska and Massachusetts are also included.

Community based spill response is an effective way to deal with initial response to oil spills and an efficient way to mitigate the negative impacts of a spill. Washington State has developed a comprehensive program that successfully incorporates local knowledge and manpower to protect valuable and sensitive areas around the state.

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ACRONYMS

ADEC	Alaska Department of Conservation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (1980)
CSRA	Community Spill Response Agreement
CSRP	Community Spill Response Program
CWA	Clean Water Act (1972)
DEM	Department of Emergency Management
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Program
FWPCA	Federal Water Pollution Control Act (1948)
GRP	Geographic Response Plan
IOSA	Island Oil Spill Association
MassDEP	Massachusetts Department of Environmental Protection
MTCA	Model Toxics Control Act (1989)
NCP	National Contingency Plan
NEPA	National Environmental Pollution Act (1970)
NOAA	National Oceanic and Atmospheric Administration
OPA	Oil Pollution Act (1990)
RCW	Revised Code of Washington
SARA	Superfund Amendment and Reauthorization Act (1986)
USCG	United States Coast Guard

Introduction

Major maritime oil spills of the past have created concern among government, industry, and the public about how to effectively respond to a disastrous spill event. A massive spill occurred in 1967 when the *Torrey Canyon* ran aground, causing the tanker's hull to fracture and spill 36 million gallons of crude oil into the English Channel (Belardo, Harrald, Wallace, & Ward, 1984). The grounding of the *Argo Merchant* in Massachusetts (1976) was a catastrophic spill that released 7.7 million gallons of heavy crude oil in three separate releases during one week (Psaraftis & Ziogas, 1985). An uncontrolled blowout from a Union Oil offshore platform released more than three million gallons of crude oil into Santa Barbara Bay in 1969, soiling 40 miles of coastline and triggering a massive public outcry (County of Santa Barbara, 2005). Other significant spills include the *Amoco Cadiz* (68.7 million gallons) grounding, France (1978); the Ixtoc-I (140 million gallons) well blowout, Gulf of Mexico (1979); the Ashland Oil spill (four million gallons) into the Monongahela River at Floreffe, Pennsylvania, the nation's largest inland oil spill (1998); the *Exxon Valdez* (11 million gallons) grounding, Alaska (1989); and the recent *Cosco Busan* (58,000 gallons) oil spill into San Francisco Bay (2007). The environmental, economic, and social ramifications that were felt following these spill events demanded that emergency actions be taken by the federal and state governments to prevent large-scale spill events, to develop effective response strategies, and to mitigate the resulting damages.

The purpose of this paper is to demonstrate the advantages of pre-positioning oil spill response equipment by state government to improve overall spill response capabilities. Washington State will serve as a case study for how to design and implement a community-based initial response program. Washington's community response program for oil spills serves as a model for other states. This paper will be divided into the following six chapters: I) Background of federal environmental legislation; II) Washington State role in oil spill response; III) Oil spill response decision-making; IV) Washington State case study; V) State government programs beyond Washington; and VI) Conclusions.

I) Background of Federal Environmental Legislation

Since the 1970s, significant federal legislation has been written to address the impacts of major environmental emergencies and the ongoing environmental degradation resulting from industrial, economic, and recreational activities. This section will introduce the main federal environmental laws that deal with oil spills, and discuss the significant incidents that led to these laws. These laws give the United States Coast Guard (USCG) and the U.S. Environmental Protection Agency (EPA) initial response authority and jurisdiction over oil and hazardous material events. Since the scope of this paper is on state and local government response to oil spills, this information is provided to frame the context of spill response at the national level and provide the reader with a background to understand the policies that govern Washington State's decision to base spill response in local communities.

National Environmental Policy Act

The first comprehensive environmental law was enacted in the United States when Congress ratified the National Environmental Policy Act of 1969 (NEPA). President Nixon signed NEPA into law on January 1, 1970, effectively establishing national environmental policies (Council of Environmental Quality [CEQ], 2007). In the same year, Nixon issued an executive order, creating the U.S. Environmental Protection Agency to implement the new law.

Prior to the passage of NEPA, environmental regulation was often complex and detailed. NEPA provided simple, comprehensive regulations that established a national policy to protect the environment and required decision makers to consider the long term or confounding environmental impacts that may result from their decisions (Alm, 1998).

The National Environmental Policy Act integrated environmental values into federal decision-making by holding the government responsible for protecting, maintaining, and enhancing the environment (U.S. Environmental Protection Agency [EPA], 2009b). This act influenced subsequent legislation by

requiring federal agencies to incorporate environmental considerations into their decision-making processes.

In essence, NEPA changed the way the U.S. government handled environmental issues by making all federal agencies accountable for the environmental impacts of their decisions and actions.

Federal Water Pollution Control Act (Clean Water Act)

While NEPA was the first comprehensive environmental law, it was informed by the Federal Water Pollution Control Act (FWPCA), enacted in 1948. FWPCA was an early effort to eliminate water pollution and to improve water quality, specifically for increased sanitation in densely populated areas. The FWPCA prohibited the discharge of hazardous materials, including oil, into the navigable waters or onto the shoreline of the United States (Smith & Sheldrake, n.d.).

Multiple amendments have altered the original text of the FWPCA. One amendment, the Water Quality Improvement Act of 1970, established civil and criminal penalties for spills and required the development of regulations for hazardous substances other than oil. This amendment also created the National Contingency Plan (NCP) to achieve a federally coordinated and efficient response to oil spills (U.S. Fish & Wildlife Service [USFW], n.d.). The NCP assigned the management role of federal on-scene coordinator to the USCG, for spills to marine and navigable waters, and to the EPA, for inland incidents (Coe, 1995; Thurston County Emergency Management, n.d.).

The 1972 amendment, commonly referred to as the Clean Water Act (CWA), significantly expanded and fortified the earlier legislation. The CWA addressed pollution prevention regulations by developing technology-based standards to manage non-point and point pollution sources (USFW, n.d). Additional provisions created the 311(k) Fund, which would later incorporate the Oil Spill Liability Trust Fund, which was designed to collect revenue through taxes on the petroleum industry (Smith & Sheldrake, n.d.). The CWA also established the USCG's National Response Center as the sole point of contact for

reporting all hazardous material discharges into the environment (National Response Center, 2002).

Subsequent amendments to the FWPCA and the CWA continue to strengthen the initial intention of the act: to improve overall water quality and to reduce hazardous pollution discharges into U.S. waters.

The Argo Merchant Incident

Six years after NEPA was enacted, a major spill into American waters tested response capabilities envisioned in the new law. This was the infamous *Argo Merchant* spill in 1976, which taught valuable lessons and led to significant improvements in oil spill response during challenging incidents in the U.S., and in related legislation, due to lessons learned.

The *Argo Merchant*, a Liberian tanker, ran aground on rocks off the Massachusetts coast, causing a massive oil spill that challenged the response capabilities of the federal government. According to the National Oceanic and Atmospheric Administration (NOAA) (n.d.a) and Psaraftis and Zioga (1985), the events of the *Argo Merchant* occurred as follows:

- On December 15, 1976, the *Argo Merchant* ran aground 29 nautical miles from Nantucket Island, amid ten-foot seas and strong winds. The tanker, which was carrying 7.7 million gallons, or 183,000 barrels, of heavy crude oil, began to slowly leak oil into the water.
- Over the next several days, the weather worsened, the crew was evacuated, and attempts to re-float the vessel were unsuccessful. By December 20th, nearly two million gallons of crude oil had escaped.
- On December 21st, the *Argo Merchant* broke in two, releasing approximately three million gallons, or 36,000 barrels, of oil.
- The following day, December 22nd, the tanker broke again, releasing the remaining oil into the sea.

Prevailing winds kept the oil from reaching the shore. This was a fortunate turn of events, since shoreline impacts from oil spills are often technically complicated and ecologically destructive. These winds altered the

focus of the response efforts by shifting the attention from potential shoreline impacts to the impending damage to economically important fishing grounds.

The *Argo Merchant* grounding, and the subsequent federal response, received widespread public and media scrutiny. One relevant observation was that the availability and quantity of response resources near the spill site was inadequate. Other key criticisms of the response efforts included: 1) failure of the government to lighter, or transfer, the oil before it escaped to the water; 2) limited understanding by scientists of spills in general, and of how to interpret specific spill data; 3) lack of preparedness and coordination between agencies, requiring the necessity of mounting a full-scale response from scratch; 4) inability to successfully mitigate the damages through multiple attempts of *in-situ* burning; 5) use of limited or inaccurate spill-trajectory modeling software (Belardo et al., 1984; NOAA, n.d.a; Pollack & Stolzenbach, 1978). It became apparent that despite government actions, federal agencies were unable to effectively handle the *Argo Merchant* oil spill.

Carter Directive: Oil Pollution to the Oceans

In 1977, one year after the *Argo Merchant* incident, President Carter called for a study to identify and address the response problems associated with that oil spill. The study led Carter to issue a national policy directive for preventing and responding to oil pollution in the oceans. This directive required the USCG, the EPA, and NOAA to become sufficiently capable of responding to a 100,000-ton oil spill anywhere in U.S. waters within six hours (Belardo et al., 1984; Woolley & Peters, n.d.). The goal was clear, but the directive did not provide instructions to the agencies on how to achieve the new requirements. Carter's instructions regarding the six-hour response period were ambiguous; the directive did not explain if six hours referred to the time it took to dispatch the equipment, or for the equipment to reach a staging site, or to initiate the cleanup activities once the equipment arrived on scene (Belardo et al., 1984; Coe, 1995; Psaraftis, Tharakan, & Ceder, 1986).

The Coast Guard, as federal on-scene coordinator, was responsible for determining what resources would be needed to reach the directive's goal for

marine incidents. Through a contract with the U. S. Department of Transportation's Transportation Systems Center, the USCG developed strategic and tactical response plans and operational goals for oil spill response (Belardo et al., 1984; Bellantoni, Garlitz, Kodis, O'Brien, & Passera, 1979). These plans were based primarily on the frequency of spills at specific locations; the optimal type and quantity of equipment that was needed was based on the corresponding spill volume (Psaraftis et al., 1986). Based on this study, the initiative was interpreted as such: all equipment must be staged at a debarkation point near the spill and be ready to deploy within six hours of notification by the federal on-scene coordinator (Belardo et al., 1984, Coe, 1995). The result was a specific pre-spill plan for siting oil spill response equipment, with the largest stockpile staged in Philadelphia, capable of responding to a spill of less than 15,000 tons within six hours of notification (Belardo et al., 1984).

This plan enhanced preparedness along the East Coast, but did little to address risks in other regions. For instance, this plan provided minimal protection to the heavily-traveled, semi-enclosed waterways of the Puget Sound, where the risk of spills, and the opportunity for successful mitigation is relatively high (Belardo et al., 1984). As a result, Washington State agencies coordinate spill response with the USCG and the EPA, and have implemented a first-responder spill response program to manage spill incidents at the community level. This program will be highlighted later in this paper.

Comprehensive Environmental Response, Compensation, and Liability Act

The next important environmental law was passed in 1980. This law, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, deals with hazardous substances, pollution and contamination in the environment. CERCLA created the Hazardous Substances Trust Fund, set at $1.6 billion, through a tax on the petroleum and chemical industry, to be used for response to actual or potential pollution releases and during the cleanup of hazardous waste sites (Smith & Sheldrake, n.d.; EPA, 2009a).

CERCLA was amended in 1986 by passage of the Superfund Amendment and Reauthorization Act (SARA). SARA contributed to the growth of citizen involvement in spill responses by combining state government expertise with civilian perspectives during planning and cleanup decision-making. SARA also increased Congress's annual appropriation of funds generated by the Superfund tax to $8.5 billion, and included the Community Right-to-Know Act, which increased the public's awareness of chemicals, including petroleum products, being stored in and transported through their communities (EPA, 2009c; Ramseur, Reisch, & McCarthy, 2008).

Both CERCLA and SARA were intended to improve spill response because they required the spillers of hazardous substances to take responsibility for the spill and pay for the cleanup. In addition, the federal and state governments, as trustees of resources, were authorized to recover from responsible parties costs to repair damages to the environment that occurred as a result of a release of a hazardous substance (Buzzards Bay National Estuary Program [BBNEP], n.d.). Despite the importance of CERCLA and the SARA amendment, this legislation was written to address hazardous substances and did not include oil-specific hazards. Although the Clean Water Act covered oil, the omission of oil from CERCLA left a hole in federal policy. This oversight was addressed four years later in the Oil Pollution Act, following the tragic events of the *Exxon Valdez* oil spill.

The Exxon Valdez Incident

On March 24, 1989, the tanker *Exxon Valdez* ran aground in Prince William Sound, creating the largest and most devastating oil spill in U. S. history. The *Exxon Valdez* incident is well known and has received tremendous media attention. The public interest aroused at the time of the spill continued for years afterwards, as communities and government agencies contemplated the impacts of the spill and the effectiveness of cleanup actions. The *Exxon Valdez* incident has reappeared in recent news reports commemorating the 20th anniversary of the catastrophic spill. According to NOAA (n.d.b), the events of the first days of the *Exxon Valdez* spill are as follows:

- On March 24, 1989, the tank vessel *Exxon Valdez*, which was traveling outside of normal shipping lanes to avoid ice, collided with and became grounded on Bligh Reef, a remote, biologically diverse region in Prince William Sound.
- The tanker was carrying 53 million gallons of Prudhoe Bay crude, and within six hours of grounding, nearly 11 million gallons of oil had been spilled into the surrounding water.
- It took 35 hours to completely encircle the vessel with containment boom.
- Once the vessel was surrounded, field-tested and experimental response techniques were employed to mitigate the spill. Responders applied dispersants and conducted *in-situ* burning during the earliest operational periods, when a storm moved into the region on March 26th, these techniques were no longer effective.
- Skimmers were used to recover oil from the water, and a combination of high-pressure flushing and sorbents were used to remove oil from the shoreline.

Throughout the spill response and cleanup actions, which continued for several years, federal and state on-scene coordinators, working in a unified command, faced numerous logistical challenges. Because the spill occurred in a remote area, it was necessary for response equipment and personnel to be flown to Anchorage, transferred to Valdez, and then transported to the spill site. Many of the affected areas were inaccessible by land, which required equipment and personnel to be transferred by vessel to isolated locations, and necessitated that used response materials be removed for disposal following the cleanup of these sites. Amid the challenge of assembling a large work force in a short period of time, it became apparent that many of the volunteers that arrived were inexperienced in spill cleanup and had never received any formal safety training (NOAA, n.d.b). In addition to having to manage the various response resources, the unified command also was expected to oversee aerial surveillance, trajectory

modeling, shoreline assessments, and natural-resource damage assessments to continually reassess the scope and extent of the spill.

Spill-response managers faced an unprecedented challenge during the *Exxon Valdez* response. Although the federal government had prepared a cadre of skilled and highly trained spill responders and scientists, their expertise was overwhelmed by several unexpected factors: 1) the large volume of oil that was spilled; 2) the broad geographic range to which the oil spread; 3) the severity of the spill on the biological community; 4) the variety of profession opinions; and 5) the multitude of logistical challenges (NOAA, 2006).

The calamitous response to the *Exxon Valdez* spill proved that the federal response agencies were unable to effectively handle a massive spill incident. Lessons learned from *Exxon Valdez* led Congress to pass a new law that ultimately shifted clear responsibility onto state government and local communities.

Oil Pollution Act

The following year, Congress passed the Oil Pollution Act (OPA) of 1990 in reaction to the insufficient response to the catastrophic *Exxon Valdez* oil spill. The OPA required that federal and state governments and industry be better prepared to respond to oil spills, and provided direction for these agencies to prevent spills, minimize their impacts, and improve the efficiency of cleanup operations (Iakovou, Ip, Douligeris, & Korde, 1996). A national contingency plan was prepared, and a national response team was formed, unifying federal agencies during preparedness planning and disaster response, and further involving state governments.

In response to the Oil Pollution Act, the USCG formed the Marine Environment Protection Program, and established a third National Strike Force Team – two already existed – to expand rapid-response capabilities and to maintain specialized response equipment nationwide (Iakovou et al., 1996). The new policy required the Coast Guard to upgrade and expand its spill-response capability, specifically for offshore incidents, and to supplement spill equipment provided by industry or the responsible party. In order to meet this directive, the

agency pre-positioned spill response equipment at unmanned sites that had limited commercial or private response resources. These equipment caches were intended to provide sufficient equipment for strike teams to rapidly respond to a 100,000-gallon spill within each strike team's geographical area, and to respond within six hours to major spills of up to 26 million gallons within 200 miles of shore, offering protection for the marine environment and minimizing damage and cleanup costs (Coe, 1995). The positioning of pollution-prevention resources at stations throughout the U. S. provided a band-aid during the initial response to a spill, and enabled the USCG to mitigate a worst-case spill scenario.

Before the Oil Pollution Act, the spill response community did not prepare contingency and response plans intended for mutual aid response actions. The OPA strengthened requirements for coordinated planning and preparedness by developing area committees and area contingency plans, and tested the prescribed response capabilities through mutual aid exercises (Sheldrake, n.d.). Additionally, the new legislation imposed strict planning and preparedness requirements on facilities and vessels that stored or transported large quantities of oil, including requiring minimum response equipment, emergency-response plans, and regular training drills. The result of OPA was a national preparedness plan that focused on managing contingency plans and response resources as a whole, inclusive of federal, state, and local governments, plus industry (Plourde & Foresman, 2003).

Ultimately, the OPA improved the overall readiness and capabilities of the national response system. And more significantly, and as this document will explain, the law shifted greater responsibility to state government, and ultimately to local communities.

II) Washington State Role in Oil Spill Response

Under the Oil Pollution Act, designated state agencies, as appointed by the state's governor, are responsible for managing spills of oil and hazardous substances within their borders (U.S. Department of Homeland Security & U.S. Coast Guard, 2006). In Washington State, the Department of Ecology (hereafter referred to as Ecology) is designated as a trustee of the state's natural resources, and is the agency responsible for oversight of hazardous waste cleanups, including spills of oil.

If a spill of significant magnitude or impact occurs, the federal government will support the response actions of the state government by providing technical assistance, field response, and financial support for response and cleanup expenses. More frequently, state response programs deal with small-volume spills that impact the waters of the state. It is in response to these frequent, small-volume spills that a community-based oil spill response equipment-caching program is most effective.

In response to the cumbersome and circuitous cleanup requirements identified under CERCLA, Washington State (hereafter referred to as Washington) passed the Model Toxics Control Act (MTCA). This state law (Washington Administrative Code 173-340-300) was a citizen-mandated toxic waste cleanup law that was passed in 1988 and went into effect in March 1989. (Washington State Department of Ecology [Ecology], 2005). MTCA differed from the federal legislation because it did not exclude petroleum, like CERCLA did, and it also developed a streamlined process with specific benchmarks for cleaning up oil and hazardous waste sites (D. Byers, personal communication, March 24, 2009). MTCA mandates a response to remove hazards associated with a petroleum product spilled onto the ground or to any waters of the state, including ground water, which was excluded in federal legislation, and marine waters within three nautical miles of shore (Ecology, 2005). As implemented by Ecology, MTCA provides straightforward cleanup standards for hazardous waste sites, to protect human health and the environment, while avoiding the complexity associated with the federal Superfund program.

In 1991, Washington adopted new oil pollution laws to complement the federal OPA regulations: Title 90.48, water pollution control, and Title 90.56, oil and hazardous substance spill prevention and response (Washington State Legislature, 2009). Title 90 legislation was initially written for water resource management and was later adapted for pollution control (D. Byers, personal communication, February 22, 2009). Chapter 56 of Title 90 authorizes Ecology to implement and maintain an effective oil spill prevention and response program, and the equipment-caching program supports this objective (Washington State Legislature, 2009).

The Department of Ecology's oil spill response equipment-caching grant was discussed and anticipated for several years before the program was funded by the state legislature. In order to meet their responsibility as natural resource trustee, the Department of Ecology worked with industry stakeholders, local response agencies, tribes, and interested individuals to determine the most effective means for developing and implementing a community-based response program. The program, which will be presented in Chapter V, was executed in 2006, and continues to provide resources to local first responders for use during spill incidents.

Title 90 led to the Department of Ecology's decision to include community-based responders into oil spill response, and laid the groundwork for Ecology's equipment-caching program, which is the subject of this paper. The following section deals with the methodology Ecology used to make decisions about how to design and implement this program.

III) Oil Spill Response Decision-Making

To ensure the health and safety of Washington's people and natural resources, Ecology's Spills Program designed an innovative, community-based oil spill response program. This program was organized around the three logical levels of emergency planning: strategic, tactical, and operational. The strategic level addresses where to pre-stage equipment and personnel that will be needed for a future spill response. At the tactical level, decisions are made about what equipment is needed to respond to a specific spill. The operational level deals with the response itself. As resources are scarce, this multi-level approach allows planners and responders to deal with oil spills efficiently and cost effectively. In establishing its community-based program, Ecology focused primarily on the strategic level. However, a brief discussion of the multi-level decision-making process will clarify elements of each of the three levels.

The published studies on this topic approach this system as a problem to be solved, as it invariably is, and most researchers have developed algorithmic formulas to tackle the challenges associated with emergency planning and response (Belardo, et al., 1984; Iakovou, et al., 1996; Psaraftis, et al., 1986; Psaraftis & Zioga, 1985; Toregas, Swain, ReVelle, & Bergman, 1970; Wilhelm & Srinivasa, 1997). This chapter will explain the three levels of the oil spill response decision-making matrix and review the relevant literature.

Algorithmic formulas used to solve decision-making problems tend to separate the *strategic*, *tactical* and *operational* levels, developing separate formulas for siting (strategic), dispatching (tactical) and responding (operational). This may have resulted from a governmental priority on maintaining tight accountability of publicly owned resources. While strategic algorithms focus solely on the locational problem – including type and quantity of equipment and the issue of optimally siting it – the tactical problem deals with allocating appropriate resources after a spill has occurred. And operational problems assess where equipment and personnel are needed once the response is underway. This separation fails to consider the integrated-management approach of staging and

dispatching equipment as a set, which enables an effective response to an oil spill when early intervention is critical in preventing environmental damage.

The Washington State Department of Ecology solved this problem by pre-staging equipment appropriate for an initial response inside of a mobile trailer that can be dispatched and deployed during the first hours of a spill. An example would be a response trailer pre-positioned near to a fueling dock at a marina. By combining the strategic concern for having containment booms and adsorbent materials readily available with the tactical consideration of when and how firefighters and other emergency responders will use this equipment, Ecology planners combined the strategic and tactical levels in a way that greatly accelerates the response.

The following overview is meant to familiarize the reader with the decision-making priorities of spill planners and on-scene coordinators. As stated above, emphasis will be placed on the strategic level of the decision-making process, because that is the core component of the Washington State equipment grant program.

Strategic Level

Overview

The strategic aspect of the oil spill problem focuses on preparedness and contingency planning for future spills. Decisions made during strategic planning address spills before they occur, typically five to ten years prior to a spill event, and are based on historic data, probabilistic information, and the potential consequences of the expected response (Iakovou et al., 1996; Psaraftis et al., 1986).

Preparedness is the central objective of strategic-level decisions for oil spill response, dealing primarily with pre-positioning of response resources, either as individual pieces of equipment or as equipment packages. It falls upon the strategic planner to determine the optimal location, type, and quantity of equipment to be stockpiled for future spills. Additional consideration must be given to the uncertain and potentially high costs of natural resource damage, as well as the variable costs of the actual cleanup (Psaraftis & Ziogas, 1985).

Considerations for strategic-level decision-making include: where to site equipment so that responders can easily access these resources; the relationship between chosen cache location and the risk of spills at these sites; the function and limitations of specific equipment based on the anticipated type of oil(s) that may be spilled; possible weather conditions and sea states under which the initial response and ongoing cleanup will occur; and availability of personnel to respond with the pre-positioned equipment. Given these concerns, strategic level decision-making can impose restrictions on the tactical and operational levels, specifically regarding where, what, and how many equipment caches are pre-positioned for timely response to oil spills.

The following case study of the Ecology's equipment-caching program is based on the strategic-level decision-making hierarchy. The process of preparing for spills into state waters has led Ecology's Spills Program to determine optimal locations for pre-positioning equipment with the ultimate goal of reducing the negative impacts and excessive costs associated with oil spills. An in-depth exploration of how Ecology addressed this strategic-level spill response problem and designed a community-based first responder oil spill response program will be explained in Chapter IV.

Literature review

Deciding where to pre-position adequate response equipment before a spill occurs is the fundamental priority of the strategic level. Psaraftis, Tharakan, and Ceder (1986) have developed a practical mathematical programming model to solve this problem, which addresses the issues of both location and allocation of response equipment. The authors determine the appropriate types and levels of cleanup equipment deemed capable of responding to potential spills, and prescribe storage locations based on likely spill sites. This mixed-integer formula incorporates historical data, such as frequency of past spills, with probabilistic information, including variables of spill volume and the expected level of response, to meet the overall goal of minimizing total costs. This model assumes that fixed costs, such as acquiring and maintaining equipment, are known, as well as the ability to predict the damage costs resulting from the spill (Psaraftis, et al.,

1986; Wilhelm & Srinivasa, 1997). In order to determine the versatility of their model, the authors apply the formula to New England to illustrate the model's potential.

In two other studies for the United States Coast Guard, Charnes, Cooper, Harrald, Karwan, and Wallace (1976) and Charnes, Cooper, Karwan, and Wallace (1979) developed multi-criteria models that would aid federal spill response planning, specifically with regard to resource allocation for offshore spills. The objective of the 1976 model is to predict the effectiveness of a future spill response and the ability to deal with that spill over time, which is dependent on the strategic management issue of resource siting, including such variables as spill probability, responder availability, and equipment effectiveness (Belardo et al., 1984; Charnes et al., 1976). Although the 1979 model also addresses the locational aspect of the strategic problem, this model was designed to evaluate the capacity of response resources on a smaller scale (Charnes et al., 1979). This was necessary because while the USCG, as federal on-scene coordinator, responds to significant or large oil spills, many spills are managed at the state level, demonstrating the need for effective state and local response resources.

Belardo, Harrald, Wallace, and Ward (1984) developed an approach to siting equipment prior to a spill that allows for the multiple objectives that the decision maker may need to consider. This partial covering approach is designed for a single major maritime spill, yet incorporates the probability that pre-staged equipment may be needed to cover multiple regions, therefore recognizing the resource-availability constraints that would occur during simultaneous spill incidents (Belardo et al., 1984; Psaraftis et al., 1986). This model has been successfully adapted and applied to the multi-objective strategic decision-making problem associated with determining the appropriate location and allocation of emergency medical response vehicles. (Daskin & Stern, 1981; Moore & ReVelle, 1982).

Thorough strategic-level planning for spill response is key to executing a successful initial response and managing resources for ongoing cleanup efforts. To determine the optimal siting location for spill response resources, researchers and decision makers combine spill data, such as historical records of spill volume

and frequency at specific locations, with knowledge of responder availability and equipment effectiveness. A comprehensive pre-spill strategic plan that includes pre-staging of response equipment helps to minimize environmental damages and costs that accompany an oil spill.

Tactical Level

Overview

The decisions made during strategic planning will come into play during the tactical level of spill response. Equipment that was pre-staged will be deployed during response actions, and available personnel identified in the strategic pre-spill plan will be dispatched to handle the spill incident. The following section will examine the considerations of spill response decision-making at the tactical level.

The tactical level of spill response deals with specific spill incidents after they have occurred. Tactical level decision-making involves a detailed plan about what types and quantities of resources, including equipment and personnel, are needed to respond to an existing spill. Other key decision triggers at this level include: when resources, including personnel, should be dispatched to the staging area at the spill scene; how specific equipment will be used during the cleanup of the spill; and how long each piece or set of equipment will remain on the scene (Psaraftis et al., 1986; Wilhelm & Srinivasa, 1997). The goal of the tactical level is to oversee an efficient, cost-effective cleanup with regard to the aggregate actions that must take place during a specific spill event.

Literature review

Psaraftis and Ziogas (1985) have developed an analytical algorithm for the tactical decision maker. Their methodology proposes the optimal dispatching of spill-response cleanup equipment and personnel to a specific spill after it has occurred. This algorithm was designed as a component of a larger computer program at the Massachusetts Institute of Technology, which enables the on-scene coordinator to input individual variables about the spill and then analyze the

resulting possible cleanup options to minimize response and damage costs (Psaraftis & Ziogas, 1985; Wilhelm & Srinivasa, 1997). This program can serve as a valuable tool for the tactical level decision-maker when a timely response to the spill is the top priority.

To allow for the most effective cleanup possible, Wilhelm and Srinivasa (1997) have calculated a Tactical Decision Problem with the objective of minimizing response time between when equipment is dispatched and when it arrives on scene. The Tactical Decision Problem addresses the issue of allocating available resources so that all of the equipment needs will be met for each critical operational period. This goal is achieved by dispatching individual pieces of response equipment to a staging area, where these components are built into a functional set and deployed as a response set.

The tactical level of spill response deals with getting the needed personnel and equipment that was identified during the strategic level to the spill site so that they may be used during the operational level of response. Effective tactical decision-making will ensure that the appropriate resources will be available to be incorporated into the spill response. Ecology identified the tools and personnel which are likely to be needed for spill response during strategic planning, and the decision to activate individual pre-staged caches will be made during the tactical level.

Operational Level

The actual response to an oil spill occurs during the operational level. Successfully responding to an incident depends on identifying and dispatching the right resources during the tactical level. Response operations will be more effective if the proper equipment was pre-staged during the strategic level, and of these resources, the appropriate response equipment and trained staff are readily available to conduct the response.

The operational level of the oil spill decision-making hierarchy addresses issues associated with the on-scene response phase of a spill incident. This level focuses on effective cleanup of a specific spill by incorporating the equipment and personnel identified during the tactical level (Wilhelm & Srinivasa, 1997). On-

scene operations are detailed action plans designed and agreed upon by the state or federal on-scene coordinator, or by both working in a unified command. These plans determine exact response objectives and actions, such as specific boom deployment configurations or the spatial allocation of response operations in relation to environmentally or culturally sensitive areas (Psaraftis & Ziogas, 1985). Because much of the equipment used during response operations is highly specialized and expensive, decision making at the operational level must be targeted to and appropriate for each individual spill incident.

There is a tremendous amount of literature and discussion on the appropriate methodology and techniques for on-water spill response (American Petroleum Institute, NOAA, USCG, & EPA, 2001; Fingas, 2000; Nordvick, 1995). Decisions made at this level focus on the optimal performance of the response resources given the actual conditions (Iakovou et al., 1996). Operational decision making is an important component of the spill response decision hierarchy, but is not a significant concern of the Washington State equipment grant program, and therefore beyond the scope of this paper.

IV) Washington State Case Study

Introduction

The Washington State Department of Ecology has designed a unique program to enhance statewide oil spill response capabilities by pre-staging equipment at vulnerable locations and by providing equipment for local citizen-based first response. Ecology's Oil Spill Equipment Caching Grant Program is unique because it enables local community members to preserve their sensitive resources during an oil spill, prior to the notification or response efforts by government, industry, or contractor personnel.

Ecology's Grant Program is an example of an original approach to rapid-response mobilization and deployment of equipment by community-based first responders. Rapid response better serves the end goal of minimizing environmental damage, more effectively protecting cultural and economic resources. In addition, this case study is an important contribution to the spill prevention and response field by providing a model of a successful equipment-caching program that can be used in other states and internationally to limit the potentially catastrophic environmental consequences of an oil spill.

This case study will provide specific details of Ecology's grant program, enabling other spill response agencies to design similar community-based programs. The Washington case study component of this paper is divided into the following sections:

1) Grant program background
2) Applicants and grant recipients
3) Equipment
4) Training
5) Equipment in action
6) Conclusions

Following the Washington State case study will be an examination of other state community-response programs. While Washington has pioneered use

of the mobile equipment cache, Alaska has long pre-staged equipment due to the remoteness and isolation of many communities. Since Washington implemented its equipment program, Ecology has provided this model to other state governments. Following Washington's example, Massachusetts has initiated a comparable program, and California recently hired a spill contractor to create a similar program. The similarities and differences of the state-level programs will be addressed in Chapter V.

Grant Program

Overview

Prior to the Oil Spill Equipment Caching Grant Program, few local governments and tribes in Washington had adequate equipment to protect their resources in the event that a spill occurred within their jurisdiction. Until this program was implemented, Ecology responders, private contractors, and industrial businesses were the primary users of spill response equipment in Washington State. During the time that elapses while equipment is transported to and deployed at a spill site, significant damage could occur to local environmental, cultural, and economic resources. This absence of equipment among local first responders was the key inspiration for Ecology's equipment-caching program.

Ecology was motivated to pursue this grant program for two reasons: increasing state-wide response equipment supported the objectives of Governor Christine Gregoire's Puget Sound Initiative, and the success of a pre-staged equipment deployment was demonstrated during a fire at the Gig Harbor Marina in 2005. The success at Gig Harbor, and subsequent equipment deployments, will be highlighted in the Equipment in Action section of this case study.

The primary objective of the Spill Equipment Caching Grant Program was to enhance the availability of oil spill response equipment around the state, and to enable local governments and tribes who are first responders to protect their communities and high-priority resources. The grant program was based on the knowledge that the response that occurs during the first hours of a spill is crucial to limiting environmental damage. The objective was achieved by providing

mobile equipment caches and familiarization training to community-based first responders. Having proper equipment and trained personnel to respond during a spill is critical to minimizing the spreading negative impacts from oil spills that are not cleaned up quickly.

Equipment provided through this grant program was pre-packaged in mobile trailers. Having portable caches enables local first responders and Ecology spill responders to rapidly mobilize and deploy equipment to contain a spill and protect local resources. Specific details regarding spill equipment will be provided in the Equipment section of this case study.

Familiarization training was also provided to grant recipients. Specific details regarding training will be provided in the Training section of this case study.

Funding

In 2006, Ecology approached the Washington State Legislature seeking $750,000 to fund a program to pre-stage oil spill response equipment throughout the state. Based on the need for this program, the Legislature and Governor Gregoire appropriated $1.45 million toward this effort. The funding source for this grant program was the Local Toxics Control Account. Ecology directed 100% of the funding to grant recipients.

Funding for awards was loosely distributed on a first-come, first-serve basis. However, efforts were made to ensure that funding was strategically allocated throughout the state. Regional multi-agency planning meetings were held to identify potential applicants, which enabled Ecology to anticipate requests for, and estimate disbursement of, funding throughout the state. Ultimately, 65% of funds were distributed to coastal and Puget Sound western Washington recipients and 35% of funds were distributed to central and eastern Washington recipients.

*Timeline*s

Prior to the July 1, 2006 start date of the grant program, Ecology issued a request for supply and training contractors. A formal bid process was conducted for one month, with appropriate time given for question-and-answer dialogs, bid

submissions, and contract negotiation. Specific details regarding selection of the equipment contractor will be provided in the following sub-section of this paper.

Funds for this grant program were available for one year, starting on July 1, 2006. All project equipment and training approved by Ecology was due by June 30, 2007. Applications for the equipment-caching grant were accepted, reviewed, and awarded during this twelve-month period.

An additional timetable was established from July 1, 2007 to September 30, 2007. This period was used to analyze the impacts of this project, to provide follow-up communications with the contractor and the grant recipients, to develop an internal tracking system and training materials, as well as to conduct final performance evaluations for each grant.

Equipment contractor selection

As required by state policy, Ecology issued a request to spill response contractors for qualifications and quotations in order to find a qualified contractor to deliver the equipment and provide training in its use.

Bid proposals were received by three licensed contractors with a minimum of five years of demonstrated experience in marine spill response and training in Washington State.

Bids proposals were evaluated independently by a panel of six response experts for the design and training criteria outlined in the bid request. Cost was evaluated using assumed equipment-purchasing estimates (50 trailers, 28,000 feet of general purpose containment boom, 6,000 feet of swift water river boom, 40 deliveries, etc.). The costs from all three vendors were within approximately 4% of each other.

The equipment caching grant contract was awarded to Global Diving & Salvage, Incorporated (hereafter referred to as Global), of Seattle, Washington.

Applications and Grant Recipients

Recruitment and application

Applicants were recruited through Internet postings and by word-of-mouth. Ecology personnel approached potential, eligible applicants, explained

the logistics of the program, and encouraged these agencies to apply for the grant and to share the opportunity with their colleagues.

Applications for the equipment-caching grant were accepted for 12 months, and were reviewed several times between July 1, 2006 and June 30, 2007. Applications submitted after the funds had been encumbered, or after June 30, 2007, have been retained in the event that additional funding becomes available.

The grant application was a single-page form available for hard-copy or electronic submission. Applicants were asked to provide basic agency contact information and to request a generalized type of equipment cache(s). Types of caches were pre-determined by Ecology based on anticipated usage and deployment locations, and included: a trailer with general purpose boom, a trailer with river boom, a boom vane, or other. Applicants were also asked to respond to questions regarding equipment storage and deployment. Specifically, applicants identified where the equipment would be stored, what resources or assets would be protected, who would deploy the equipment, and what support equipment, such as boats, would be used for deployment.

Applicants were permitted to request funding for multiple caches.

Appendix A is the application form that recipients submitted to apply for the oil spill response equipment grant.

Eligibility and selection criteria

In order to qualify to receive state grant funds, applicants had to represent a public agency or tribe. Eligible non-tribal applicants included city and county governments, such as public utility districts, port districts, and emergency management, fire and police departments. Private businesses, as well as state and federal governments, were not eligible to receive grant funds, associated equipment or training. However, ineligible agencies were invited to train with the grant recipients, and Ecology encouraged the development and enhancement of mutual-aid response relationships.

Grants were awarded based on five major criteria:

1) Applicants must have a substantial threat of an oil spill occurring within their jurisdiction. The threat may be a spill to water or to land, which includes spills from highway and rail shipping traffic.
2) Applicants must have sensitive environmental, cultural, and economic resources within or adjacent to their jurisdiction. These resources must be vulnerable during a spill event and be of significant value to the applicant's community.
3) Recipients of response equipment must be able and willing to deploy the spill response equipment in the event of a spill. Additionally, recipients must be willing to permit Ecology access to the equipment when not in use by the recipient.
4) Regional partnerships that will enhance the value of the equipment. Grant applicants were encouraged to identify inter- or multi-agency mutual aid relationships that would be formulated or strengthened as a result of receiving spill response equipment.
5) Proximity of existing nearby response equipment. Awards were granted based on the geographic distance and accessibility of nearby equipment that would be available for response by applicants, as well as by Ecology responders and contractors.

Awards

Ecology received 138 eligible applications for the Spill Caching Grant Program.

Grant funds were awarded to 60 agencies. Of these recipients, 47 agencies received a single equipment cache and 13 agencies received two or more equipment caches. Ninety-nine equipment caches were pre-staged throughout the state using designated grant funds.

Appendix B is a map of oil spill response equipment cache locations, grouped by geographic location, in Washington State.

Grant agreements

Recipients of grant funding entered into a binding agreement with Ecology. The purpose of the grant agreement was to provide funding to hire a contractor (Global) to supply the recipient with an Ecology-specified equipment cache of spill response equipment and to provide targeted familiarization training.

The following is a simplified list of terms identified in the grant agreement:

1) The recipient is the legal owner of the equipment.
2) The recipient must not re-sell the equipment. If the recipient withdraws from the program, the equipment must be returned to Ecology.
3) The agreement does not require the recipient to use the equipment during a spill event.
4) If the equipment is not in use by the recipient, the recipient must allow Ecology, including agents and contractors, access to the equipment. Equipment will be returned in the same (or an improved) condition as when it was borrowed.
5) The recipient is responsible for licensing, care, maintenance, repair and non-response related replacement of the equipment.
6) Equipment that is used during a reported spill event will be cleaned or replaced by Ecology at the expense of the responsible party.
7) The recipient must disclose the location of the equipment, and update Ecology if the equipment is moved.
8) Ecology will select appropriate equipment for individual locations and order the equipment from Global on behalf of the recipient.
9) The recipient will maintain appropriate records and documentation.

Processing funds for the grant program involved collaboration between Ecology, Global, and the recipient. The payment process went like this: Global provided equipment and/or training to the recipient, accompanied by an invoice. Upon delivery, the recipient submitted a state invoice voucher (form A19-1A) to Ecology to request funding to pay Global. Ecology released funds to the recipient, who then used the funds to pay Global. In several cases, the recipient

paid Global prior to receiving funding from Ecology, but this was not standard procedure.

According to the contractual agreement between Ecology and Global, the recipient was required to pay for equipment and/or training received within 30 days. Due to the processing time of each agency, most payments were not received by Global within 30 days. Realistically, most grants agreements were fully executed within 60 days of equipment and/or training delivery.

Equipment

Overview

A key intention of the grant program was to provide standard equipment caches and training to all recipients, enabling first responders to respond to a spill with their equipment or to provide skilled manpower to a neighboring jurisdiction. The equipment provided through this grant was intended for use during the initial response to a spill event, therefore spill cleanup equipment used in a later stage, such as skimmers, was not included. Caches were designed based on the containment boom that would used at each location, either standard boom or swift-water boom. In addition, a boom vane, which is a relatively new, sophisticated piece of response equipment, was available for select locations.

During the initial phases of the grant, the majority of equipment was pre-staged at waterfront locations along the Puget Sound, where the standard or general-purpose cache would be most effective during a spill. When Ecology began to award grants to recipients along the Columbia River, it became necessary to tailor each cache based on the varying river conditions present at each pre-staging location. Specialized caches were also designed for recipients throughout Central and Eastern Washington.

Appendix C provides details regarding the distribution of oil spill response equipment by Ecology region.

Standard caches

The standard cache of equipment was designed to be stored within an 18-foot mobile trailer. The equipment in the trailer consisted of 800 feet of eight-inch by twelve-inch general-purpose or swift-water river containment boom, a 30-pound anchor system, navigation lights, buoys, adsorbent materials (pads, sweep, and boom), responder personal protective equipment (PPE), and a decontamination station. Trailers were equipped with a toolbox for boom maintenance, a spare tire, fire extinguishers, and a first-aid kit, as well as a manual containing spill documentation and safety forms, Material Safety Data Sheets, job hazard analysis guides, and Ecology-designed Geographic Response Plans (GRPs).

Standard caches were delivered mostly to Western Washington recipients. Ecology pre-staged 43 standard caches in the department's Northwest and Southwest regions, including two caches containing an additional 400 feet of boom. Also, Ecology delivered to riverfront recipients three standard caches with six-inch by six-inch river boom, in place of the eight-inch by twelve-inch swift-water river boom.

Figure 1. An 18' mobile trailer stocked with oil spill response equipment.

Figure 2. (Left) Anchor systems and navigation stobe lights.

Figure 3. (Right) Sorbent materials and additional supplies for spill responders.

Figure 4. Restocking comtainment boom into the rear section of a mobile trailer during the Douglas County Public Utility District familiarization training.

Specialized caches

Several changes were made to the standard cache of equipment based on the anticipated deployment and pre-positioning sites.

Containment boom was the most specialized piece of equipment. If eight-inch by twelve-inch general purpose or river boom was not practical for a location, because of varying water conditions such as tide, river current, etc., a recipient received either six-inch by six-inch swift water river boom (as described earlier), six-inch by twelve-inch inland boom, or four-inch by six-inch marina boom. Overall, agencies received between 200 feet and 1,200 feet of boom.

The 30-pound anchor system designed for the Puget Sound was not realistic for deployments along the Columbia River and inland river systems. In these cases, the 30-pound anchors were replaced with 50-pound anchors. When this change was made, the floating navigation lights that were used with standard caches were exchanged for lights that clipped directly to the boom.

Finally, it was recognized that 18-foot trailers would be impractical at certain inland locations. Ecology swapped out the larger trailer for a ten-foot trailer. On average, the ten-foot trailers contained 400 feet of boom and all of the remaining equipment of the standard cache. Incorporating the smaller, less expensive trailers into the grant program also allowed Ecology to supply equipment to a greater number of local governments and tribes.

Specialized caches without trailers

Several caches of equipment were pre-positioned around the state without the storage trailer. The decision to award a recipient a cache without a storage trailer was based upon the following: the initial equipment request by the applicant; available equipment currently owned by the recipient; the recipient's storage capabilities; location of nearby equipment delivered through this grant program; and the ability of the recipient to meet the overall eligibility criteria.

These specialized caches were generally awarded to recipients with limited storage space, or to supplement their existing spill response resources. Equipment included in these caches varied by recipient, but ranged from several bags of sorbent materials to full-size standard caches minus the trailer. The typical small

cache included sorbent materials, duct tape, heavy-duty bags, and PPE.

Ecology delivered 32 specialized caches without trailers to nine recipients throughout the state. Of these nine agencies, only four received a single cache, while the remaining recipients received multiple caches for storage at several different locations.

Boom vanes

A boom vane is a revolutionary swift-water spill response device that enables responders to contain, recover or deflect a spill with or without a vessel and without an anchor system. The boom vane relies on river currents or vessel movement for power, and is most effective in currents ranging from one half knot to five knots. Boom vanes are manufactured in three sizes: one half meter for shallow water deployments, one meter for standard and/or river deployments, and two meters for open water ocean deployments.

Responders can deploy the boom vane either from the shore or from an on-water vessel. For a shoreline deployment: a mooring line attached to the boom vane is securely anchored on land, then the containment boom is attached to the boom vane, and finally, the boom vane is placed into the water where it will be propelled by currents into operational mode. Offshore deployments are similar, except that the vessel serves to anchor the equipment and propels the boom vane through the water.

Ecology pre-staged boom vanes at four locations in Washington: Wenatchee, Bingen, Burbank, and Asotin. Recipients of the boom vanes included career and volunteer fire departments, as well as members of hazardous materials response teams. The agencies that received the boom vanes also received a standard equipment cache plus additional boom vane accessories, including life jackets, a pike pole, and throw bags.

Figure 5. One-meter boom vane assembled for a deployment training exercise.

Figure 6. Boom vane deployment in the Columbia River.

Washington State Department of Ecology equipment

To supplement the department's existing response equipment, Ecology purchased equipment from Global through this contract, using unrelated funds. This equipment increases the quantity of response resources available for use around the state.

Ecology acquired a standard cache with general-purpose boom, plus an additional 400 feet of river boom. Also, two boom vanes, with accompanying

accessories, were obtained: a half-meter boom vane and a one-meter boom vane. The 18-foot trailer is stored near Ecology's headquarters in Olympia, and the river boom and both boom vanes are being stored in a pre-existing trailer at the Vancouver field office.

Additionally, a small cache of equipment containing 200-feet of general-purpose containment boom and an anchor system were provided for Horsethief Lake State Park along the Columbia River.

Training

Familiarization training was offered to local government and tribal agencies that received an equipment trailer. Recipients were asked to host their own training event so that field exercises could be conducted at their respective deployment sites, and so mutual-aid response partners could be included in the training.

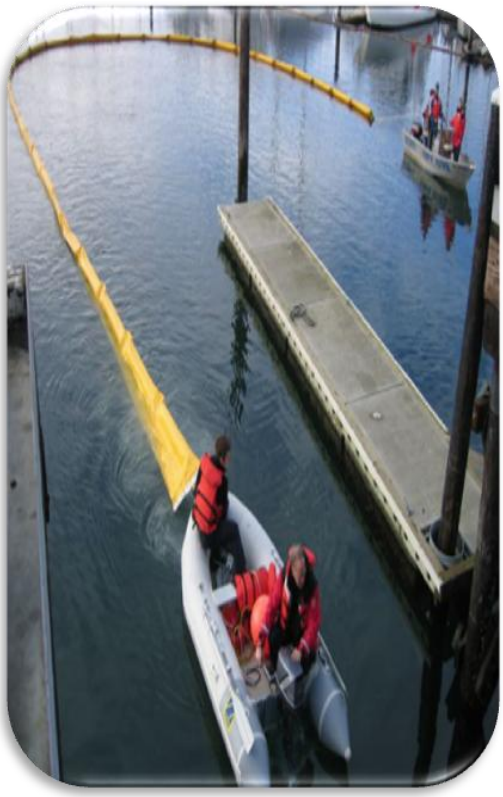
The familiarization training was prepared and facilitated by Global. The training was eight hours in length, divided into two portions: a classroom lecture and a field exercise.

Material presented during the classroom session included: types and characteristics of oil, on-scene operations, booming strategies, shoreline clean-up techniques, responder personal protection, decontamination methods, legal issues of spills, case studies, and Ecology's GRPs. Global, Ecology, and the recipients also used this time as an open forum to discuss logistics of the equipment-caching program.

The field session included a walk-through of the trailer to provide the recipients with a familiarization of trailer contents and to discuss the use, limitations, and maintenance of the equipment. The primary focus of the field exercise was hands-on training. Recipients practiced deploying boom for various strategies from the shoreline and on-water with vessels, as well as setting and retrieving anchors. Those agencies that received boom vanes practiced assembling and disassembling the equipment, as well as deploying and controlling the vane with and without attached booms.

Sixty-one training sessions were held throughout Washington State, providing

training for approximately 1,000 individuals. Agencies were encouraged to host refresher training events and to establish train-the-trainer programs so that all responders become comfortable with, and knowledgeable about, the equipment before a spill event occurs.



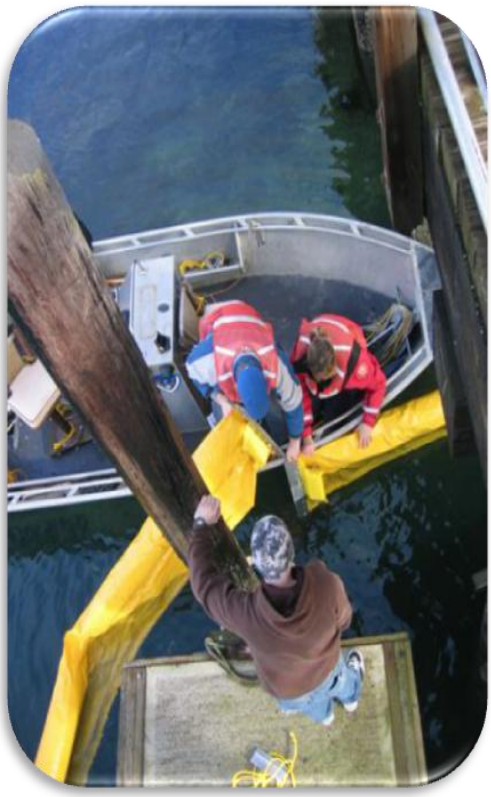


Figure 7. (Left) Practicing a U-shaped boom deployment during the equipment familiarization training at Pt. Roberts Marina.

Figure 8. (Right) Connecting the end plates of two lengths of hard boom during equipment familiarization training at Pt. Roberts Marina.

Program Maintenance

All equipment caches and trainings were delivered by June 2007. Since that time, Ecology has supported grant recipients in several ways, including: inviting community-based responders to participate in regional training exercises; providing technical assistance during response operations; arranging for cleaning and resupply of response equipment after it has been used; creating how-to

instructional materials for spill reporting and equipment deployment; and maintaining a current database that lists equipment locations and 24-7 contact numbers for use by spill responders statewide. Ecology continues to work closely with grant recipients to ensure that each agency is willing and able to safely and effectively conduct first response actions during a spill.

According to design, Ecology's grant program was implemented at the local level and requires minimal oversight by the state government. As stated previously, Ecology has no funding to provide refresher training or to support ongoing maintenance of the spill response equipment. Unlike other states' programs, which will be described in Chapter V, there is no dedicated funding source, such as a barrel tax, to support this program. As a result, the hope for future funding depends largely on the ability of Ecology's Spills Program to document and highlight the successes and benefits of the caching program. At the close of the 2009 legislative session, no monies were allocated to maintain or expand the equipment-caching program. For now, Ecology will continue to support the response actions of community responders and will address the funding issue during subsequent legislative sessions.

Equipment in Action

Ecology's community-based spill response program has proven to be successful. Once the program was fully executed, response caches have been staged at 99 key locations around Washington State, including 60 locations in Puget Sound. The equipment has been used for a variety of spill incidents, from small spills that required deploying sorbents to clean up a few gallons of oil, to mounting large-scale responses that required staging several trailers at the spill scene and deploying hundreds of feet of containment boom. As of April 2009, response equipment pre-positioned through the grant has been staged or deployed more than 40 times in Washington State.

The following section will describe some of the successful activation and deployment responses accomplished by community-based spill responders.

City of Gig Harbor

In July 2005, the Gig Harbor Fire Department purchased some inexpensive oil spill response equipment. At this time, Ecology provided funding to the fire department to purchase a mobile trailer to store its new containment boom and adsorbent materials.

Purchasing the equipment and the trailer was a simple preparedness measure. In doing so, the Gig Harbor Fire Department was a step ahead of most public agencies when it came to spill readiness. Though it was not realized at the time, this decision would impact the future of community-based spill response throughout Washington.

Three weeks later, in August 2005, the Gig Harbor Fire Department responded to a massive fire at the Gig Harbor Marina. As the fire rapidly spread among the boats docked there, firefighters quickly deployed the newly purchased containment boom and adsorbent materials to prevent fuel and oil from entering the surrounding water. Having accessible equipment enabled firefighters to contain the fuel and oil, averting a significant environmental disaster.

Ultimately, the marina fire destroyed 50 boats containing thousands of gallons of oil and fuel. Ecology estimated that use of the equipment cache prevented more than $1 million dollars in damage to marine and shore life. This successful response by the Gig Harbor Fire Department provided the inspiration for Ecology's Equipment Caching Grant Program.

The Gig Harbor Fire Department has since used its Ecology-granted spill response equipment. On February 5, 2007, firefighters responded to a fire aboard a 46-foot pleasure craft at the Peninsula Yatch Basin. The vessel had approximately 200 gallons of diesel fuel on board, which was visible in the water when firefighters arrived on the scene. Due to the immediate accessibility of the equipment, coupled with the training and prior experience of the responders, the firefighters were able to initiate a timely deployment of the spill response equipment. Firefighters circled the marina with containment boom and lined the inside of the hard boom with adsorbent materials to soak up the spilled diesel fuel. The early actions taken by the first responders averted an environmental catastrophe.

Figure 9. Containment boom surrounds a burning vessel during the Gig Harbor Marina fire, 2005.

Figure 10. Contractors recover oil and debris that was contained within hard boom that was deployed by firefighters during the Gig Harbor Marina Fire, 2005.

San Juan County

San Juan County represents a unique component of Ecology's Equipment Caching Grant Program. Despite being the smallest of Washington's 39 counties, San Juan County received five standard equipment caches, which are located on three of the largest islands: San Juan, Orcas, and Lopez. This arrangement was possible due to the unique relationship between the local governments and the

devoted volunteers at Islands' Oil Spill Association.

Islands' Oil Spill Association (IOSA) has been responding to spills throughout San Juan County and Washington State since 1988. IOSA is a community-based organization that provides initial assessment, spill containment, and clean-up services of shorelines and wildlife. Ecology has worked closely with IOSA on past spill events, and the knowledge and commitment of the group made the association an ideal partner for the grant program. Since IOSA is a private organization, and was therefore ineligible to receive equipment based on grant criteria, local governments were encouraged to apply for the grant in partnership with IOSA.

The five equipment packages that are pre-staged in San Juan County were awarded to three local government agencies, one to the Port of Lopez, one to the Port of Friday Harbor, and three to the San Juan County Department of Emergency Management (DEM). While the Ports and DEM are the owners of the equipment, IOSA volunteers participated in the familiarization trainings and have established agreements with the agencies to access and use the equipment during an oil spill. The enhanced relationship between the state and local governments and the citizens of San Juan County truly reflects one positive accomplishment of the equipment grant.

The equipment in San Juan County has already been successfully used on several occasions. In addition to the following examples, IOSA and its San Juan County partners have responded to multiple spill events where the sorbent materials and PPE contained within the equipment trailers have been used by the responders.

In November 2006, at the request of the USCG, IOSA mobilized to deploy 2,800 feet of boom for two GRP strategies in response to a tugboat carrying 1,200 gallons of diesel fuel that was sinking in Prevost Harbor near Stuart Island. The vessel was towed to Roche Harbor, where IOSA, at Ecology's request, surrounded the vessel with boom until it was determined that the vessel would not sink.

In December 2006, the F/V Stanley sank in Fisherman's Bay near Lopez Island due to high winds. IOSA responded by deploying boom awarded through

the equipment grant onto the water surrounding the vessel, and plugged the source of the diesel leak. IOSA volunteers continued to monitor the site, and in January 2007, along with the San Juan County Public Works and the Washington Department of Natural Resources, the F/V Stanley was successfully raised and towed to Bellingham, at which point the containment boom was cleaned and repackaged in the trailer for a future spill.

These two examples highlight the achievements of Ecology's grant program within San Juan County.

Figure 11. Island Oil Spill Association members with their new equipment trailer.

Figure 12. IOSA members demonstrate techniques for using hard boom during a training exercise at Deer Harbor, Orcas Island.

Figure 13. IOSA members practice deploying containment boom around a boat during a training exercise.

Conclusions

The Washington State Department of Ecology Spill Response Section has designed a unique and valuable program with the Oil Spill Caching Grant Program. By providing oil spill response equipment and training to first responders throughout the state, the opportunity to protect sensitive environmental, cultural, and economic resources is greatly increased.

This grant program can serve as a model for other agencies attempting to enhance their own spill-response programs. Based on the continuing successes of this grant, Ecology hopes to receive additional funding to expand response resources in Washington, and to continue to provide ongoing training to grant recipients.

Figure 14. Firefighters begin to deploy containment boom on Moses Lake to circle a sunken vessel that was releasing oil into the lake.

Figure 15. The author, representing the Washington State Department of Ecology, at the 2008 International Oil Spill Conference, in Savannah, Georgia.

V) State Government Programs Beyond Washington

While the Washington State Department of Ecology developed an innovative equipment-caching program to provide community responders with a first line of defense against oil spills, Washington did not invent the concept of community-based response. Even before Ecology had established Washington's equipment-caching program, a similar program was already being utilized in the State of Alaska, where a citizen-based oil spill response program is necessary due to the vast size of the state and the remoteness of communities (Alaska Department of Environmental Conservation [ADEC], 2009; Collazi, 1999). If a spill occurs during a period of bad weather, it could take days to fly responders and resources to a very remote location. In the time it takes to mount a response, the spill incident may be over, or may have devastated an isolated village. This weakness became apparent after the *Exxon Valdez* spill, and led Alaska to increase the involvement of local citizens in initial responses to spills. Alaska's citizen-based program subsequently influenced the design of Washington's program, as will be discussed below in a review of similarities and differences between the two states' programs.

State of Alaska

Alaska is well known for the catastrophic grounding and subsequent oil spill from the supertanker *Exxon Valdez* that polluted Prince William Sound on March 24, 1989. For residents living with the environmental degradation from that massive spill, *Exxon Valdez* changed the way Alaskan communities rallied together to manage environmental emergencies. During the spill response, citizens had provided state and industry response teams with critical knowledge of local conditions, such as sea states, tidal fluctuations, weather, and geography (Nuka Research and Planning Group [Nuka], 2005). By successfully incorporating this community-level knowledge into the spill response, and by recognizing the obvious lack of spill response equipment available for first responder use, there emerged in Alaska a growing recognition of the need for

state-funded programs and response equipment that would be positioned throughout the state for rapid deployment.

In January 1990, the Alaska Oil Spill Commission issued a report acknowledging the influential role of the community-based work force following the *Exxon Valdez* oil spill. This report called for communities to be included in spill response, and recognized the importance of incorporating local knowledge and expertise (Collazi, 1999). The report, the *Wreck of the Exxon Valdez*, states: "A substantive role should be given to the affected communities in any response system . . . local interests, local knowledge and experience . . . often made the community-based work force the most efficient available," (ADEC, 2009). This report led to implementation of a Community Spill Response Program as a core element of Alaska's Department of Environmental Conservation Prevention and Emergency Response Program.

Growth of Alaska's community spill response program

Alaska's community-based spill response program builds on the awareness that local residents are usually the first line of defense to deal with the immediate impacts of an oil spill along the state's extensive coasts and vast interior crossed by remote pipelines. By establishing the Community Spill Response Program (CSRP), Alaskan officials provide local responders with equipment and training needed to effectively protect human health and the environment during a spill event. Goals of the CSRP include: 1) making local response an integrated part of the state response network; 2) using local experience and resources to the greatest possible extent; and 3) sustaining initial spill-response capability and readiness at the local level (ADEC, 2009).

In Alaska, the Department of Environmental Conservation (ADEC) is trustee of the state's natural resources. The Department of Environmental Conservation works to fulfill its responsibility by partnering with local residents through community-response programs. This relationship enables the state government and the citizens to be better prepared for spills, and to coordinate response efforts when incidents do occur.

Community response in Alaska originated in 1986, when Alaska passed House Bill 470, the Oil and Hazardous Substance Release Response Fund, commonly known as the Response Fund, or the 470 fund (City of Homer, 1997; Majors, 2001). At that time, money deposited into the 470 fund came primarily from two sources: the responsible party, either collected through civil penalties for discharging oil or by recovering response and cleanup expenses; or from the federal government, which provided reimbursement to ADEC to recover costs accrued during state-funded response actions (ADEC, 2007). This bill provided a funding mechanism for ADEC to pay the expenses incurred during a community-based oil spill response.

In 1989 – after *Exxon Valdez* – the Alaska Legislature passed several bills that increased the funding sources and uses of the Response Fund. Senate Bill 260 established a nickel-per-barrel surcharge, and deposited the tax into the Response Fund; the barrel tax effectively raised the balance of the 470 fund from $1 million to $50 million to subsidize response to oil spills, (ADEC, 2007). Senate Bill 264 established the Depot/Corps Program and assigned the ADEC director the responsibility of equipping and staffing the emergency response depots, by means of Response Fund revenues, at locations with a threat of a significant oil spill (Nuka, 2005). By establishing the Depots/Corps system, Alaska pioneered community-based spill response.

Senate Bill 215, passed in 1994, significantly altered funding for spill response activities. SB 215, which renamed the Response Fund as the Oil and Hazardous Substance Release Prevention and Response Fund, impacted the use of the five-cent per barrel tax in two ways: 1) the balance and future revenues were split between two accounts, with three-cents being deposited into a response account and two-cents going into a prevention account; and 2) the division of the Response Fund effectively reduced monies available for response and cleanup actions by 40 percent (ADEC, 2007). The Depot/Corps Program remains an integral part of Alaska's spill-response community, but financial support for the program is less certain due to the reduction of operational funds designated for community-based spill response.

Response equipment available through the Alaskan CSRP is tailored to meet the needs of each individual community. Equipment is stored in a stationary Conex container and the contents are generally uniform throughout the state, although the quantity of sorbents or type of boom will be adjusted to accommodate the conditions where the equipment will be deployed (ADEC, 2009). A typical cache contains these basic components: 1,000 feet of 20" containment boom plus additional harbor boom, seven over-pack drums, an anchor system, sorbets, and personal protective equipment. (S. Tiernan, personal communication, February 18, 2009). This basic equipment package provides sufficient resources for trained citizens to conduct an initial spill response, and additional equipment, such as skimmers, which are modified by site, enabling local communities to conduct a thorough spill cleanup.

In order to participate in the Community Spill Response Program, Alaskan communities or municipalities must sign a contract with ADEC known as a Community Spill Response Agreement (CSRA). Agreements negotiated with each community are tailored to need local needs, and to maximize the response resources at ADEC's disposal. The three key aspects of the CSRA are: activation, reimbursement of costs incurred during a response, and identification of local resources, such as available manpower, equipment, and other support components (ADEC, 2009).

In Alaska, community-based spill response is a cornerstone of the state's spill response program. The CSRP is a unique community-based program that fulfills the needs of remote and isolated communities to mitigate the devastating effects of oil spills. The successful merger of local knowledge and manpower with state government supplied resources has improved preparedness and response capabilities statewide. As of December 2008, 48 communities had signed response agreements with the state government (Appendix C). These agreements protect the people and natural resources of Alaska. In conclusion, the Alaska Department of Environmental Conservation has created an impressive program to put response equipment into the hands of the community.

Alaska and Washington: Similarities and differences

The concepts behind Alaska's Community Spill Response Program were used by Washington State during the development of Ecology's spill response equipment grant. Ultimately, Washington and Alaska share the same goal: zero oil spills. Additionally, both states recognize the benefit of providing resources to the people immediately impacted by an oil spill by giving them the equipment and training needed to protect sensitive resources.

The primary difference between Alaska's and Washington's grant agreements is the reimbursement component. When Alaskan CSRA resources are activated, the actual expenses that the responding community incurs are reimbursed by ADEC (ADEC, 2009). These funds are used to resupply and maintain the equipment caches, and to provide training for the responders. In contrast, The Department of Ecology has no funding source to compensate local responders for their time or additional equipment that they use during their response actions. In Washington, response equipment is replaced when it is used, but Ecology recovers any costs to pay for cleaning and resupply of the equipment from the party responsible for the spill. The recipients of Washington's equipment cache maintain the equipment as part of their vehicle fleet, and they received initial familiarization training, but there is no funding source to pay for ongoing maintenance or training.

Ongoing funding for community-based response programs is a critical issue for both states. The reduction of funds appropriated to sustain the Depot/Corps Program jeopardizes the long-term operations of community-based spill response in Alaska. In Washington, there is no dedicated long-term funding to support the maintenance of the program. The Washington State Department of Ecology's grant program was made possible by a one-time grant appropriated by the 2006 Washington State Legislature. Washington bears the cost of replacing equipment used during a spill response, restocking trailers but leaving maintenance and upkeep as the responsibility of the local grant recipient.

Alaska's Community Spill Response Program is considered an extension or overlap of its Depots/Corps Program. Based on the same concepts of pre-staging spill response equipment and training responders how to use it, the primary

difference is that Alaska's CSRP equipment is available mainly to remote and isolated communities, and not necessarily to those with the greatest spill potential identified through the Depots/Corps program. Washington Ecology's grant program combined these criteria and considered both location and risk of spill when determining where to pre-stage response equipment.

Another important difference between spill response in Alaska and Lower 48 coastal states like Washington is that Alaska hires very few contractors for initial response and cleanup actions. In Washington, a response contractor is usually hired to control the source of the spill and clean up the spilled product. In general, Alaska does not rely on contractors for cleanup, but rather depends on the CSRP as a mechanism for ADEC to extend spill response preparedness and response capability statewide (S. Teirnan, personal communication, February 18, 2009).

Ultimately, community-based spill response has been successful in Alaska and Washington. By sharing the framework for how to develop and implement an effective first responder oil spill response program, both states have advanced their level of readiness and continue to improve their ability to aggressively respond to oil spills.

Massachusetts State

Another coastal state that has come to recognize the benefits of community-based oil spill response is Massachusetts. Like Alaska, Massachusetts has suffered destructive spills along its coast, which highlighted the need for local citizen response to spills. Lessons learned from these spills, and from federal assistance in cleaning them up, offered valuable insights into the advantages of community-based response. But the Commonwealth of Massachusetts did not at first establish a full-scale community-based response to oil spills, and subsequently modeled its program on that of Washington State.

Massachusetts, like Washington, is a coastal state with valuable natural resources that are constantly at risk of damage from an oil spill. Approximately 2,000 oil tankers and barges carry more than three billion gallons of oil past Cape Cod annually, and nearly two billion gallons of petroleum products are

transported through Buzzards Bay each year. (BBNEP, n.d.). The coastal communities of Massachusetts have experienced several devastating oil spills that have led the state government to incorporate local responders into initial spill response activities. In 1969, the tank barge *Florida* ran around in Buzzards Bay, spilling approximately 189,000 gallons of #2 fuel oil, the second largest spill in the state's history (Massachusetts Department of Environmental Protection [MassDEP], 2007). Seven years later – in 1976 – the catastrophic *Argo Merchant* spill of 7.7 million gallons occurred in Nantucket Sound (NOAA, n.d.a). For several years after the infamous *Argo Merchant* incident, many small-volume spills occurred in Massachusetts waters (BBNEP, n.d). Then in 2003, the tanker barge *Bouchard No. 120* struck rocks in Buzzards Bay, spilling 98,000 gallons of #6 fuel oil. This spill significantly impacted the way that local communities and state government respond to oil spills. The next section will describe the roles of citizen responders around Buzzards Bay before and during the *Bouchard No. 120* oil spill, followed by an explanation of the relevant state oil spill laws that were developed in response to the *Bouchard No. 120* incident.

Buzzards Bay and the Bouchard No. 120 oil spill

Buzzards Bay is an environmentally sensitive body of water in southeastern Massachusetts. Buzzards Bay connects to Cape Cod Bay via the Cape Cod Canal, and is bordered by the Elizabeth Islands and the Rhode Island Sound. There are many communities located along the bay, and residents depend on shellfish and commercial fishing harvests to support the local economy. Past oil spills have motivated local citizens and government to get involved to protect their vulnerable marine environment.

In 1981, five years after the *Argo Merchant* spill, local authorities, with support from state and federal agencies, developed a regional oil spill contingency plan to protect Buzzards Bay from future spills. This plan compiled local information on shoreline access points, oil transfer locations, processing and storage facilities, environmental sensitivity maps, available response equipment and services, and current contingency plans (BBNEP, n.d). In 1985, the Massachusetts Department of Coastal Zone Management established the Buzzards

Bay Project to provide support for local towns to develop management plans that would protect water quality and living resources (Massachusetts Office of Coastal Zone Management, 2007). Two years later, in 1987, the Buzzards Bay Project joined the EPA's newly created National Estuary Program, further integrating public involvement in the role of preserving Massachusetts's environment (EPA, 2009d).

Between 1990 and 2000, the Buzzards Bay Project received federal funding to purchase oil spill response equipment and provide training to local responders who could initiate response actions to keep oil from reaching the shoreline. Municipalities that received federal monies used matching funds to purchase containment boom, storm drain covers, sorbent materials and personal protective equipment to be used by trained citizen responders during an oil spill (BBNEP, n.d.). These key municipalities also developed prevention and management plans, mutual aid agreements, and training drills to prepare first responders for the intensive initial spill response period (BBNEP, n.d.; Costa, 2003). The federally supported Buzzards Bay program successfully oriented municipalities and community members to the challenges associated with spill response.

The Buzzards Bay response community was tested on April 27, 2003 when the tanker vessel *Bouchard No. 120*, known as *B-120*, struck rocks in the bay. The collision ripped a twelve-foot hole in the hull, spilling 98,000 gallons of #6 fuel oil into Buzzards Bay (BBNEP, n.d.). Many of the towns along 90 miles of affected coastline established their own command posts and mobilized manpower to deploy the response equipment (Costa, 2003). The participation of local first responders during this the *B-120* spill had a positive impact by averting damage from some sensitive locations. Unfortunately, shifting winds cause oil to continue to wash up on shorelines for more than two weeks.

The result of the *Bouchard No. 120* spill was more than 90 miles of oiled coast; hundred of seabirds were oiled or killed; and 178,000 acres of shellfish beds and recreational sites were closed for months after the incident (MassDEP, 2007). Although the volume spilled during the *Bouchard No. 120* incident was relatively small compared to the multi-million gallon spill of the *Exxon Valdez*, Buzzards Bay is a small body of water with sensitive resources that were heavily

damaged by this spill. The damage caused by this spill inspired Massachusetts legislators to take action to involve local citizens in spill responses.

Massachusetts Oil Spill Act of 2004

Following the April 2003 *Bouchard No. 120* barge spill, the Massachusetts legislature passed the Oil Spill Prevention and Response Act of 2004. The Oil Spill Act was intended to "strengthen several statutes that govern Massachusetts' ability to prevent and respond to oil spills in the coastal waters of the Commonwealth," (MassDEP, n.d.). Major provisions of the act include the establishment of a trust fund collected from a barrel tax, increased manning requirements for vessels carrying oil as cargo, more stringent insurance coverage, and use of a tug escort for vessels that are in distress (MassDEP, n.d.).

With passage of the Oil Spill Act, Massachusetts established a trust fund that receives $0.02 per barrel of oil shipped into Massachusetts (LaPlante, 2005; MassDEP, 2007). As designated by the act, the fund will be capped at $10 million dollars; the balance of the fund, as of winter 2008, was $4.4 million dollars (MassDEP, 2008). The Massachusetts Department of Environmental Protection (MassDEP) oversees the fund, and allocates the money to improve and enhance spill prevention and response activities. Monies collected by this barrel tax have been allocated to purchase oil spill response trailers and provided training to local responders.

Massachusetts' community-based spill response program has significantly improved readiness and minimized impacts from marine oil spills. Establishing a program sponsored by the state government was a natural course of events, given the history of damaging spills in state waters and the willingness of local citizen groups to respond to spills. The state program enhances the aging federal citizen-based response program, and expands the geographic area covered by protective resources.

Based on the long-standing federally funded program then in use by local municipalities, the Massachusetts DEP had an understanding of how to design a community-based oil spill response program. In addition, MassDEP officials contacted David Byers, spill response manager for the Washington State

Department of Ecology, who provided his East Coast colleagues with the blueprints for Ecology's community-based program. MassDEP adapted Ecology's program to meet its needs, but essentially the concepts are the same and the ultimate goals of spills prevention and effective immediate response when spills do occur are shared by both agencies.

Coastal Massachusetts municipalities have received mobile equipment caches, similar to those used by Ecology, to protect sensitive local resources. The equipment cache designed by MassDEP contains the following: a 20-foot trailer stocked with 800 feet of general purpose boom and 200 feet of marina boom, an anchor system, sorbent materials, personal protective equipment, a generator to operate portable lights, and an air compressor (MassDEP, n.d.). The type of equipment available to Massachusetts responders is slightly more comprehensive than the equipment available to Washington responders, particularly because Massachusetts has a designated funding source for initial and ongoing supply of the caches, while Washington's program was established with a one-time grant. Both programs are designed to store standard equipment available inside mobile trailers so that any responder can easily access and deploy the response equipment during the critical period when a spill first occurs.

As with Ecology's program, equipment used during a community-based response in Massachusetts is re-supplied by the state government, usually through the cost recovery process. One difference between the two programs is that MassDEP retains ownership of its trailers, and is responsible for ongoing maintenance and for stocking consumable materials on an annual basis, whereas Ecology's program transfers ownership to local government or tribes, and re-supplies materials only when they are used during a reported spill response. Otherwise, agreements between the state and local municipalities are the same in both states: equipment must be stored in a state of readiness at a known, secure location, and the municipality advises state officials when the equipment is used (MassDEP, n.d.).

Training is conducted with recipients of the response equipment provided by monies collected in the Oil Spill Act trust fund. The intent of the training is to bring together responders from different municipalities – such as fire department

personnel, harbor masters, and shellfish wardens – to teach the skills necessary to effectively and safely deploy boom during the earliest period of response. Training events in Massachusetts also introduce local geographic response plans to the first responder community, and allow local and state officials to test the drafted response strategies (MassDEP, n.d.; MassDEP, 2008).

Before the logistics of its current state-sponsored community-based program were finalized, MassDEP had delivered 14 equipment caches to Buzzard Bay communities (MassDEP, 2008). Since then, the equipment package has been standardized, and caches delivered in the past few years are identical statewide, for ease of deployment and to simplify training objectives for first responders. In 2007, 21 communities in Cape Cod, Martha's Vineyard, and Nantucket received response trailers, and an additional 19 trailers were delivered to Buzzards Bay communities (MassDEP, 2008). Equipment deliveries and training for community-based first-responder programs are slated to continue until 2010, and hopefully will continue as long as there are monies available in the trust fund (MassDEP, 2007).

The Commonwealth of Massachusetts now has a comprehensive community-based first responder oil spill program that recognizes the importance of being prepared for a spill, and provides adequate resources and training to mitigate negative effects during the first critical hours after a spill occurs. The strategic location of equipment caches, coupled with the commitment of local responders, places Massachusetts at the forefront of community-based emergency spill response.

Other States

The State of Washington's caching program is an excellent model for a community-based spill response program. It is effective, uncomplicated, and easy to emulate. Other state governments wishing to copy Washington's program may obtain from this paper an outline of the structure and details necessary to set up a similar program. Since implementing Washington's community-based spill response program in 2006, Ecology has provided the plans, protocols and methodologies to environmental agencies of several other coastal states. As

discussed above, the Massachusetts Department of Environmental Protection executed a program based on the Ecology's grant program. Likewise, California's Office of Spill Prevention and Response has designed a community-based spill program modeled after the Washington State program, and is currently distributing spill response trailers to coastal communities.

In addition, Ecology has provided technical support to members of the Pacific States – British Columbia Oil Spill Task Force (BC/States Task Force), who may be able to advance the concept of citizen spill response along the Pacific Coast. The BC/States Task Force is comprised of natural resource trustees from state governments of Alaska, California, Hawaii, Oregon, Washington, and the Province of British Columbia (Oil Spill Task Force, 2003). British Columbia, and Canada in general, is way behind in spill response. The Canadian government is still working out who has the fundamental authority to respond to spills, according to David Byers, Ecology's spill response section manager. The issue is currently managed at the provincial level, and British Columbia, which has no dedicated spill responders, currently depends on environmental enforcement officers to respond to oil spills (D. Byers, personal communication, February 22, 2009).

Oregon is another state which currently has only minimal oil spill response capabilities, and no state-sponsored community-based programs, and therefore relies heavily on USCG and EPA support during spill events (D. Byers, personal communication, February 22, 2009). Oregon resources would be better protected if the state Department of Environmental Quality developed a community-based response program like the one designed by Washington State.

Ecology has also shared this information with the State of Hawaii, but no program has been initiated at the time that this paper was written. This may be due to a fundamental difference between each state's approach to spill response – Hawaii allows the use of chemical dispersants during response actions, whereas Washington depends on the mechanical removal of oil. The need for community-level response to oil spills may be reduced by use of chemical dispersants during response. Since dispersants speed up the emulsification process of oil into the water column, less oil may be available to reach the shoreline in areas that employ

chemical dispersants as a spill response technique.

In conclusion, Washington State has paved the way for expansion of state-sponsored community-based oil spill response. Inspired by the success of Alaska's program, and the critical lack of resources for first responder use, Washington designed a grant program that can be used by other agencies to enhance spill response readiness nationwide.

VI) Conclusions

Oil spills can cause significant damage to sensitive environmental, economic, and cultural resources. Ultimately, preventing spills from happening is the most effective way that government, industry, and citizens can protect these valuable resources. However, oil spills inevitably will occur, so long as petroleum serves as the vital energy source that drives our economy and heats our homes and workplaces. When a spill does occur, early intervention clearly is the most effective means of mitigating the damages from the spill.

The Washington State Department of Ecology has designed a community-based program that enables local first responders to take aggressive initial response actions when oil spills occur. Ecology's program provides adequate first-response spill equipment to local governments and tribes, as well as familiarization training, so that the first people on the scene of a spill can safely and efficiently protect their community resources.

Washington's program was influenced by Alaska's success with the ADEC Depot/Corps program and the Alaska Community Spill Response Program. Washington also learned lessons from federally-funded local responses to major Massachusetts spills, and – after establishing its own community-based spill response program – Washington contributed to the development and implementation of Massachusetts's state-funded community response program. As discussed above, other states are now joining the effort to shift resources to local communities and provide training to local responders in an effort to contain oil spills before the oil significantly damages the surrounding area.

This paper has presented a history of significant oil spills, and subsequent environmental legislation, to provide the reader with a basic background of spill response in the United States. The section on spill response decision-making created a framework to explain Washington State's community response program. The case study of Washington State's community-based spill response program was very explicitly detailed so that other state governments and response agencies can draw from Ecology's program to design a targeted program that can meet their own response objectives.

Spill response continues to be most effective when the source of the spill can be immediately stopped, and spilled oil can be contained or deflected to a collection point. Ecology's grant program to cache response equipment near likely spill sites makes it possible for trained community members – almost always the first people on the scene after a spill – to stop the spread of oil and limit the environmental damages and subsequent cleanup required. If other agencies create community-based response programs modeled after the Washington State program, then the negative impacts and high costs associated with oil spills will be significantly diminished.

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Appendix A. Washington State Department of Ecology oil spill response equipment grant application form.

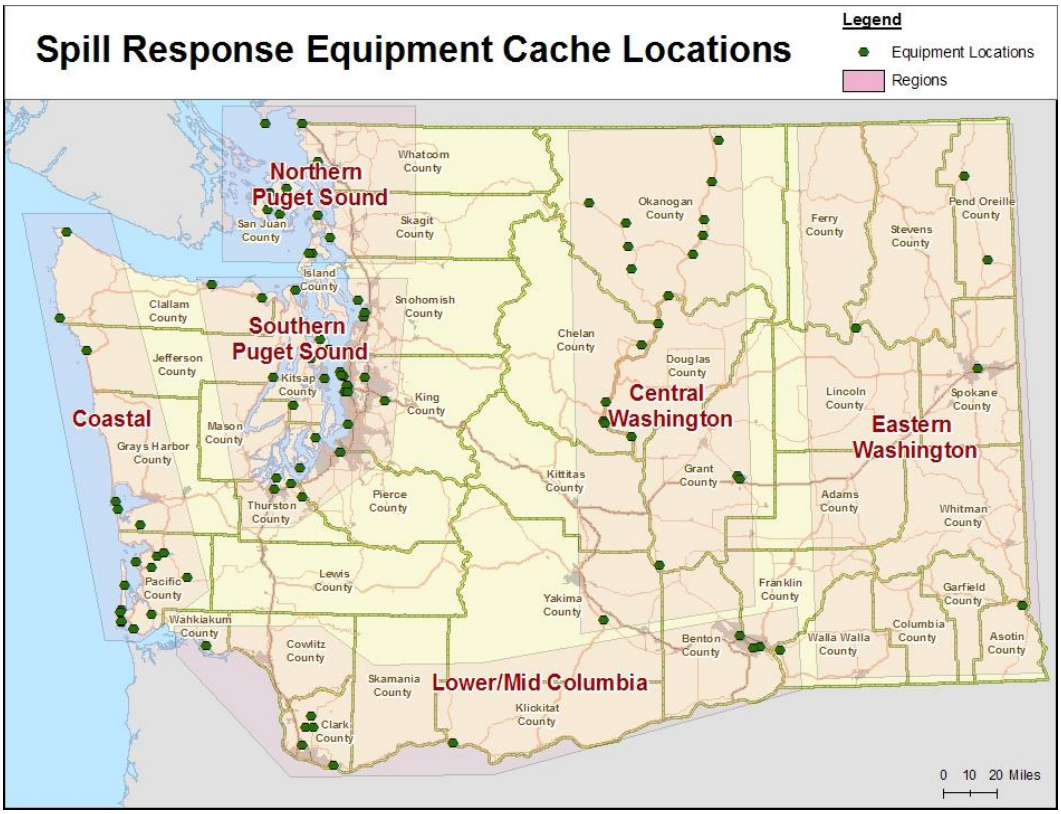
Application Information:			
Agency or Tribe Name:			
Address:			
City:		State:	Zip code:
Contact Name:			
Phone No.:	Alternate No.:		Fax No.:
Email:			

Equipment Requested	
☐ Trailer with General Purpose Boom	☐ Trailer with River Boom
☐ Boom Vane(s)	☐ Other (Specify):

Where Will The Equipment Be Located?
Identify where the equipment will be stored and what resources or assets will be protected.

How Will The Equipment Be Deployed?
Explain who will deploy the equipment and what support equipment (such as boats) will be used.

Appendix B. Map of oil spill response equipment cache locations, grouped by geographic region, in Washington State.



Map courtesy of the Washington State Department of Ecology website: http://www.ecy.wa.gov/programs/spills/response/equipment_caches.htm

Appendix C. Distribution of oil spill response equipment by Ecology region.

	ECOLOGY REGION				TOTALS	
	SOUTH WEST	NORTH WEST	CENTRAL	EASTERN	GRANT EQUIPMENT	INCLUDING ECOLOGY EQUIPMENT
CONTAINMENT BOOM (in feet)						
8"x12" standard	12,400	21,600	0	0	**34,000**	35,000
8"x12" river	4,800	800	0	0	**5,600**	6,000
6"x12" inshore	0	0	400	800	**1,200**	1,200
6"x6" river boom	0	0	4,600	5,900	**10,500**	10,500
4"x6" marina boom	0	200	1,900	0	**2,100**	2,100
Total boom awarded (in feet)	**17,200**	**22,600**	**6,900**	**6,700**	**53,400**	54,800
BOOM VANES	0	0	2	2	**4**	6
18' TRAILERS	21	25	5	7	**58**	59
10' TRAILERS	0	0	7	1	**8**	8
CACHES	15	8	8	1	**32**	33
TRAININGS	20	24	9	8	**61**	61