MARINE RESPONSE VESSEL

# Marine Response Vessel Use and Design Assessment

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February 2009

## Abstract

The problem was that the Vancouver Fire Department had identified deficiencies in its ability to respond to incidents on the Columbia River. The purpose of the project was to describe standards and practices for waterway emergency response elsewhere, and to make recommendations for improvement to the Vancouver Fire Department's river response capabilities. Using the descriptive research method, the following questions were explored: a) What are the industry standards for fire and EMS protection of comparable seaports and waterways?, b) What are the industry standards for the design and capabilities of applicable marine response vessels?, c) What recommendations should be made to improve the Vancouver Fire Department's river response capabilities? The project examined the Vancouver Fire Department's river and shoreline response areas, as well as its response history therein. Those findings were compared to industry practices for waterfront fire and rescue response, as well as related national standards. Procedures included an extensive literature review, as well as several informal interviews. The results included an overview of response vessel presence, capabilities and use in North America and Europe, with comparisons to Vancouver's situation. The value of national standards was shown as existing capabilities in Vancouver were explored. A combination of industry practices and national standards was used as the basis for recommending improvements to Vancouver's response capabilities. A response vessel appeared to be justified, but it was determined that more research was necessary. Recommendations included immediate initiation of a Determination of Needs Study as outlined in NFPA 1925, Standard on Marine Fire-Fighting Vessels, and several consequent steps to assist in the implementation of the study results.

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## Introduction

Fire agencies that protect port facilities and waterways often face special challenges. The Port of Vancouver, Washington handles both ocean-going and river vessels, which carry a wide variety of cargo as well as passengers. The Vancouver Fire Department protects the port and surrounding riverfront largely from shore, as it has no vessel that can address the complex problems that marine traffic brings to the area.

According to Steve Eldred, Vancouver Fire Department Special Operations Chief, Vancouver's dependence on other agencies for fire-rescue vessel response is not sustainable in the long term. Portland, Oregon's Fire Bureau (PFB) has traditionally been called when Vancouver waterfront incidents occur, but the PFB's closest vessel with firefighting capabilities is at least 30 minutes away, and PFB boats often have a considerably longer response to Vancouver when weather conditions or other incidents are taken into account. (S. Eldred, personal communication, December 8, 2008)

The problem is that the Vancouver Fire Department protects a very active commercial seaport and over 20 miles of Columbia River shoreline, but has no fire-and-rescue-capable watercraft. The number of emergency incidents of all types on the river is increasing, but the Vancouver FD often cannot take direct action because it does not have an appropriate vessel available. This situation has repeatedly put both the public and responders in peril.

The purpose of this research is to describe the applicable standards and practices for port fire protection, rescue on waterways, as well as related vessel-based emergency

response, and to make recommendations for improvement of the Vancouver FD's river response capabilities where warranted.

Using the descriptive research method, the following questions will be answered: a) What are the industry standards for fire and EMS protection of comparable seaports and waterways?, b) What are the industry standards for the design and capabilities of applicable marine response vessels?, c) What recommendations should be made to improve the Vancouver Fire Department's river and port response capabilities?

## Background and Significance

Vancouver, Washington, is situated on the north shore of the Columbia River, approximately 90 miles (145 km) inland from the Pacific Ocean. Vancouver's position near the river's upstream limit of tidal influence allows for ocean-going as well as river vessel access. Vancouver became a seaport soon after Lewis and Clark first traveled through the area. The river shore here hosted exploration vessels as well as those carrying supplies to the Hudson's Bay Company's Fort Vancouver. (Fort Vancouver, 2008)

Fort Vancouver served as the administrative and supply hub of the company's Columbia Department, servicing an area stretching from the Yellowstone country to Hawaii, and from Russian Alaska to Mexican California. Once serving as the border between Canada and the Oregon Territory, the Columbia River is now the border between the states of Oregon and Washington. (Fort Vancouver, 2008)

The Port of Vancouver was formally made a Port District in 1912. It played a pivotal role in ship building and commodities transfer in both world wars, and it handled 568 vessel calls in 2007. (Port of Vancouver, 2007) The Port serves as the downstream hub of the Columbia/Snake River inland navigation system that reaches as far east as

Lewiston, Idaho. This system is a major carrier of barged bulk products, especially wheat and petroleum fuels. A growing inland cruise ship industry sends large river passenger vessels through Vancouver during tours of the Columbia/Snake system. Major east-west and north-south rail lines converge at the port. Additionally, the port is currently planning for a major expansion, which will include enlarging its rail yards and ship berthing capacities. (Port of Vancouver, 2007)

The Vancouver Fire Department (VFD) was established in 1867, and has always relied on other entities, mainly the US Coast Guard (USCG) and the Portland Fire Bureau for marine response. (S. Eldred, 2008) The USCG, increasingly focused on security, no longer deals directly with fire fighting, and neither agencies' vessels are well positioned for response to Vancouver, when they are available at all. (S. Eldred, personal communication, December 8, 2008)

The VFD considers itself an all-risk agency, and over 80% of its overall responses are for emergency medical (EMS) incidents. In the river, common responses include suicide attempts from bridges and boating mishaps. According to VFD Battalion Chief Rick Huffman, trained rescue swimmers are assigned to fire companies at several river-area fire stations, but using shore-based rescue swimmers is extremely dangerous in the wide, fast-moving Columbia River. (R. Huffman, personal communication, November 12, 2008) Huffman states that in the winter, floating debris ranging from ice chunks to entire trees can make any water entry even more treacherous.

The VFD acquired a surplus USCG rescue boat several years ago to perform single-victim rescues in the river, but its small size (17 ft. / 5.2 m in length) and lack of weather protection for crew and patient make it only marginally useful in the winter

months. This vessel has no patient handling, firefighting or pollution control capabilities. (S. Eldred, personal communication, December 8, 2008)

Vancouver's waterfront facilities include both concrete and heavy timber structures and piers. There have been a number of significant building, piling, bridge and dock fires along the river during the VFD's history. Grain elevator fires are a recurring problem, and the most recent major ship fire occurred in 2006. The port handles some very dangerous chemicals in large quantities, and the region is considered at risk from very large earthquakes. (R. Huffman, personal communication, November 12, 2008) According to Chief Huffman, all of these factors seem to point to the need for a robust multi-purpose response vessel with the ability to pump significant volumes of water.

This research project intends to examine the fire, rescue and hazardous materials threats found within the VFD's waterfront service area. Through a review of applicable literature, the project will also describe the national standards and best practices for the design and operation of a response vessel to address such threats. Finally, recommendations will be made for enhancement of the VFD's ability to address its waterfront hazards. If the research indicates that a response vessel is warranted, specific recommendations for its size and features will be made as well.

It is hoped that this project's results will guide the VFD's development of better tools for the protection of its waterfront and the people that work and recreate there. Further, it is hoped that the project will assist readers from other jurisdictions as they assess their own ability to protect ports and other waterfront property.

Because it appears that the VFD's capability to address emergencies along the Columbia is being outstripped by the expansion of the port and other river-based

activities, it is hoped that this project will address the U.S. Fire Administration's fifth operational objective, which encourages the fire service to respond appropriately (and in a timely manner) to emerging issues.

Finally, a central theme of all four of the National Fire Academy's Executive Fire Officer courses was *situational awareness*. All four courses stressed some form of ongoing risk assessment, in partnership with others, in order to plan for the reduction of threats or the mitigation of problems once they occur. Using the descriptive research method, this project will detail the capabilities and limitations of the VFD's current marine response, and will make recommendations for enhancing same where appropriate. Potential partnerships will be explored wherever possible.

## Literature Review

### *Vancouver's Waterfront*

The Vancouver Fire Department's river shore response area extends from its boundary with the City of Camas to the Ridgefield National Wildlife Refuge, some 24 miles (38.6 km) downstream. This stretch of shoreline includes a mix of property uses; heavy industry, commercial, high-end residential, recreation, as well as undeveloped natural areas.(S. Eldred, personal communication, December 8, 2008) Within this response area, the river averages 1 mile (1.6 km) in width.

Interstate 5 (I-5) roughly bisects the area as it crosses the Columbia in downtown Vancouver. There are two major concentrations of river shore industry. Upstream of the I-5 Bridge is the Columbia Business Center. Occupying the site of a huge Kaiser shipyard that built Liberty and Victory ships for wartime use, it hosts a wide variety of manufacturing, warehousing and heavy fabrication businesses. Barges, yachts, small

ships and oil platforms, as well as bridge components are built here, and usually leave the area via the river. (S. Eldred, personal communication, December 8, 2008)

Since 1900, most of the VFD's largest structure fires have been in the enormous and historic shipyard buildings here. Several have required fire boat assistance from the Portland Fire Bureau. (Gentry & Leavitt, 1992) There are shipways, slips, a yacht basin and a large public boat ramp facility in this area as well.

Upstream from this area, on the Oregon shore of the river, is the Portland International Airport. Because of its location along the river, airliner emergencies involving a water landing have long been a focus of contingency planning. (R. Huffman, personal communication, November 12, 2008) The airport fire department maintains one rescue vessel for use in such emergencies, but that agency's plans are heavily dependent on mutual aid from law enforcement and fire agencies on both sides of the river.

The VFD's participation in past drills here has underscored its lack of mobility on the river. The Clark County Sheriff's office has a river response vessel (no EMS or fire capabilities), but it is not consistently staffed. Since the VFD's current vessel is a small, open-platform design (moored with the Sheriff's boat several miles downstream in the port) there are essentially no ready-to-respond, all weather response vessels poised to cover the Washington half of the river during an aircraft incident (excluding Oregon mutual aid). (R. Huffman, personal communication, November 12, 2008)

The river stretch along the Columbia Business Center is one of the two main sources of responses for the VFD's current rescue vessel. The large public boat launch here provides river access for hundreds of pleasure boats during summer boating season, as well as fall and winter sport fishing periods. There are tree-fringed public beaches in

the area, which have contributed to swimming accidents as well as shoreline wildfires. (R. Huffman, personal communication, November 12, 2008)

The other area that has created repeat business for the VFD rescue boat is just downstream from the I-5 bridge. The bridge is, unfortunately, a popular platform for attempting suicidal jumps into the river. In addition, the combination of a narrowing channel, rapid currents, and heavy recreational and commercial boat traffic has contributed to a number of vessel accidents in this area over the years. (R. Huffman, personal communication, November 12, 2008)

The Port of Vancouver essentially begins here in downtown Vancouver, at the I-5 Bridge. Two huge grain terminal complexes and one of the region's largest rail yards mark the upstream end of the port. Port facilities stretch several miles downstream from the grain facilities, with ship berths lined end-to-end along the shoreline. Some berths are for general cargo, but others are specially equipped for bulk products like grain, fertilizer, mineral ores, or liquid chemicals. (Port of Vancouver, 2007)

There are a number of large, above-ground bulk storage tanks at several port sites. They are connected to dock facilities, area tank farms and a regional transmission system by pipeline. Products handled and stored can include all types of petroleum-based fuels, as well as large quantities of methanol and a number of other chemicals. Ships load and off-load these products at a dedicated berth. (S. Eldred, personal communication, December 8, 2008) A constantly staffed, double track railroad drawbridge crosses the river near the grain terminals. Interestingly, when the bridge is in the open position for river traffic, the bridge operator is isolated from shore by wide river channels. (R. Huffman, personal communication, November 12, 2008)

The port hosts a constant stream of seagoing vessels. At any time, there can be multiple ships berthed for the loading or off-loading of products. In addition, a number of ships are usually anchored in the river channel just offshore, awaiting the availability of their assigned berths. (S. Eldred, personal communication, December 8, 2008) At the time of this writing, a US Navy Military Sealift Command vessel, 950 feet (290 m) long, is berthed indefinitely at Vancouver, awaiting its next assignment. The VFD and its response partners plan to conduct fire and rescue training aboard this active-duty vessel, but, as in past activities of this type, the VFD's lack of a multi-mission response vessel will probably be a common discussion topic at these drills. (S. Eldred, personal communication, December 8, 2008)

In 2007, the port hosted a total of 568 vessel movements to-and-from its facilities. (Port of Vancouver, 2007) The port district is in the process of a major development project that will greatly expand ship and barge access through the addition of berths and land facilities. In addition, the biggest rail improvements in decades will dramatically improve train access and yard facilities within the port. The port is already a major entry point for the huge wind turbine generators used throughout the northwest, and it is Subaru's main west-coast point-of-entry for its new automobiles. (Port of Vancouver, 2007)

Near the downstream end of the port, a major inland tug and barge company maintains its headquarters. This means that there are a number of medium to very large river tugs, as well as an assortment of barges and other craft present here at all times. A small tank farm for tug fuel is located here as well. (R. Huffman, personal communication, November 12, 2008)

The port and related industries are of huge economic importance to the city and the region. A recent article in Digital Communities magazine stated that, when Portland and Vancouver are viewed as one regional entity, their ports make the region the ninth most trade-dependant economy in the United States. (Beard, 2008) According to VFD Division Chief Eldred, any disruptions on the river or in its port facilities could have very significant economic impacts on the region. (S. Eldred, personal communication, December 8, 2008)

Finally, the VFD is a member agency of the Maritime Fire Safety Association (MFSA), which is a unique, industry-supported fire protection and pollution-control consortium. (S. Eldred, personal communication, December 8, 2008) Through MFSA, virtually every fire agency on the Columbia and Willamette rivers, from the mouth of the Columbia upstream to Portland and Vancouver (in both Oregon and Washington) has agreed to provide what amounts to automatic mutual aid for vessel or port-based incidents. With the help of MFSA pooled equipment, the VFD has become adept at carbon dioxide application for extinguishing fires in grain terminals and ship holds. (S. Eldred, personal communication, December 8, 2008)

Although it fields no self-propelled vessels of its own, MFSA maintains pollution control equipment and supplies at several sites along the Columbia. Just as with fire incidents, however, the MFSA member fire agencies are expected to provide the initial response and mitigation measures. As with other river problems, mobility on the water is the key to quick response, and, here again, the VFD's lack of an all-weather, multi-purpose boat appears to be a significant deficit in its ability to respond and take decisive action. (S. Eldred, personal communication, December 8, 2008)

*Industry Practices*

The U.S. Fire Administration (USFA) published a special report on fire boats in 2003, as part of its Technical Report Series. (Ockerhausen, Stambaugh & Kelly, 2003) The report gives a good, albeit brief overview of fire boat history, as well as recent trends in vessel design and mission expansion. Several case studies are presented, describing conventional firefighting as well as special missions taken on by fire boats around the country. The report emphasizes that, as ports around the country have modernized, phasing out wooden structures (and thus become somewhat less fire-prone), some of the most successful fire boat operations have flourished because of their multi-mission capabilities. In a survey undertaken for the USFA report, it was found that 40% of the fire boat responses reported were for water-related rescues. (Ockerhausen et al. 2003)

The report lists three basic functions for modern, multi-purpose fire boats. The first is rescue operations (and the related transporting of responders to remote locations). The second is marine firefighting operations, including use as a forward command post for some land operations, some types of recovery missions, and environmental emergencies. The third function listed is water supply operations for certain land-based fire situations, as well as for disasters of all kinds. (Ockerhausen et al. 2003)

In his comprehensive book on American fire boat history, author Paul Ditzel describes how the City of San Francisco designed two large fire boats immediately after the catastrophic 1906 earthquake and fire. (Ditzel, 1989) Because of the degree to which the city's water distribution system was destroyed by the earthquake, these boats were designed to be a key component of an auxiliary water supply system. Although they had a

number of standard firefighting appliances aboard, they were each officially designated as *9000 g.p.m.* (9000 gallons/minute or 34,100 liters/minute [l.p.m.]) *floating pumping stations.* The city was determined that no future earthquake or other calamity would ever find the city without water for firefighting. (Ditzel, 1989)

Interestingly, San Francisco was severely damaged by the Loma Prieta earthquake and consequent fires on October 17, 1989, mere weeks after Ditzel's book was first published. The San Francisco FD's fire boat Phoenix is given much of the credit for saving the Marina district of the city by pumping seawater into supply lines that were hand-laid in the streets for firefighting, exactly as city planners had envisioned in post-quake 1906. (SFFD Fireboats, 2007) The USFA report examines this incident for one of its case studies, as well.

The Phoenix pumped in excess of 5.5 million gallons (19 million liters) of water during this incident, and still had ample fuel available when the 15 hour operation ended. (Ockerhausen et al. 2003) Shortly after the 1989 disaster, anonymous donors funded the purchase of a second fire boat (a surplus vessel from Vancouver, British Columbia) to augment the Phoenix. (SFFD Fireboats, 2007)

The Portland/Vancouver region is also considered to be at high risk for major earthquakes. (The Cascadia Region Earthquake Workgroup [CREW], 2005) Because of the underlying geology, some areas of Vancouver near the river are vulnerable to especially severe damage. These areas include the port and some of Vancouver's downtown core. This city center is also the seat of Clark County government, and is the location of most regional emergency management facilities and other government offices. (R. Huffman, personal communication, November 12, 2008)

It appears that the loss of the city's water distribution system during such an event is quite plausible, perhaps even likely. Chief Huffman states that, in such a scenario, both the city center and the port could benefit from the availability of a fire boat with the capacity to pump large volumes of water for an extended period. He envisions a situation quite similar to San Francisco's, with one or more fire boats providing an auxiliary water supply for firefighting. Unfortunately, as envisioned by the CREW (2005) report, this earthquake scenario, impacting the entire region, would virtually guarantee that Portland's fire boats would be committed to Portland problems, and thus be unavailable for Vancouver's use. (R. Huffman, personal communication, November 12, 2008)

In addition to San Francisco's earthquake experience, Ditzel (1989) recounts the development and use of fire boats in most American ports, on both fresh and salt water. There are dozens of incidents recounted, involving both vessel fires and fires in fixed facilities (berths, wharves, docks). Wooden piers and wharves, like those that underlie several significant commercial areas in downtown Vancouver, are a recurring theme in Ditzel's descriptions of great American fire boat saves (and losses).

Ditzel confirms what Chiefs Huffman and Eldred have implied, which is that, although fire boats are normally not the direct extinguishers of shipboard fires, their presence at such incidents is invaluable for a number of reasons, including rescue of firefighters. (Ditzel, 1989) Ditzel shows that protection of wharves and other land-based facilities from a burning ship is a common theme for these incidents. Many civilian rescue incidents are also described, wherein vessel designed primarily for firefighting were used in lifesaving efforts having nothing to do with fire.

Interestingly, in addition to the many much larger ports discussed, there are a number of rough analogs to the Port of Vancouver described in the book, for which Ditzel recounts major incidents and fireboat history. It is clear that many ports comparable to Vancouver's in size and activity have operated marine response vessels for many decades. (Ditzel, 1989)

Another author, casting a much wider net, implies the same. Klaus P. Hecker, in his book on modern fire boat development, details the evolution of response vessels both small and large from around the world. (Hecker, 1982) A number of brief case studies are presented that deal with river-based, multi-mission vessels in northern Europe. Many of these response vessels are in river systems that see no large ships; they protect civilian boaters and commercial barge traffic. Despite this, they are often relatively large, custom-designed vessels with fire fighting, medical treatment and pollution-control capabilities. (Hecker, 1982) The author shows each of these vessels as an integral part of a city's emergency response and hazard-mitigation capabilities.

Although both Hecker (1982) and Ditzel (1989) discuss some operations that deploy large, primarily fire fighting craft in conjunction with smaller, more maneuverable support craft, many of the river-based craft in both books appear to be hybrids. These vessels are relatively large to allow them to deal with high water and rough winter weather, but their above-deck structures must be low enough to fit under bridges.

These vessels must be able to hold position in a significant current while pumping firefighting water at high volume. They are usually of shallow-draft design to allow operation in fluctuating river levels and shallow areas, and their equipment and layout affords true multi-mission capabilities. They are truly self-contained vessels that can

travel significant distances from base (because of the linear nature of river systems). (Hecker, 1982)

The USFA report, while focusing on smaller European harbor response vessels, also emphasizes the degree to which European boats have evolved into fast, longer-range multipurpose platforms, able to operate independently. (Ockerhausen et al. 2003)

*National Standards*

The National Fire Protection Association (NFPA) Standard on Marine Fire-Fighting Vessels, 2008 Edition governs the design, construction, operation, and testing of marine fire-fighting vessels. It appears to be a comprehensive guide to building firefighting watercraft. (National Fire Protection Association [NFPA] 1925, 2007) The standard includes equipment and operations criteria for many other duties (medical response, rescue, pollution control) but assumes that firefighting is the vessel's primary function by design.

The standard requires a *Determination of Needs Study* as the first step in the process of establishing criteria for a response vessel. (NFPA 1925, 2007) This study is intended to examine the capability and mission requirements of the proposed vessel. It should take into account the physical properties of the area to be protected, as well as the history of fire and rescue emergency incidents there (where response vessels either did respond or would have responded, had they been available). It requires that the jurisdiction does a detailed examination of the possible fire and EMS demands on the vessel through historic, present-day, as well as future potential. The standard also suggests that the following outside influences be examined as they relate to the vessel's proposed missions: US Coast Guard standards, NFPA standards, American Boat and

Yacht Council standards, and local insurance considerations. (NFPA 1925, 2007) The value of this comprehensive study requirement is strongly emphasized by the USFA report as well. (Ockerhausen et al. 2003)

However, the USFA report, citing an earlier edition of NFPA 1925, discusses a now-outdated three part classification system for fire boats. (Ockerhausen et al 2003) The current (2008) edition of NFPA 1925 has been updated so that fire boat typing is consistent with the National Incident Management System's Emergency Support Function (ESF) #4, as well as national resource typing standards. (NFPA 1925, 2007)

As a consequence, in the 2008 edition of NFPA 1925, response vessel classification into one of five *vessel types* is based on capabilities. Vessel size follows these capabilities closely in most cases. The most capable are Type I vessels. They must have two fire pumps with a total minimum water pumping capacity of 20,000 g.p.m. (80,000 l.p.m.) In addition Type I vessels must carry fire fighting foam and foam production equipment, and must carry enough fuel to remain *on-station* (working at an emergency scene) for at least 48 hours. (NFPA 1925, 2007)

For comparison, a Type III vessel must have a minimum pumping capacity of 4500 g.p.m. (18,000 l.p.m.) through two pumps. In addition, the Type III foam requirements are less stringent, and it must carry sufficient fuel to remain on-station for at least 8 hours. The smallest vessels, in the Type V classification, are required to have 1 fire pump with a minimum capacity of 500 g.p.m. (2000 l.p.m.), but no foam. The Type V minimum on-station time is 4 hours. (NFPA 1925, 2007)

Chiefs Huffman and Eldred agree that NFPA 1925 should serve as a very detailed manual for designing fireboats. (R. Huffman, personal communication, November 12,

2008) Once the jurisdiction decides on a pumping capacity and other mission requirements (based on the Determination of Needs Study), the standard will provide tremendous assistance in sizing and equipping the vessel. The degree to which the standard addresses ancillary missions and capabilities (including rescue and EMS roles, vessel stability, etc) makes it clear that it is based on many decades of real-world experience. (NFPA 1925, 2007)

There is another entity that uses real-world experience in its recommendations concerning emergency response vessel standards. The Insurance Services Office (ISO) is an organization that calculates risk in order to help insurance carriers set premium rates. In conjunction with these calculations, ISO has been rating the capabilities of fire departments for the last 37 years. ("Nation's Fire," 2008) In Washington State, the Washington Survey and Rating Bureau (WSRB) uses the ISO criteria to rate fire agencies. (D. Bivins, personal communication, January 7, 2009)

The ISO criteria assign deficiency points in a number of areas including fire department equipment and staffing, water supply infrastructure, and even environmental risk assessment. Ultimately, each agency is assigned an ISO rating *class* from one to ten. Class ten is the worst, and represents an extremely marginal agency (essentially no fire protection at all). At the other end of the scale, a class one agency has met or exceeded all criteria, and is considered as efficient as possible when its response area's overall risks are taken into account. (Grading Schedule, 1974)

In April, 2002, the WSRB released the results of its examination and re-rating of the Vancouver Fire Department. According to its findings, the VFD had last been rated in 1967, at which time it was assigned class three. (Zechlin, 2002) In the 2002

examination, the VFD was found to have serious deficiencies in several areas, and it was demoted to class four. This class change affected commercial fire insurance premiums through a 4-8% increase, but, because of the ISO rating structure, the drop to class four did not increase premiums for residential properties. (D. Bivins, personal communication, January 7, 2009)

The VFD was penalized for very large inadequacies in staffing, inspection practices, and port fire protection. (Zechlin, 2002) Interestingly, the report concluded that Vancouver's waterfront was well in excess of the minimum size requiring a fireboat, and this deficiency was given essentially equal weight (133 points) with the VFD's long-standing and well-publicized overall fire suppression staffing deficiencies (134 points). (D. Bivins, personal communication, January 7, 2009)

The details of the fire boat requirements are clear cut. Jurisdictions protecting a total of more than one mile of *wharf frontage* (buildings, berths and storage requiring fire operations from the water) must station a fire boat no further than 1.5 miles (2.4 km) from any part of said frontage. The vessel should have a total pumping capacity of one-half of the highest required fire flow for the area (and not less than 5000 g.p.m./19,000 l.p.m.). (Grading Schedule, 1974) The vessel must be properly equipped, staffed, maintained and tested according to industry standards, which appear to be those of NFPA 1925.

According to the VFD's Senior Deputy Fire Marshal John Gentry, fire codes applied to a recent methanol facility upgrade in the port required an increase in local water main fire flow capacity to 3000 g.p.m. (11,400 l.p.m.). He suspects that there are several areas along Vancouver's waterfront that would benefit from a re-examination of

fire flow with the ISO standard and intent in mind, as past efforts (other than the ISO re-rate) have apparently overlooked the role that a fire boat might play in a major firefight. (J. Gentry, personal communication, January 13, 2009)

Vancouver's fire boat deficiency points were actually reduced to 133 from 200 because of the existing mutual aid agreement with the Portland Fire Bureau, but the deficiency remains quite significant, according to VFD Chief Bivins. (D. Bivins, personal communication, January 7, 2009)

In the aggregate, the literature reviewed for this project appears to show deficiencies in response capability in Vancouver, when the VFD is compared to other agencies protecting ports and waterways. The ISO rating certainly reinforces this view.

The presence of the Determination of Needs Study requirement in NFPA 1925 made several things clear. The first was that such a comprehensive assessment of Vancouver's river response capabilities should be done as soon as possible. The second was that said study was clearly beyond the scope of this research project, given the time and resource constraints already present.

Nevertheless, while there may be as-yet unanswered questions about the specific pumping capacity and other mission requirements needed in Vancouver, both industry practices and national standards seem to make a very good case for the inclusion of a vessel-based, multi-role response capability in Vancouver.

## Procedures

Research for this project began at the National Fire Academy's Learning Resource Center (LRC) in August 2008. An extensive review of available literature there, as well as at local libraries and on the internet ensued. In addition, much time was

devoted to an exploration of the current situation in Vancouver, as is typical for projects using the Descriptive Research methodology. Two VFD members, Special Operations Division Chief Steve Eldred, and Battalion Chief Rick Huffman, were consulted at length because of their in-depth knowledge in several areas. Chief Eldred's extensive hazardous materials background, combined with his having conducted special projects with port tenants involving the shipping and storage of hazardous products, made his input invaluable. Eldred also oversees the VFD's Technical Rescue Team and Marine Division.

Chief Huffman has many years of Technical Rescue Team experience, and has been involved (in several capacities) with emergency incident response involving the Columbia River. His first-due response area includes the port, downtown Vancouver, and the Columbia Business Center. Both Huffman and Eldred are deeply involved in regional planning, training and response initiatives with the VFD's many Oregon and Washington emergency services partners.

With regard to the literature, emphasis on existing national standards (ISO and NFPA) rather than the current practices of neighboring agencies was intentional. As described, several VFD neighbors have emergency response vessels, but Huffman and Eldred inferred that some of those agencies have essentially always had vessels, and, where they have been applied at all, national standards appear to have been secondary to the existence of the vessels. If the VFD engages in a Determination of Need Study, the experiences of at least the Portland Fire Bureau and the Port of Portland with regard to response vessels would have to be examined in detail.

Limitations encountered in this project include a lack of detailed response records kept by the VFD. The current incident reporting database is not readily capable of

identifying historical boat use within Vancouver's response area. Recent attempts to track use of the VFD's small rescue vessel have resulted in some very limited statistics, but more extensive analysis of both actual and potential use of this vessel for past incidents is necessary.

The literature available on the subject of emergency response vessels was somewhat limited as well. A number of fire service periodical articles were not included in this research because they were extremely general in scope. The total number of publications available (even including some very old works) is small.

## Results

The first research question sought to identify the industry standards for fire and EMS protection in seaports and waterways comparable to Vancouver. The research found a number of rough analogs to Vancouver described in the comprehensive books by Ditzel and Hecker. The Vancouver waterfront's size, industrial base, and river setting (fresh water and significant current) appear to make it a larger, more demanding port to protect than many described in the books, especially those on some European rivers.

Numerous references to fires involving Vancouver-like wharf construction, waterside buildings, and visiting ships offer easy comparisons to Vancouver in both works. In addition, accounts of the value of fire boats as auxiliary water supply sources in natural disasters seems to have direct correlation to some of Vancouver's inherent risks.

The USFA report corroborated much of what Ditzel and Hecker wrote, and expanded upon a number of their points. It also emphasized the value of NFPA 1925 and its requirement for in-depth analysis of the need for a response vessel.

The Insurance Services Office (ISO) criteria for fire protection of wharf frontage afford added detail in the form of an actual analysis of the VFD's existing capabilities. Vancouver suffered a demotion in its rating in part due to a sizeable penalty for the lack of a fire boat. The ISO findings were unequivocal- the penalty stated emphatically that Vancouver needs it own fire boat.

NFPA 1925, Standard on Marine Fire-Fighting Vessels, requires the Determination of Needs Study as the first step during the "exploration" phase of a response boat project. In other words, the study is intended to help determine whether a boat is warranted, and if so, the level of capabilities it must have.

The second research question sought to identify the industry standards for the design and capabilities of a response vessel appropriate for Vancouver's waterfront. The literature review identified some broad characteristics for river-based vessels, including shallow draft for variable water depth, as well as the ability to remain stationary in river current while pumping. Hecker discussed the tendency for river-based vessels to be sent relatively long distances from port in all weather conditions, necessitating robust, self-sufficient craft.

The ISO criterion for fire boat pumping capacity appears to be a necessary early consideration in the process. However, NFPA 1925 appears to be the definitive work to serve as the basis for the process of designing a response vessel.

As discussed above, the NFPA 1925 Determination of Needs Study, conducted as an official, methodical analysis by a jurisdiction, should serve to formally establish the justification for acquisition of a response vessel. ISO pumping capacity requirements would be examined in detail by this study. Once such a study identified the missions and

capabilities required, NFPA 1925 offers a detailed matrix for the vessel's design. Importantly, it takes into account the non-firefighting duties that these vessels often conduct.

The third research question strove to identify recommendations that could be made to improve Vancouver's river and port response capabilities. When viewed as a whole, the practices of other agencies around the world, coupled with the NFPA and ISO standards, seem to give fairly clear direction for Vancouver to follow in an effort to improve river response.

Numerous sources established the critical role that response vessels play in ports everywhere, and Vancouver's similarity to many of those ports is difficult to overlook. Consequently, it seems clear that the VFD could justify its own multi-purpose response vessel on the Columbia River. The conduction of an NFPA 1925-based Determination of Needs Study would help the VFD establish specific justification for, and capabilities of, this prospective vessel.

## Discussion

The Vancouver Fire Department protects a vibrant waterfront and seaport that is expected to grow in size and activity. (Port of Vancouver, 2007) The literature clearly indicates that similar ports (as well as some significantly smaller ones) around the world have long used fire boats to protect these economically important community assets. (Hecker, 1982) A multi-purpose vessel would clearly be easiest to justify, especially when the trends towards rescue and environmental response are considered. (Ockerhausen et al. 2003) (Ditzel, 1989) Frankly, when rescue missions, pollution response and other common response vessel duties are considered in addition to

firefighting, it appears that Vancouver could be said to be unique in lacking its own multi-mission response vessel.

Historically, the VFD has relied totally on other agencies, especially the Portland Fire Bureau, for its river response needs. But, with increased regional growth, as well as the looming threat of a regional natural disaster, this reliance seems rather short-sighted. (S. Eldred, personal communication, December 8, 2008)

The VFD has already been significantly penalized for the lack of a firefighting vessel through the worsening of its ISO rating. (Zechlin, 2002) As a result, the business community in Vancouver has paid higher insurance rates since 2002 for deficiencies that include the lack of a fire boat. (D. Bivins, personal communication, January 7, 2009)

Coupled with the ISO findings, the criteria set forth in NFPA 1925, Standard on Marine Firefighting Vessels, regarding the Determination of Needs Study, make it clear that Vancouver should embark on the formal process of establishing the need for, and missions of, a response vessel as soon as possible. (NFPA 1925, 2007) Once such a study is complete, NFPA 1925 provides guidance for translation of those identified missions into specific size and capability criteria for a multi-role response vessel.

The discovery of the Determination of Needs Study requirement in NFPA 1925 changed the course of this research to some degree. The study's formal and comprehensive analysis of the waterfront and existing response levels seemed to be exactly what the VFD needed to create an unequivocal picture of the implied deficiencies in its capabilities. (NFPA 1925, 2007)

At the same time, it became clear that, done right, such a study would far exceed the scope of this research project. Still, the VFD's course seems clear. The lack of a

capable vessel, long ago established in VFD institutional memory as a serious, unaddressed problem (R. Huffman, personal communication, November 12, 2008), can be methodically reviewed (and either definitively confirmed or rejected as a problem) by the Determination of Needs Study outlined in NFPA 1925.

In the interim, this research has demonstrated that a robust, multi-mission response vessel is probably warranted, and that, using the ISO criteria alone (Zechlin, 2002), this vessel should have a minimum pumping capacity of 5000 g.p.m (19,000 l.p.m.). Further, a cursory application of the NFPA typing criteria, taking the ISO pumping capacity into account, implies that the VFD's situation warrants a Type 3 vessel. (NFPA 1925, 2007) The research further suggests that this vessel should be designed for self-sufficient operations in a dynamic river environment, with shallow draft, low bridge clearance, position-holding and other river-specific capabilities. (Hecker, 1982)

In the process of conducting the Determination of Needs Study, the VFD should consider the many potential partners that may be engaged in whatever solution is proposed. The port and its major tenants, as well as a large segment of the business community in the greater Vancouver area, stand to benefit in a number of ways from an enhanced river response capability. (S. Eldred, personal communication, December 8, 2008) Naturally, the average citizen spending time on the river (or crossing it by bridge or aircraft) would enjoy a greater level of protection from this increased capability as well.

Despite the current economic stagnation in the region, the current and expected growth of Vancouver's waterfront implies that there may be partnership opportunities

(tied specifically to port expansion) for the VFD in a quest for improved river response. Enhanced response capabilities and related potential economic benefits could attract partners for the VFD (through funding, berth acquisition, and other initiatives) in its attempt to acquire, house and maintain a multi-role response vessel.

## Recommendations

In response to the results of this research, the author recommends that the Vancouver Fire Department engage in the following as soon as possible:

- Conduct a Determination of Needs Study of the VFD's capabilities and shortcomings on the river and in the port, as outlined in NFPA 1925, Standard on Marine Fire-Fighting Vessels, 2008 Edition
- If, as expected, the results of the Determination of Needs Study recommend the acquisition of a response vessel, use the design criteria provided in NFPA 1925 to establish the NFPA vessel type classification, and its consequent features, including: size, capabilities, pumping capacity and equipment complement (based on the study-identified vessel missions and capabilities)
- Engage vessel manufacturers in order to identify the approximate cost of a vessel of the correct NFPA type classification and mission capabilities
- Identify and engage community partners to explore potential cost sharing, as well as other financial assistance, for the acquisition, berthing, maintenance and operation of such a vessel

Future readers should closely examine current and future NFPA Standards, as well as other established standards that may apply to their jurisdictions. In addition, there are, no doubt, a number of North American fire agencies that have completed a Determination of Needs Study, and insight into their experiences and results would be invaluable to any agency considering such an endeavor.

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