INTERTIDAL ZONE OIL RECOVERY FROM THE BURIED DERELICT S.S. CATALA

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ABSTRACT

Built in Scotland as a Union Steamship Company tramper in 1925, the S.S. Catala plied the coast of British Columbia for decades before ending her sailing career as a floating hotel in Ocean Shores, Washington. In 1965 a fierce Pacific storm capsized the 229' riveted steel-hulled vessel at her moorings transforming a real estate developer's dream into a local attractive nuisance. The casualty occurred at Damon Point, a land spit that has since become a State Park and is one of the coast's richest migratory waterfowl habitats as well as the nesting ground for two federal and state-listed threatened birds. Multiple salvage efforts had failed before the derelict's superstructure was cut away and the hull buried in the mid-80's. In the spring of 2006 a beachcomber discovered black oil within the Catala's rusted remains setting-off a Washington State Department of Ecology driven effort to remediate the wreck before the winter storm season created a catastrophic persistent oil release. Time was short: site access could not begin until August when the threatened birds vacated the spit; the contractor had to withdraw by the end of September when the site became vulnerable to ocean storm surges. Regulatory compliance was complicated: Ecology had to win fast-track permits from five separate agencies before they could authorize their contractor, Global Diving & Salvage, to begin work. Engineering was challenging: heeled over and buried in the intertidal zone, the Catala's keel was 26' below grade; a robust sheet pile cell had to be constructed to provide worker safety from unstable soils and manage water in-flow. Despite these conditions the project team was able to safely remove over 30,000 gallons of bunker oil from the ship delivering to the State of Washington a striking example of the benefits of a pro-active derelict vessel response. This case study will discuss the technical and managerial process by which this intertidal site was remediated.

DERELICT VESSEL REMOVAL

This is a case study of the S.S. Catala, a derelict vessel abandoned at Ocean Shores, Washington. It is an example of a successful proactive mitigation effort by both the Washington Departments of Ecology and Natural Resources. Public land owners are often faced with the problem of derelict vessels that have been abandoned on their properties. These nuisances pose costly environmental threats through their latent capability to discharge pollution into aquatic habitats. Proactive mitigation efforts are notoriously difficult to fund, but a reactive response following a vessel sinking or oil spill is staggeringly more expensive[1]. Under the worst-case scenario, the Catala had the potential to release over 60,000 gallons of Bunker C fuel oil in addition to other unquantified hazardous materials within her hull. Multiple federal, state and local regulatory agencies were able to organize quickly, fast-tracking permitting issues and funding sources. The beneficial outcome of this project not only confirmed the ability of those agencies to effectively focus their efforts when needed, but also highlighted the value of responding to environmental threats in an organized, planned manner before they evolve into uncontrolled releases.

S.S. CATALA – THE SHIP

The biography of the S.S. Catala, the "Queen of the Union Steamship Company,"[2] begins with her construction of riveted steel in Scotland in 1925, a time when ships were designed to accommodate both trade and travel. With a length of 229 feet and a breadth of 37 feet, this twin screw vessel was big enough to offer first and second class cabins, an elegant dining salon and a spacious cargo hold. Two triple expansion steam engines drove her 1,476 gross ton hull through the coastal waters of British Columbia for the majority of her trading life. By 1962 the Catala had retired from the coastal trade and sought to provide novelty hotel accommodations for tourists attending the Seattle World's Fair. Thereafter, her engines removed, she was towed to Ocean Shores, Washington to finish her days as floating lodgings for the charter fishing trade.

HER FINAL RESTING PLACE

Moored inside Gray's Harbor, the Catala became a casualty of a fierce winter storm on New Year's Day in 1965. The vessel broke free from her pier and partially capsized, filling with water. For the rest of her life she remained listing and stranded on the Damon Point spit (Figure-1). The Catala's final career was as an attractive nuisance where legions of teenagers conducted rites of passage on her canted decks and in her abandoned staterooms. It was all in good fun until injuries prompted officials in the early 1980's to cut her superstructure to the sandline and bury the rest. Nevertheless, nature has a way of overcoming man's best laid plans; winter storms washing over the Damon Point spit would periodically uncover portions of the ship. In the ensuing years, Damon Point

became a State Park that offered tourists a portal for trekking along the beach to visit the curiosity of the Catala's rusting hull.

FIGURE-1: THE CATALA STILL INTACT AND PARTIALLY BURIED CIRCA POST-1965 (PHOTO COURTESY OF JIM WALKER)

DISCOVERY OF POLLUTION

It was a beachcomber who in April 2006 discovered the threat of pollution from the Catala. Coming upon vestiges of the ship protruding from the sand (Figure-2), the gentleman thrust a stick into an unsecured portside hatch in the partially exposed deck. The stick was withdrawn dripping with black oil, an event that prompted the notification of the Washington Department of Ecology (Ecology). Quickly assuming the role of the lead agency, Ecology assembled an investigative team that included a naval architect, an environmental site assessor, an asbestos abatement company and a marine salvage contractor. During a two day site visit the team mapped the ship's resting position, confirmed the presence of asbestos, drilled 12 perimeter soil borings and secured the open hatch with a padlocked blind flange. It was evident that during the prior effort to bury the ship some or all of the fuel oil had never been removed.

FIGURE-2: THE VISIBLE PORTION OF THE CATALA IN APRIL 2006 (PHOTO COURTESY OF THE WASHINGTON DEPARTMENT OF ECOLOGY)

DAMON POINT – ENVIRONMENTALLY SENSITIVE

Gray's Harbor in general and more specifically Damon Point are prime habitats for an interconnected biological pyramid that encompasses grey whales, harbor seals, salmon, trout, herring, anchovies, crabs and other benthic organisms. Migratory waterfowl rest there while following the north-south West Coast flyway. The area annually sustains small shorebirds, ducks and geese, loons and two rare and troubled bird species. The federal Endangered Species Act (ESA) lists the western snowy plover as threatened while the streaked horned lark is similarly listed by the State of Washington; it is also a candidate for ESA protection. Both species are late season ground nesters that are vulnerable to extinction due to a contracted breeding range, habitat loss and recreational human interference.

This sensitive site's unknown threat was the extent of pollution lying within the Catala's deteriorating hull. Historic meteorological and ocean climate data showed that winter storm surges annually inundate the Damon Point spit. Indeed a paved road, now long washed away and accreted over with sand, once ran from the parking lot to the spit's terminal point. These surges were likewise capable of further exposing the Catala and potentially release the fuel oil resting in her tanks.

REGULATORY STAKEHOLDERS

Multiple regulatory stakeholders had interests in the ship. To the Washington Department of Ecology's Spill Response Program, the Catala required emergency action to pre-empt a spill from occurring in a place of ecological significance. The Washington Department of Natural Resources, as steward of the State's 2.4 million acres of aquatic lands, owned the land where the Catala had been abandoned and was also concerned about the pollution threat from the vessel. Washington Parks and Recreation Commission functioned as the administrator of area ocean beach recreation. Both the U.S. Fish and Wildlife Service (USFWS) and the Washington Department of Fish and Wildlife (WDFW) were resource trustees for the wildlife species dependent upon the Damon Point area for habitat. Additional permit authority was vested with the U.S. Army Corp of Engineers and Grays Harbor County. The U.S. Coast Guard was no longer actively involved in the Catala following its directive to secure the open hatch prompting this effort.

Proponents of aquatic projects, whether they are public institutions or members of the private sector, face a number of individual permit requirements. Eighteen months could be considered "fast track" to permit a marine project of standard significance while 3-year application periods are not unheard of. Despite the fact that the Catala was an emergency action, Ecology would still be required to achieve resource trustee concurrence and win permits from the statutorily-responsible regulatory agencies before remedial actions could begin. Those permits and their issuing agencies were identified as:

- Hydraulic Project Approval -Washington Department of Fish and Wildlife
- Right of Entry - Washington Department of Natural Resources
- Section 404 / Nationwide Permit 38 "Cleanup of Hazardous and Toxic Waste" – Corp of Engineers
- Section 404 / Nationwide Permit 22 "Removal of Vessels" – Corp of Engineers
- State Environmental Policy Act Exemption – Washington Department of Ecology
- Shoreline Management Act Exemption – Grays Harbor County

QUANTIFYING THE WORST-CASE SCENARIO

Delineating the sand-concealed ship was one of the first tasks for the stakeholders and their investigative team. With information gathered from local and archival sources, naval architects from the Glosten Associates identified a sectional rendering that could reasonably be attributed to the Catala. Using field measurements from the exposed portion of the wreck, Glosten personnel were

able to create a 3-dimensional model of the ship and calculate the potential oil capacity of her tanks.

Five integral tanks were identified as likely oil holders:

Forward Deep Oil Tank:	5,984 – 6,358 gallon capacity
No. 1 Fuel Oil Tank:	14,961 – 22,442 gallon capacity
No. 2 Fuel Oil Tank:	8,977 – 13,465 gallon capacity
No. 3 Fuel Oil Tank	7,481 – 11,221 gallon capacity
No. 4 Fuel Oil Tank	3,740 – 5,984 gallon capacity

Under the worst-case scenario almost 60,000 gallons of persistent product could be entombed in the wreck's double bottom tanks and free-standing day tanks. To complicate the scenario, Glosten's 3-D model (Figure-3) portrayed the ship as listing 23° to the starboard and trimmed at the stern by over 5°. The keel, at its lowest point, could lie 26 feet below the existing terrain grade which was composed of unconsolidated granular sand and fine silt.

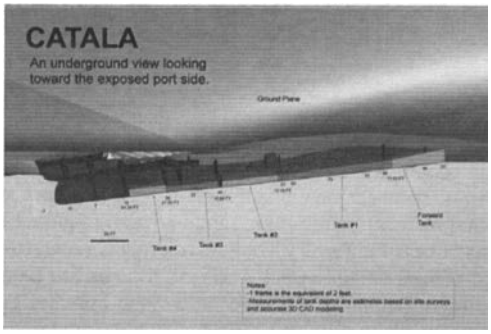

FIGURE-3: NAVAL ARCHITECT'S BELOW GRADE VISUALIZATION OF THE CATALA (RENDERING COURTESY OF THE GLOSTEN ASSOCIATES)

CONTRACTOR STRUCTURE

Following the initial investigation, Ecology had, by the end of June 2006, developed a two season approach and a contractual mechanism for mitigating the pollution threat from the Catala and permit applications were submitted to the appropriate agencies. Global Diving & Salvage, Manson Construction, National Response Environmental Corporation (NRCES), PSC Environmental Services and Walker Specialty Construction would participate in a teaming arrangement to remediate the ship. Functionally, Global would act as the primary site-responsible contractor with the other firms contributing resources according to their individual expertise. Because of the conservation strategy protecting the threatened snowy plover and the streaked horned lark, USFWS and WDFW felt strongly that work could not safely begin until the birds' nesting season was over; thus July 31, 2006 was the soonest the contractors could mobilize to Damon Point. Based on a metocean data risk assessment of the onset of early winter storms, Ecology advised the contractors that they would be expected to vacate the site for the first season by September 30, 2006; a short amount of time to accomplish much unquantified work.

WORKING WITHIN THE INTERTIDAL ZONE

The Catala partially lay within the intertidal zone. Though subject to annual variations, it was believed that tidal waters impinged upon the wreck from two sides in a wedge shaped pattern that proceeded from her port quarter to just starboard of the No. 1 tank centerline bulkhead. Over the years the Pacific Ocean had scoured a channel along the Catala's port side to feed a saltwater lagoon in the center of the spit; the channel flow changed direction four times daily with estimated current speeds of up to 3.2 knots. The team was faced with three immediate technical challenges: 1) how to protect the personnel working below grade in unstable soils, 2) how to provide adequate containment in the event of an uncontrolled release of oil and 3) how to manage the encroachment of tidal waters.

Conceptually, a large sheet pile cofferdam or cell was the preferred method for overcoming the immediate technical challenges (Figure-4). However, information from which to perform defensible engineering calculations was scarce. Soil borings taken during the late spring site investigation were for environmental purposes only; intact cores to yield geotechnical information did not exist. Without specific knowledge of the native soil, structural engineers at Reid-Middleton, the sheet pile cell designer, were forced into evaluating a succession of ultra-conservative designs given the requirements of the cell. Those requirements could be summarized as: 1) protecting personnel working in up to a 26 foot deep excavation with the potential for 7 feet of above channel bottom tidal water on the wet side of the sheet pile wall and 2) having the structural integrity to remain intact through winter conditions characterized by overtopping green ocean water.

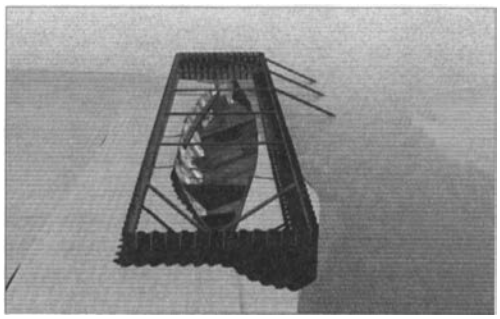

FIGURE-4: NAVAL ARCHITECT'S RENDERING OF THE CATALA INSIDE THE SHEET PILE CELL (RENDERING COURTESY OF THE GLOSTEN ASSOCIATES)

While a sheet pile cell, however robust, could protect the workers, how could it effectively be dewatered? With the ocean on three sides of the narrow spit, the saltwater aquifer was thought to be near the surface; a condition easily confirmed by removing a few shovelfuls of sand. One consulting hydrogeologist estimated that between 500,000 and 3 million gallons of water per day would need to be pumped from the cell to keep it dry. Mechanically moving that volume of water was achievable; uniformly meeting the water quality discharge criteria of a Total Petroleum Hydrocarbon level of < 10 ppm and a background turbidity level of < 17 NTUs *was not* achievable. Time and funds did not exist for either further study or the equivalent of building a temporary municipal-grade water treatment plant.

Confident that a sheet pile cell could fulfill its structural mission, the project was mobilized on July 31, 2006. The overall urgency was such that the dewatering issues would just have to be solved in the field.

VISCOUS OIL REMOVAL

At ambient summer temperatures (> 70°F) the Catala's bunker fuel was pourable though viscous. Common prior experience convinced the project team that black oil is more successfully pumped when its viscosity is reduced. Two candidate methods were evaluated: introduction of a bio-fuel cutter stock and the application of heat. Because tank integrity was unknown, or at least suspect due to the effects of age and corrosion, circulation of a cutter stock was deemed too environmentally risky, sheet pile containment not withstanding. Evaluation of the remaining heat option was then

subdivided into 1) methods that more or less uniformly increased product temperature throughout each entire tank, and 2) the application of localized heat through a heat exchanger to raise product temperature at the pump suction (Figure-5). Of the two, the localized method was selected although sufficient resources to heat an entire tank volume were mobilized to the site. Steam was the initial favored heat source until a consulting thermodynamic engineer made a winning argument for using a hot water system. Hot water would enter the heat exchanger at 200°F and be able to heat the surrounding oil to 120°F imparting nearly the same heat transfer ability as steam but with a simpler and safer delivery.

FIGURE-5: USING A HEAT EXCHANGER TO INCREASE PRODUCT TEMPERATURE AT THE PUMP SUCTION

Ecology authorized the first season workplan based upon construction of a sheet pile cell, the mass excavation of the sand covering the Catala, removal of the oil through the application of heat, and industrial cleaning of the emptied fuel tanks. With the mitigation of pollution anticipated to be complete by late fall 2006, the effort to remove the ship and restore the site would be deferred to the second season in 2007.

INFRASTRUCTURE CONSTRUCTION

At one time, an asphalt road traversed the length of the spit although the road had long been covered by 2 – 4 feet of sand. A break in the remaining pavement occurred within 100 feet of the Catala, making the ship an island bounded by the waters of the lagoon channel on one side and a dry scour area on the other. Before any mobilization could occur, the access infrastructure would require repair. Crews began by clearing sand from over 1,100 lineal feet of road; in some areas the side cast sand was 11 feet high creating a tunnel-like effect. Two sections of road were in need of more than just sand clearance: one 133 foot section was completely undercut leaving the unsupported pavement cantilevered over a void; the other area, the site of a lost culvert, was soft and uncompacted. In a five day campaign involving geo-textile, graded aggregates, timber crane mats and heavy equipment all areas of the access road were made ready for mobilization.

MOBILIZATION

Trailers, heavy equipment, auxiliary power units and materials characterized the Catala mob. A Manitowoc 4000 lattice boom crawler crane was the most challenging piece of equipment to mobilize; arriving in a convoy of 11 semi-trailers, there was valid concern that the single lane access road to the ship would not support the weight of the heaviest trailer carrying the crane's car body. With little room to maneuver at the terminal end of the road, the trucks delivered crane components one trailer at a time in sequential order for immediate assembly.

SHEET PILE CELL CONSTRUCTION

Construction of the sheet pile cell was the first task. The project team, in close consultation with Reid-Middleton, agreed that the cell would parallel the ship's port side for 244 feet with 54 foot end walls running perpendicular to her bow and stern. Thereafter the agreement became less solid; the team initially visualized a structure of three full-sides with the fourth side being a partial wall and ramp. Given the potential for a deep excavation and the unknown geotechnical conditions, the design engineers felt that only a four-sided cell could overcome the probability of a strong inward bending moment. Reinforcing the cell became the next point in need of resolution. Nine design revisions incorporating wale beams, cross braces, corner gussets and buttresses were proposed before concurrence was reached on one that enclosed a 13,176 square foot area. As the design evolved, Manson Construction, cognizant of the brief work window, was purposefully driving sheets to an average depth of 39 feet. The project team would have to achieve concurrent task progress if they were to mitigate the threat by the targeted September 30, 2006 first season demobilization date.

EXCAVATION

As the sheet pile wall progressed counterclockwise from the bow, excavation occurred to expose the dry upland portions of the ship (Figure-6). It soon became evident that not only had the Catala become buried by sand, but that the sand had also migrated into her interior spaces packing every void, a worst-case scenario volume calculated at 5,000 cubic yards. The tank tops had to be exposed to access the oil within. Deck space above the Forward Deep Oil Tank was easily cleared by an excavator. The space above the No. 1 Fuel Oil Tank, though within the excavator's reach, presented a greater challenge. A section of the port side shell had in previous years been cut away to the tank top while the starboard side shell and some decking remained angled at the final resting list. The excavator would have to approach the edge of the excavation cautiously scooping sand while maintaining a far enough setback to keep its ground pressure from collapsing the excavation. Sand removal from these exterior areas was periodically supplemented by the use of a small 1.25 cubic yard clamshell bucket. Though slow and requiring re-rigging of the crane head block, the little clamshell proved its value as the appropriate tool for vertically-accessible-only locations.

FIGURE-6: AERIAL VIEW OF THE CATALA REMEDIATION PROJECT (PHOTO COURTESY OF THE WASHINGTON DEPARTMENT OF ECOLOGY)

PSC Environmental had mobilized two "air movers" to undertake the task of removing accreted sand from the ship's interior. These truck mounted vacuum units, capable of an 8 cubic yard payload, extracted sand from the ship through 8 inch diameter flexible corrugated pipes. Though labor intensive they performed

efficiently on dry sand, though less so on wet. In excavating the access impaired below deck spaces, the air movers proved to be the best available technology for the job.

ASBESTOS ABATEMENT

Anticipation of encountering asbestos containing material (ACM) had always been part of the remedial action plan. White fibrous chunks were scattered throughout the native soils prior to excavation. Sheets of the material, affixed to the bulkheads of machinery spaces, became visible as the sand was removed. Walker Specialty Construction was the teaming member responsible for asbestos abatement. Fully suited in Tyvek® coveralls and respirators, their technicians worked daily on their hands and knees with archeological diligence to remove the material from the soil. By the end of the 2006 season, Walker personnel had extracted 22 cubic yards of ACM, most of which was not bigger than a phone book.

PUMPING

It had been the plan to completely clear sand from the tank tops before attempting to access the oil. Locating the wedge-shaped liquid level in the tanks was thought to be more accurate if the tank tops could be seen. Hot tapping the heat-enhanced tanks at their lowest point was viewed as the quickest, cleanest method of pumping the oil. Ten days into the project, that initial pumping plan abruptly changed.

First on site each day was the Manson pile driving crew. On the morning of August 9, 2006 the "pilebuck" foreman reported that the prior night's high tide had distributed tar balls and sheen throughout the partially completed cell. None of the contamination escaped the preventative NRCES-placed containment boom encircling the cell, validating the project's oil spill contingency plan; however this event reaffirmed the emergency nature of the Catala response. Subsequent investigation revealed a below-grade opening cut into the port side shell years earlier during a previous salvage effort. The opening was sealed by a vertical sheet metal patch held in place only by soil friction. On the other side of the sheet metal was the No. 1 Fuel Oil Tank with a volume of up to 22, 442 gallons of black oil. It was theorized that concussions from the vibratory hammer driving the sheet piles loosened the patch allowing the tide to hydraulically transport the oil outside the tank. With the cell barely a quarter complete, the project team could only speculate on how many other sheet metal patches existed in the 229 foot ship's hull.

The hot water boiler and heat exchangers were still days out on delivery and the ship remained largely buried beneath the sand. A quick risk assessment convinced the project management that priorities had changed and oil removal had to start immediately. Vacuum trucks were mobilized to the site initiating their first draw from the No. 1 Fuel Oil Tank through the patched port side opening. As the viscous oil level fell beyond the reach of the stinger, crews cold-cut access ports across the tank tops. The procedure lacked the technical precision visualized in the workplan but it was simple, effective and progressive toward achieving the first season's goal of oil removal. It remained the method of product extraction throughout the duration of the project, augmented only by the application of localized heat.

DEWATERING

As three sides of the sheet pile cell reached completion, dewatering the cofferdam could begin in earnest. A shallow sump and 4 inch submersible pump could effectively manage the inflow of water into the cell, but the effluent was turbid and periodically contaminated with oil. The turbidity could be reduced by using frac tanks as sedimentation ponds, but it was impossible to guarantee a pollution-free effluent without treating the water. To insure water quality compliance, a temporary water treatment system was constructed using five frac tanks and three carbon cells. Frac tank elevations were set so that the gravity outflow of water through the carbon cells was at equilibrium with the pumped inflow. The post carbon-treated water was then returned to the saltwater aquifer using an infiltration basin. Surplus tank capacity enabled the system to remain in balance through greater tidal ranges and maintenance periods to backflush the filters.

STRUCTURAL SHIPBOARD REINFORCEMENT

In reality the hull of the Catala was primary containment while the sheet pile cell and outer boom were respectively secondary and tertiary measures. Sand accreted on the decks and packed into the interior spaces performed two functions: 1) acting as a counter force against the inward bending moment of the surrounding ground and 2) serving as a sponge to wick tidal water throughout the hull. As that sand was removed, the risk increased that ground pressure might collapse the starboard side shell until the cell was completed. Additionally, upward hydraulic pressure from groundwater continued to force water through the porous hull, contaminating it with oil that clung to the ship's interior from historic releases. Consultations with the Glosten Associates naval architect convinced the project team that to guard against collapse of the starboard side shell, the hull would require diagonal bracing every 10 feet between the side shell and deck (Figure-7). Controlling the capillary movement of water could only be achieved by building false bulkheads between the tank tops and making the ship watertight between each bulkhead.

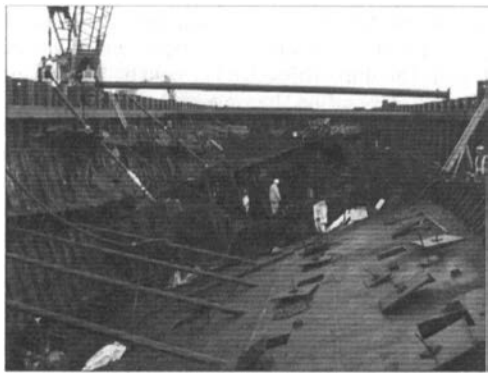

FIGURE-7: WORK ABOARD THE REINFORCED CATALA INSIDE THE SHEET PILE CELL

TANK CLEANING

As the tanks were drained, crews from PSC Environmental began industrially cleaning the spaces. Heavily baffled, the tanks conformed to the shape of the hull offering very little room for personnel to maneuver (Figure-8). Cleaning followed the pattern of hand scraping sticky clingage, steam cleaning the tank walls, intermediate washing with an undiluted citrus degreaser and lastly, a steam rinse. There was concern that the lapped plate-and-rivet construction would hold residual oil, allowing it to weep to the tank bottoms, but that fear never materialized. As the ship was freed of sand, tank cleaning continued in a fore to aft progression. Since oil had migrated throughout the ship over the years, all non-tank areas were also steam cleaned removing the source of future contamination.

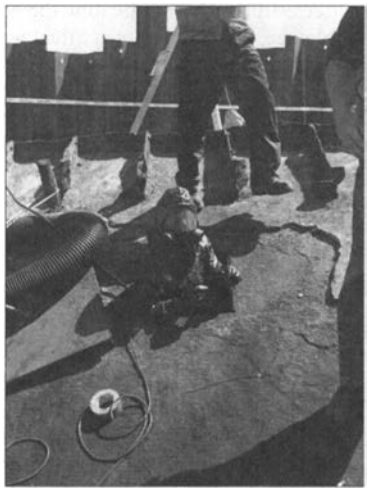

FIGURE-8: A TANK CLEANER EMERGES FROM THE CONFINED FORWARD DEEP OIL TANK

MOTHBALLING FOR WINTER

The project team worked up to the end of September 2006 removing 31,064 gallons of Bunker C fuel oil from the Catala. All but the No. 4 Fuel Oil Tank had been inspected, pumped and cleaned. The decision was made to mothball the project for the winter and effect completion in the spring 2007. The machinery spaces surrounding the No. 4 tank remained packed with sand and were welded shut in preparation for the winter. To discourage vandals, a chain link fence crowned with razor wire was erected along the top of the sheet pile cell. The ship, stripped of her sand ballast and influenced by groundwater pressure, had become lively during the final month. To keep her stable over the winter, the tanks were pressed-up and a surcharge of water was placed on top of the deck. Dewatering efforts within the sheet pile were stopped leaving the Catala under the forces of the natural tidal seepage and her increased ground reaction. Though later than preferred, the site was fully demobilized by October 20, 2006. Two weeks later, the ocean washed out the first season's access road leading to the Catala.

EPILOGUE – SEASON TWO

All but 1,170 gallons of oil was removed in the 2006 season. Using the same team, the Washington Departments of Ecology and Natural Resources extracted the remaining fuel, removed the ship and restored the site during the second season in 2007 (Figure-9). The project's two season accomplishments can be summarized[3] as:

~ Heavy Fuel Oil Removed and Recycled	34,500 gallons
~ Related Oily Water Transported Offsite for Treatment[4]	360,000 gallons
~ Oil-Contaminated Sand Removed and Disposed	2,585 tons
~ Asbestos-Containing Material Removed and Disposed	33 cubic yards
~ Scrap Steel Recycled	345 tons

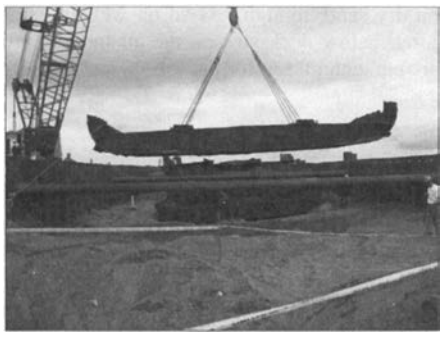

FIGURE-9: THE CATALA WAS REMOVED FROM DAMON POINT DURING THE SECOND SEASON IN 2007

BIOGRAPHY

Mr. McCarthy has practiced construction and applied science as a project manager for over 15-years. He has taken civil, remedial, and marine projects from design through start-up as well as having supervised remedial actions and emergency responses. A licensed professional mariner, Mr. McCarthy consults in heavy salvage, marine construction and marine pollution control. He has additional experience with aquatic permitting and complex logistics management for remote site operations. A graduate of the University of Illinois at Champaign-Urbana, Mr. McCarthy has enhanced his practical skills with technical courses in instrumentation, process controls, water treatment, rigging and heavy lift.

ENDNOTES

1 The cost of the Catala remediation was approximately $188 (USD) per gallon of Bunker fuel recovered; the emergency response costs of other West Coast persistent oil spills have exceeded $1,052 (USD) per gallon spilled
2 Ocean Shores Interpretive Center brochure
3 Source: Washington Department of Ecology
4 Does not include water carbon-treated on-site and reintroduced into the saltwater aquifer