Tank Barge ARGO: A Case Study on the Employment of NCP Special Teams

Abstract

On October 20, 1937 the Tank Barge ARGO sank during a fall storm on western Lake Erie. The barge was reported to be carrying 100,000 gallons of crude oil and 100,000 gallons of benzol and was thought to have sunk in Canadian waters. The ARGO was identified as a potential polluting wreck in NOAA's Remediation of Underwater Legacy Environmental Threat (RULET) project and ranked as the greatest legacy underwater environmental threat on the Great Lakes. However, the exact location, condition, and disposition of the sunken barge and its cargo were a mystery for over 78 years. On August 28, 2015 the Tank Barge ARGO was discovered by the Cleveland Underwater Explorers in U.S. waters, beginning a three month response by the U.S. Coast Guard Federal On-Scene Coordinator to mitigate the substantial threat to the environment and public health posed by the ARGO's cargo. Rife with challenges, the response included complex dive operations, hot tapping, chemical lightering and storage, environmental protection and monitoring and severe logistical constraints, all of which required an extensive incident management organization and utilized almost every "special team" under the National Contingency Plan. This case study summarizes the response to the Tank Barge ARGO and details how "special teams" were utilized by the Federal On-Scene Coordinator to safely and effectively respond to the environmental threat. Specifically, the capabilities of the National Strike Force, District Response Group and District Response Advisory Team, and Scientific Support Coordinator during this response are highlighted and offered as a best practice for other oil and hazardous substance responses.

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Introduction/Historical Background

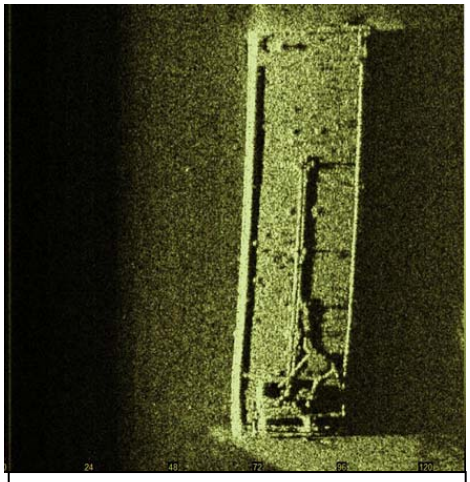
No Trace of Argo with Cargo of Benzol is Found in Lake Erie Near Islands; Shipping Warned. This was the title of a 1937 newspaper article describing the search and rescue efforts of the U.S. Coast Guard (USCG) after the tank barge ARGO foundered and sank during an October storm on Lake Erie. The ARGO is a single skin, steel riveted hull tank barge that was constructed in 1911. It measured 120 feet by 35 feet with a depth of 12 feet. Designed for coastal service on the East Coast, it was home ported and operated out of New York, NY. However, on this particular voyage it had ventured into the Great Lakes on a round trip voyage from New Jersey to Sault Ste. Marie. Pulled by the tug SYOSSET, it was returning to New Jersey fully loaded with 4762 barrels of product; reported to be one half benzol and one half crude oil. The tug and barge was believed to have sought refuge near Pelee Island during the storm and encountered strong winds and waves causing the coastal barge to sink. The two crew members on board the ARGO were rescued by the tug SYOSSET. The barge was never located, but it was thought to reside just north of the U.S./Canadian border in Canadian waters (Garrett, 2015) and (Helton et al., 2016). It was unknown how much; if any, of the cargo remained on board the barge, though there had been occasional reports of oil sheen in the general area of the wreck.

As a result of a congressionally mandated research project to identify wrecks with the most ecologically and economically significant pollution potential in U.S. waters, the ARGO was identified as one of 87 priority wrecks in NOAA's 2013 Remediation of Undersea Legacy Environment Threats (RULET) report. Five out of the 87 priority wrecks are found in the Great Lakes and of these five, the ARGO was ranked as the greatest legacy underwater environmental threat on the Great Lakes. Based upon available information, the report recommended the use of

surveys of opportunity to attempt to locate this vessel and gather more details on the vessel's condition. The report also recommended that information on the ARGO be noted in the Area Contingency Plans so that if a mystery spill is reported in the general area, this vessel could be investigated as a potential source. Furthermore, outreach efforts with the dive and fishermen community who frequent the area to gain awareness of changes in the site was also suggested (NOAA, 2013).

Discovery and Assessment

In August 2015, while performing a search for historical shipwrecks in Lake Erie using side scan sonar, a member of the Cleveland Underwater Explorers (CLUE) detected a target of interest on the lake bottom. After post-discovery research, CLUE concluded that they had found the ARGO which had sunk nearly 80 years earlier. Thought to have sunk in Canadian waters, it was discovered in U.S. waters approximately nine miles east of Kelly's Island off of Marblehead, Ohio. The CLUE and the National Museum of the Great Lakes contacted USCG District 9 and NOAA with the discovery. After reviewing the evidence and concerned with the significant pollution potential and threat to public health, the USCG supported further assessment of the vessel's condition and disposition (CLUE, 2016). In late October of 2015, CLUE divers matched the barge dimensions to the historical documented construction of the tank barge ARGO. During this operation, support personnel detected a strong "solvent" smell and notified the USCG that the barge may be leaking. Pollution responders from USCG Marine Safety Unit Toledo went to the scene and also reported



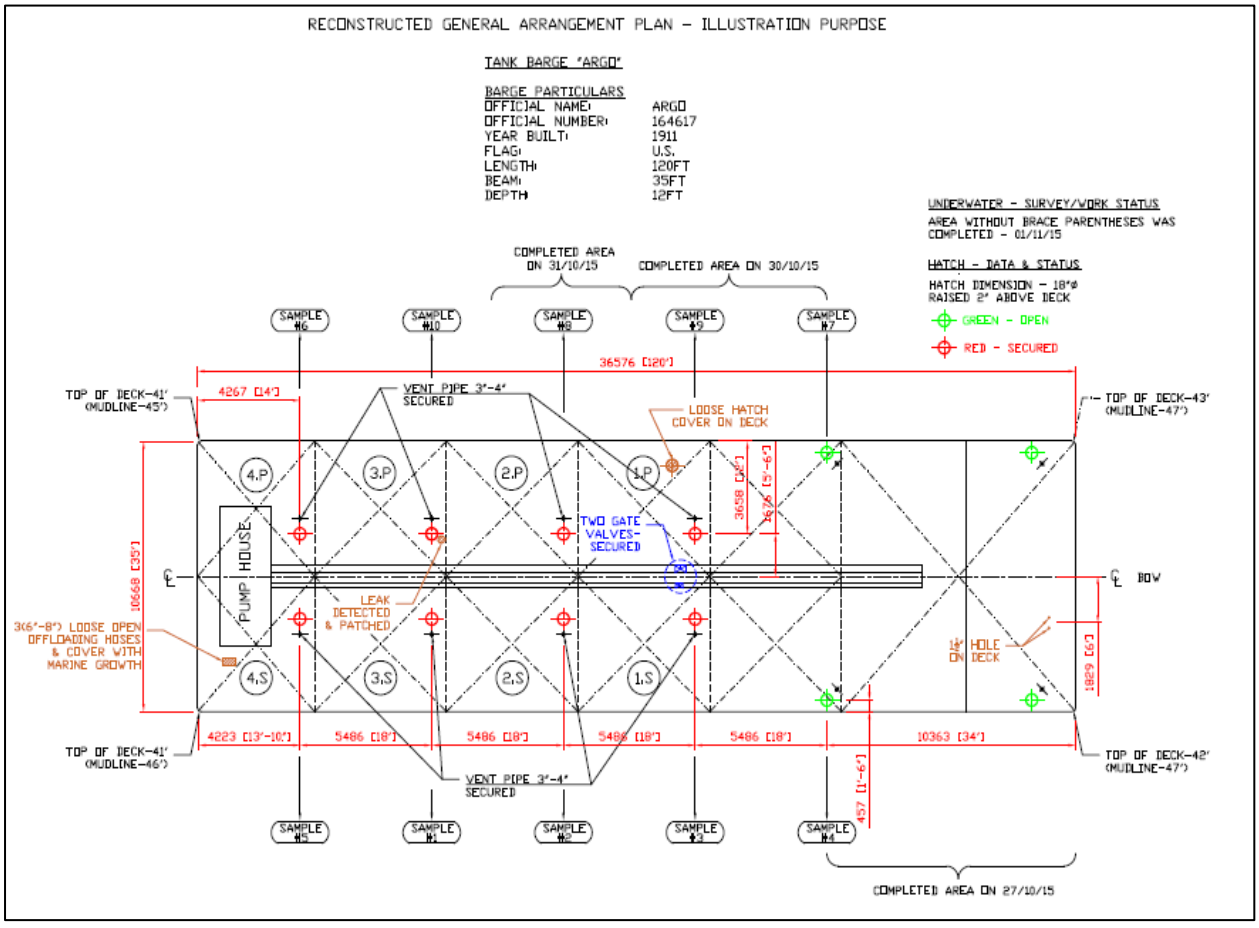
Sidescan image of the ***Argo*** (Sidescan by Tom Kowalczk / CLUE); http://www.clueshipwrecks.org

a solvent odor. The following day, a USCG overflight observed a 400 yard by 20 yard sheen in the vicinity of the sunken barge, indicative of an oil pollution source. With reports of a discharge from the barge, a safety zone was established around the site and the Commander Sector Detroit/Federal On-Scene Coordinator (FOSC) established a Unified Command between with the State of Ohio Environmental Protection Agency to initiate a coordinated response to the pollution threat. However, as the incident grew in complexity it quickly exceeded the capabilities of the local USCG resources and it was evident additional resources would be needed to safely and effectively manage the incident.

Response Summary

The Unified Command initially had very limited information available and avoided making assumptions that were not supported by facts. This drove the response into a vigorous and comprehensive assessment phase. The overall objectives of the response were: safety and security of responders; protection of public health; assess and control the source of the spill; identify and protect resources at risk; and keep the public and stakeholders informed. The USCG contracted T&T Marine Salvage to conduct contaminated diving operations, complete an underwater structural assessment of the sunken barge, identify and patch the source of the leak, and develop a cargo removal plan. Working at a depth of 45 feet and in less than one foot visibility, the divers completed a hand over hand assessment of the barge. The assessment revealed an intact barge covered in heavy marine growth and Zebra Mussels. The barge was partially buried in the muddy lake bottom with only five feet protruding above the mud line. At the direction of the unified command, divers systematically collected samples of marine growth and sediment in and around the barge to better characterize the site. The divers identified a total of 12 hatches. The four forward hatches were open and were thought to be void spaces. The

eight remaining hatches were found to be closed, indicating the potential for containment of the original cargo. Due to the age of the vessel there was no information on the internal construction or configuration of the barge. It was unknown if there were eight individual cargo tanks and if they were manifolded together, or if port and starboard tanks communicated, or if there was just one large tank with eight hatches or expansion trunks. It was also unknown whether the tank(s) could contain a mixture of benzol and crude oil or if the benzol and crude oil were shipped as separate commodities. Additional information regarding the cargo was required to make informed decisions and plans of action.



Schematic produced by T&T Marine Salvage for the unified command showing results of the hand-over-hand assessment including dimensions, hatch positions and sample locations.

With the potential for a substantial amount of cargo remaining within the barge, plans were made to hot tap and sample each intact tank and remove the barge's contents as required. The barge's tank configuration was unknown, however a conservative planning assumption was made that each of the closed tank hatches sat atop of an intact tank. The initial plan was to hot tap and install a valve at the top of each tank for product removal and a valve at the lowest point on the side of the tank to allow lake water to backfill the tank and equalize pressure as product was removed. This method required excavation of sediments around the barge to access the lowest point of the tanks. Excavation of sediments posed a series of challenges and concerns, including safety of divers, stability and integrity of the vessel, and the handling and disposing of potentially contaminated sediments. To better characterize the sediments prior to excavation, a comprehensive sediment sampling plan was developed. However, prior to implementing the plan and taking core samples, all operations were suspended.

On November 4, 2015 while clearing a port side surface location on the ARGO's hull for assessment and hot work preparation, a rivet dislodged creating a one inch diameter hole. The hole was quickly plugged but an unknown substance was released from the ARGO. When the substance reached the surface of the water, air monitoring sensors alarmed and recorded spiked readings of 94 -104 parts per million (ppm) benzene (the NIOSH short term exposure limit for benzene is 1 ppm). Personnel at the surface were briefly exposed to the chemical vapors. Dive equipment that came in contact with the substance while underwater showed signs of degradation, raising serious safety concerns and questions about the identity and concentration of the product. Due to personnel exposures and equipment degradation, the unified command suspended operations, called for a safety stand down to reassess the situation, and requested

additional resources to augment the incident management team. Due to the increased risk to public health, the safety zone was expanded to one nautical mile around the barge.

Prior to moving forward with any removal plans, the unified command needed to identify the product and understand its hazards. On November 9th, divers briefly removed the plug that sealed the rivet hole and took a source sample. Again, spikes of benzene were recorded by surface air monitoring equipment and the diver's suit and facemask showed signs of degradation after coming into contact with the product. The sample was analyzed by the Louisiana State University and the U.S. Environmental Protection Agency's Edison laboratory. Both labs were consistent in their findings and identified the product as primarily benzene (70-79%) with lesser concentrations of toluene and xylene (Helton et al., 2016).

With the product identified as benzene and questionable integrity of the riveted hull, the unified command worked with T&T Marine Salvage to develop a cargo removal plan that eliminated the need to remove sediments in an effort to minimize actions that could negatively impact the integrity of the barge. Instead of hot tapping and installing valves at the top and bottom of a tanks, access would be made from the top of the barge only. The plan called for divers to install ball valves and a stand pipe with an internal tank pressure monitoring device at the top of each tank. As the contents of a tank are removed through the ball valve, lake water could flow into the tank through a standpipe to displaced product and equalize any pressure differential. An important part of the cargo removal plan was temporary storage. Since this type of product is no longer transported on the Great Lakes, there were no suitable temporary storage resources readily available to contain any lightered product. A custom temporary storage barge had to be pieced together using a deck barge, six temporary storage tanks, and a vapor recovery system. Due to the volatility of the product, every component of the pumping and temporary

storage system was meticulously examined to ensure chemical compatibility. On November 20th, a prototype installation was completed on the previously leaking cargo tank, as a proof-of-concept prior to moving forward with the remaining tanks. The proof of concept was successful, resulting in the removal of approximately 12,000 gallons of benzene and water mixture.. Working within intermittent favorable weather windows to safely conduct operations, product was removed from the remaining tanks using the hot tapping method. On December 2nd, all lightering operations were completed. In total, approximately 48,000 gallons of benzene and benzene-water mixture was removed, of which an estimated 1,600 gallons was pure product. In addition, there was approximately 10,000 pounds of spent carbon within the vapor recovery system that was used to filter harmful vapors.

Special Teams and the Keys to Success

Faced with significant public health and safety issues, international coordination, complex dive operations, hot tapping, chemical lightering and storage, deteriorating weather conditions, environmental protection and monitoring, and severe logistical constraints, the FOSC called upon a number of National Oil and Hazardous Substances Contingency Plan (NCP) Special Teams to augment the incident management organization. The NCP prescribes the existence of Special Teams that are organized, trained, and equipped to assist the FOSC in their oil and hazardous substance preparedness and response mandates. During the ARGO response, the District Response Group/District Response Advisory Team, National Strike Force, and the NOAA Scientific Support Coordinator were critical to overcoming significant challenges and achieving a successful response.

District Response Group (DRG)

The DRG is a Coast Guard Special Team under the NCP, but it is not an operational entity in the traditional sense. It is a doctrinal concept that provides a framework within which the Coast Guard Districts organize their resources for a pollution response operation. This framework ensures that all Coast Guard assets residing in the District can be brought to bear in the most efficient manner, to assist the FOSC in responding to an actual or substantial threat of discharge from a vessel, facility, or other source. The District Response Advisory Team (DRAT) is the nucleus of the DRG. The DRAT is designed to be comprised of four to six people and designated as the coordinating body for the DRG. As a readily accessible, deployable team, the DRAT is charged with providing technical and logistical support for the FOSCs within their respective District during oil spills and chemical releases. The DRAT Supervisor is the focal point within the District organization for all activities involving the DRG and DRAT. Recent organizational changes in some Districts have resulted in a variety of personnel organization structures for DRATs, with some districts reprogramming virtually all their DRAT positions to other duties. However, the District 9 (D9) DRG and DRAT has proven to be the gold standard with an exceptionally proficient and proactive team, meeting the original intent of the Oil Pollution Act of 1990 (OPA90) and U.S. Coast Guard policy. The D9 DRAT provides strategic guidance for D9 units overseeing responses to regionally or nationally significant incidents. Each D9 unit identifies baseline resources likely to be requested by the DRAT to support these types of events. The D9 DRAT identified and sourced personnel and resources to provide technical, logistical support and subject matter expertise to Sector Detroit in support of the ARGO response. As the case with ARGO, D9 DRAT first utilized D9 DRG resources, drawing

on trained personnel from every USCG Sector, but quickly coordinated with other NCP augmentation forces as the need for additional expertise was required.

The D9 DRAT was critical to the success of the ARGO response. Throughout the response the DRAT assisted the FOSC with building and maintaining the optimal organizational structure. With expansive knowledge of all District response resources and personnel, a proactive role in training and preparedness activities involving all of the District's field units, and active engagement with the Area Committees and Regional Response Teams, the DRAT supervisor and staff were optimally postured to select personnel from within the District staff to fill critical command and general staff positions. Recognizing the need for both ICS and pollution response subject matter expertise, the DRAT coordinated the use of Atlantic Strike Team and USCG Incident Management Assist Team (CG-IMAT) to fill the Coast Guard Incident Commander and the Operations Section Chief positions respectively. In addition, the DRAT supervisor sought opportunities to incorporate less experienced personnel within the response organization in order to mentor and develop the next generation of responders, which in turn would bolster the DRG's capability for future responses. Throughout the response, the DRAT supervisor served as a deputy to the Coast Guard Incident Commander, focusing on process optimization and international coordination. With the barge location only miles from the U.S./Canadian border and the potential for impacts to Canadian resources, there was a need for international coordination. The D9 DRAT, having responsibility for the Great Lakes Operational Annex (CANUSLAK) to the bilateral Joint Marine Pollution Contingency Plan, had a strong and standing relationship with Canadian Coast Guard counterparts. During the ARGO response, the DRAT was instrumental in creating an International Coordinating Officer position within the response organization. The position was filled by a member of the Canadian Coast Guard, and

all response information was shared freely to ensure situational awareness and facilitate a coordinated response in accordance with the CANUSLAK plan in the event of a catastrophic release. The DRAT also facilitated involvement of Canadian natural resource trustees within the ARGO response organization's Environmental Unit to ensure both U.S. and Canadian resources at risk were addressed.

National Strike Force (NSF)

The NSF is a USCG Special Team and is comprised of the three Strike Teams (Atlantic, Pacific and Gulf), the Public Information Assist Team (PIAT), the USCG Incident Management Assist Team (CG-IMAT), and the the National Strike Force Coordination Center. The NSF is available to assist FOSCs in their preparedness and response duties. The Strike Teams provide highly trained response and incident management technical experts that rapidly deploy to support FOSCs and Incident Commanders in all-hazard preparedness and response activities, including oil discharges, hazardous substance releases, Weapons of Mass Destruction (WMD) and Chemical, Biological, Radiological, Nuclear (CBRN)incidents, and natural disasters. The PIAT consists of crisis communications professionals that assist FOSCs in meeting the demand for public information during a response or exercise. The CG-IMAT is a rapidly deployable, scalable team of incident management experts that supports the Operational Commander in complex incident or crisis management situations for all-hazard, all threat incidents and events.

At the beginning of the ARGO response, the Atlantic Strike Team (AST) was requested to provide air monitoring and product sampling capabilities at the wreck site. The AST deployed their 26-foot Trailerable Aids to Navigation Boat (TANB), and a small team of vessel operators, also trained as oil and hazard material technicians, to provide air monitoring within the safety zone. With the ability to operate in respiratory protection equipment the boat crew monitored

atmospheric conditions and took clean water and sheen samples within the exclusion zone during dive operations. After the November 4th release which exposed divers to the product and benzene vapors, additional National Strike Force resources were requested to assist the FOSC address the increasing complexity and safety hazards associated with the operation. Needing subject matter expertise in ICS, salvage and pollution response, the Commanding Officer of the AST was asked to be the Coast Guard Incident Commander, the Commanding Officer of the CG-IMAT was asked to be the Operations Section Chief, and the AST's Industrial Hygienist filled the Safety Officer position. CG-IMAT and AST personnel also filled leadership positions within the Finance, Logistics and Operations sections. PIAT was requested to establish and lead the Joint Information Center and proactively address all aspects of public information. Combined with the hand selected personnel from the DRG, the Strike Team, CG-IMAT and PIAT effectively augmented the Sector's response organization, creating a highly capable team with the right skill-sets suitable to handle the complex and high risk chemical response operation. Pursuant to the suspension of operations on November 4th and arrival of the Coast Guard Special Teams, a thorough job hazards analysis was performed and additional safety measures were put into place, allowing operations to resume on November 9th. The team of Strike Team and CG-IMAT worked with USCG Salvage Engineering Response Team and T&T's salvage experts to develop a new cargo removal plan.

Scientific Support Coordinator (SSC)

The NCP established SSCs to be the principal advisors to the FOSC for scientific issues, communication with the scientific community, and coordination of requests for assistance from state and federal agencies regarding scientific studies. The National Oceanic and Atmospheric Administration (NOAA) provides SSCs in the Coastal Zone and are the FOSC's point of access

to the entire NOAA scientific support team with expertise in environmental chemistry, oil tracking, pollutant transport modeling, natural resources at risk, environmental tradeoffs of countermeasures and cleanup, and information management. SSC response functions include communication with the scientific community and natural resource trustee agencies, coordination of requests for assistance from federal, state, and local agencies regarding scientific matters, scientific support for operational decisions, hazard evaluation and potential effects of release, and coordinating required emergency consultations for protected resources (e.g., threatened and endangered species, cultural resources, sensitive habitats).

Arguably the SSC was one of the most influential members of the response organization. The SSC delivered data and information that influenced virtually every aspect of the response including weather forecasts, resources at risk, fate and trajectory modeling, chemical analysis of the product, and removal endpoints Working with the staff of multidisciplinary scientists within NOAA's Emergency Response Division (ERD), the SSC provided critical information that informed decision makers on the potential health and safety risks, impacts, and tradeoffs associated with various response options. This ultimately influenced response and protection strategies. The SSC and ERD analyzed the lab results for mussels growing on the barge, sediments immediately adjacent to the barge's hull, and water column samples in an effort to characterize the site. Shallow core samples collected around the barge were unremarkable and did not indicate sediment contamination. There was no indication of elevated polycyclic aromatic hydrocarbons (PAH) in the mussel samples when compared to NOAAs Mussel Watch Program data. With no indications of elevated sediment contamination beyond background, the barge was believed to be intact and its contents contained.

The SSC and ERD developed air modeling and water modeling to characterize the toxic air hazard and fate of contaminated water in the event of a release. Understanding the exposure thresholds and extent of benzene air concentrations were critical and helped determine the size of the safety zone and develop safety controls during times when wind direction threatened human population centers. The conclusions about fate and transport of contaminated water were critical to the development of strategies to protect the environment and drinking water resources.

Prior to conducting any removal operations, it was extremely important to have the resources at risk identified and prioritized, and protection strategies developed and ready to execute in the event of a release. Unfortunately, the sensitive areas and geographic response strategies (GRS) in the Western Lake Erie Area Contingency Plan were not complete. The SSC, working with state and federal trustees within the Environmental Unit, took the lead to identify and prioritize resources at risk and develop GRSs. Working with state, DRAT and Strike Team personnel, each sensitive site was visited and the proposed GRS validated. In addition, each GRS was translated into geographic information system (GIS) and loaded into NOAA's Emergency Response Management Application (ERMA) to enhance the common operating picture.

One of the most important decision points during the response was when to stop pumping, or determining "how clean was clean" with regards to the contact water that would be left inside the barge. Working within the Environmental Unit, the SSC lead the effort to develop an acceptable and practical endpoint standard. The Unified Command's priority was to remove the bulk liquid product inside the barge to mitigate the substantial threat to human health and the environment. The Unified Command recognized and accepted that a small amount of product may remain in the tanks after lightering due to clingage and product trapped within internal

frame structures of the barge. It was determined at the LSU laboratory that the interface between water and product was no longer visible at concentrations less than 5% by volume. Therefore, the Unified Command agreed to the removal endpoint criteria of two consecutive samples taken at the pump manifold that resulted in less than or equal to 5% of free floating product by volume of the sample based on a visual inspection. Once a tank was lightered to this endpoint standard, no further removal action was required and the contact water and residue remaining inside the ARGO was considered to no longer pose a substantial threat to human health and the environment. NOAA conducted both air and water models of a release at this endpoint concentration to support this determination. In actuality, each tank was pumped to an endpoint far below the established standard – there was no visible product in the endpoint samples and the headspace of the samples did not exceed 100ppm VOCs.

Conclusion

The ARGO response required interagency and bi-national cooperation and an incredible unity of effort to address the greatest legacy underwater environmental threat on the Great Lakes. During the 10-week response, the Unified Command collaborated and built a diverse and highly capable response organization of over 170 personnel from 24 Coast Guard units, 13 federal, state, local and Canadian agencies and commercial salvage organizations. Rife with challenges, the response included complex dive operations, hot tapping, chemical lightering and storage, environmental protection and monitoring, deteriorating weather conditions and severe logistical constraints which required technical expertise and experience beyond the capacity of the local unit. The FOSC looked to NCP "Special Teams" to augment the response. The D9 DRAT hand selected qualified and experienced personnel from within the DRG to staff the response organization. The Atlantic Strike Team surged equipment and personnel trained to operate in

hazardous environments to conduct environmental monitoring 9 miles offshore at the wreck site and provide safety oversight. The Incident Commander, Operations Section Chief, Safety Officer, Public Information Officer were hand selected from the Atlantic Strike Team, CG-IMAT and PIAT for their technical expertise and experience. The professional engineers from the USCG Salvage Engineering Response Team worked with T&T Marine Salvage to develop the proof-of-concept lightering and temporary storage system. Finally, the NOAA Scientific Support Coordinator was the conduit for translating complex scientific data into practical information used in nearly every command decision and operation. Federal On-Scene Coordinators should engage NCP Special Teams early on in a response. Always and immediately available to the Federal On-Scene Coordinator, the special teams designated the NCP are critical force multipliers, and in the case of the Tank Barge ARGO, were key to a safe and effective response.

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