NHL Steam Schooner Wapama
Condition Survey and Preservation Recommendations

Richmond, CA

November 2005

Phase 1A Final Report

Architectural Resources Group
Architects, Planners & Conservators, Inc.

NHL STEAM SCHOONER *WAPAMA*
CONDITION SURVEY

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Background

Architectural Resources Group (ARG) has been retained by the National Park Service (NPS) to provide a two-phase Condition Survey of the National Historic Landmark Steam Schooner *Wapama.* This vessel, built in 1915, is the last survivor of over 200 built and is currently resting on a barge at the Richmond Reserve Shipyard in Richmond, CA. *Wapama* was transferred from the water to the barge about 25 years ago because of her deteriorated condition and fears that she might sink at the San Francisco Maritime Historic Park pier. Since then she has received sporadic maintenance, and the ravages of time and exposure to weather and fresh water have taken a heavy toll.

To assist in the evaluation, ARG, as Team Leader, has retained the services of BMT Designers & Planners (D&P) of Arlington, VA for naval architecture evaluation with assistance from Allen C. Rawl Inc. (ACR), experts in wooden ship preservation and construction, and Winzler & Kelly, Consulting Engineers (W&K) of San Leandro, CA for evaluation of the presence of and nature of hazardous materials. Several meetings and on-board surveys have been conducted beginning in mid June 2005 with the goal of providing updated information as to the safety and stability of the vessel and the barge, updated structural analysis of the vessel, and recommendations for near and longer term actions to stabilize and possibly dismantle parts of the vessel. This report reviews the first phase of the work and generally covers the condition of the vessel and identifies a range of action options for consideration by the NPS. The results of this Report will provide the basis for the second phase of the work which will be to identify and evaluate preservation options and select one of the suggested options, or variation thereof, to study in further detail. In addition, at NPS request, we have contracted with the University of Minnesota through the USDA Forest Products Laboratory to perform a physical condition assessment of the main structural members to aid BMT D&P in their analysis in Phase 1B. Based on that report, the information herein may be supplemented and/or revised.

Executive Summary

The significance of the *Wapama* is that she is the last survivor of her breed and she represents an important link in the transition from the wooden sailing schooners of the 19th Century to the steel cargo ships that would be developed shortly after in the late teens and twenties. She and others like her plied the waters of the Pacific Coast for many

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years furnishing the lumber from Northern California and the Northwest to develop the cities and towns to the south.
Wapama was in a deteriorated condition when she was removed from the water. After 25 years out of the water she is in much worse condition, such that there is little if any of her original hull materials that can be saved. The rot and loss of structural integrity are too great. The rebuilding of the *C. A. Thayer* in a former aircraft hangar in Alameda is testimony to the level of work required on a wooden vessel that had been maintained on a regular basis and kept floating until rehabilitation started. Approximately 90 % of the *C.A. Thayer* hull material is being replaced. The after cabin superstructure on the other hand, is in much better shape due to more concerted efforts to protect and maintain those areas of the ship that were least deteriorated to begin with and easiest to protect.

Wapama is in a precarious structural state and requires some immediate steps to alleviate safety and liability risks as outlined in the Condition Survey. In addition we recommend an aggressive schedule for determining disposition and for funding other required short-term stabilization measures. We must emphasize that this vessel presents a large "sail area" to the wind, and is in potential danger of movement within its lateral supports, which could result in a threat to life safety as well as possible collapse resulting in material coated with lead paint falling into the water.

We have suggested a series of stabilization action items from immediate to one and three year time frames with rough order of magnitude (ROM) budgets based on costs experienced with the *C. A. Thayer* where both D&P and ACR are intimately involved. Budgeting the costs of the various salvage and restoration options listed will be considered in the next phase of the study. It should be understood that any option which does not put the Wapama back in the water, would require land-based exhibit planning and budgeting for a protective structure. The Team is aware of other vessels which are exhibited within structures on land.

We look forward to your review of the attached Exhibits and agreement on a direction for the second phase of the work to determine the ultimate disposition of this important National Historic Landmark.

WAPAMA CONDITION SURVEY

D&P Report No. 2526-001
October 7, 2005

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A) 1986 *Wapama* Historic Structure Report
B) 1985 Stability Analysis and Condition Survey of Barge 214

Wapama Condition Survey

Background

The vessel *Wapama* (Figure 1) is the last remaining example of the wooden steam-powered schooners, which hauled lumber and passengers along the Pacific Coast. Built in 1915 and registered as a National Historic Landmark (NHL), *Wapama* is constructed of old growth Douglas Fir, and is 216 feet long and approximately 50 feet from keel to house top, with a gross tonnage of 945 GT. In 1979, she was removed from her berth at the California State Historical Maritime Park at Hyde Street Pier and moved to a submarine pen at Hunters Point Naval Shipyard. This move to quiet water was to minimize stress on her hull. Prior to building a breakwater in the mid 1980's, the Hyde Street Pier resembled an ocean pier more than a bay pier. Winter storms, in particular, were extremely stressful on the entire fleet. In 1980, in anticipation of rebuilding *Wapama* in the HMB-1/Crowley Maritime Plan, she was placed upon Barge 214. Since that time she has remained on the barge and received limited maintenance. Currently, she resides atop Barge 214 in a flooded graving dock at the Richmond Reserve Shipyard in Richmond, CA.

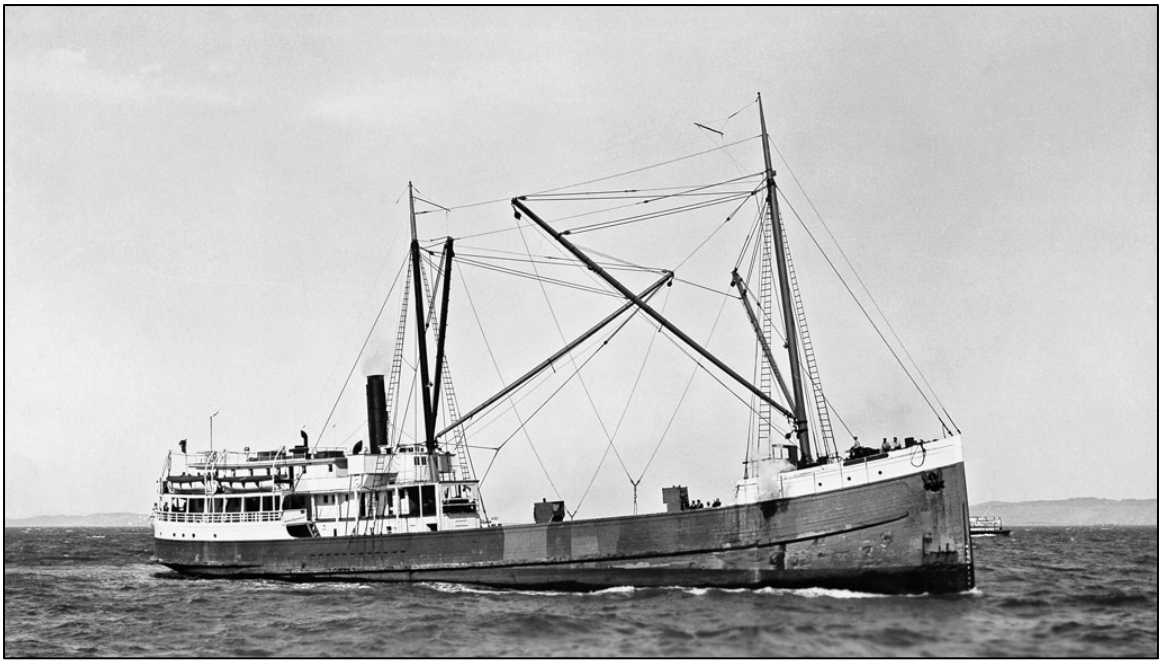

Figure 1 – *Wapama* circa 1935

Scope of Work

In February 2005, BMT Designers & Planners, Inc. (D&P) was tasked as a subcontractor to Architectural Resources Group (ARG) to undertake a condition survey of the vessel and barge and to provide preservation recommendations. The scope of work for D&P included:

- An updated safety and stability determination of the barge and vessel, both separately and in combination.

- An updated structural review of the vessel's main features and support structure.

The results of these tasks are summarized below.

Summary of the Results of the Rapid Structural Survey

During the week of June 20th to the 24th, 2005 an initial rapid structural assessment of the *Wapama* and Barge 214 was undertaken. During this time the vessel and barge were inspected and analyzed for potential safety and stability weaknesses, and areas of actual or potential structural failure were identified. During the rapid structural assessment the 1986 *Wapama* Historic Structure Report (Reference A) and a 1985 Stability Analysis and Condition Survey of Barge 214 (Reference B) were used as a baseline for assessing the vessel and barge's condition.

Barge 214

With respect to Barge 214 the rapid structural survey revealed no significant structural problems, although an upward deck deflection amidships was noted and is believed to have been caused during a reported grounding incident, prior to the barge being acquired for use in supporting the *Wapama*. A visual inspection of the tanks indicated the collection of a small amount of water and other fluids in some of the tanks, as shown in Figure 2. It would be necessary to pump these fluids out of the bilges in order to complete the visual inspection. Regular maintenance and some localized repairs are suggested to replace localized bottom damage.

Figure 2 – Example of Fluids in Bilges of Some Tanks on Barge 214

Wapama

With respect to *Wapama* the rapid structural survey revealed that the after superstructure is in relatively good shape, as shown in Figures 3 through 9, though there is some deterioration/damage in way of the Starboard Side Boat Deck, as shown in Figure 10.

Figure 3 – *Wapama* Superstructure

Figure 4 – Social Hall

Figure 5 – Main Stairway

Figure 6 – Dining Salon

Figure 7 – Pantry

Figure 8 – Smoking Lounge

Figure 9 – Wheel House

Figure 10 – Deterioration/Damage at the Starboard Side Boat Deck

Overall, the current state of the main deck house shows little change from the condition described in the 1986 Historic Structure Report (HSR). It is noted that this is due in large part to the efforts of the NPS / SAFR maintenance personnel assigned to *Wapama*. This staff, with the help of volunteers, has kept these spaces ventilated while also protecting them from the environment and rainwater seepage. This is in keeping with recommendations that were made in the 1986 HSR.

Although the main machinery space shows significant deterioration of some of the auxiliary machinery, metal gratings, and boilers (as shown in Figures 11, 12, & 13) many of the main machinery components, such as the main engine and generators, are presently in very good shape thanks to some dedicated preservation efforts undertaken by NPS /SAFR staff and volunteers, as shown in Figures 14, 15, & 16).

Figure 11 – Deteriorated Machinery

Figure 12 – Deteriorated Grating

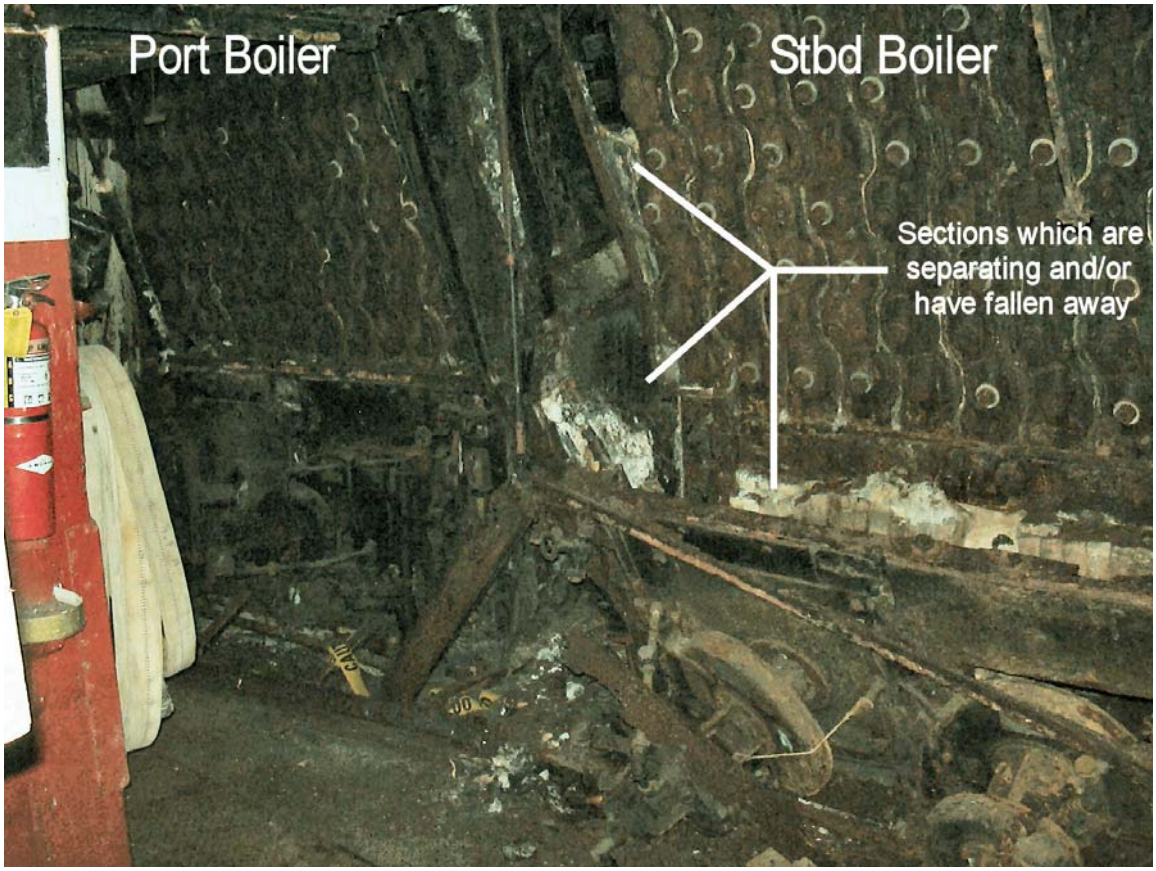

Figure 13 – Current Deteriorated State of Boilers in Engine Room

Figure 14 – Generators

Figure 15 – Main Engine (from above)

Figure 16 – Main Engine (from below)

The hull and main deck forward, by comparison, were found to be in an extremely deteriorated state. It was not possible to assess the condition of the main hull frames at this time, however the exterior hull planking and sheathing was found to be disintegrating, as shown in Figure 17.

Figure 17 – *Wapama* Current Exterior Condition

It was reported that pieces of rotten wood are continually falling from the vessel, and the NPS / SAFR maintenance individual indicated that these pieces are becoming bigger as time goes on (see Figures 18 and 19).

Figure 18 – Deterioration of Aft Rub Rail

Of particular concern from a personnel and vessel/barge safety point of view are the cast iron fairleads and chain plates on the bow. Deterioration of the deck and side hull planking under these fittings, as shown in Figure 20, have left them in a precarious state where they could fall from their current locations, potentially injuring anyone working on the deck below. Due to their weight and size they could also represent a threat to the watertight integrity of the barge if they were to fall from their present locations.

Figure 19 – Deterioration of Hull & Fittings (Fwd)

Figure 20 – Deterioration of Deck & Shell at Cast Iron Deck Fittings

Two other safety concerns include the presence of lead based paint and the possibility of structural collapse. If the decision is made to perform major structural rehabilitation or disassembly of the vessel onsite at the Richmond CA site, consideration will have to be given to protecting the surrounding environment from lead-based paint.

Additionally, within the hold, the aft end of the forward Tween deck is currently falling apart, as shown in Figure 25, and the main deck is showing signs of significant deterioration and decay at the forward end of the hatch. Specifically, the main deck stringers exhibit substantial damage and deterioration and the main deck planking exhibits signs of poorly executed repairs from much earlier in her life, as shown in Figures 26 and 27. All these issues contribute to a very perceptible sag in the main deck and main deck stringers of the main hatch opening, as shown in Figure 28. The bulwark planking, frame heads and deck waterway also show signs of major deterioration at various locations along the main deck, as shown in Figure 29. In order to prevent collapse of the vessel due to the deteriorated state of the deck structure extensive shoring was provided within the hold to support the main deck stringers over most of their length, as shown in Figure 30.

Corrective actions must be taken in the near future to avoid potential safety and liability issues. At the time of the initial Rapid Structural Survey the recommendation was made to provide a locking gate on the gangway to keep the public off the barge. As shown in Figure 31 an effort has already been made to implement this recommendation. It is also suggested that temporary vertical netting could help to mitigate material dropping into the bay.

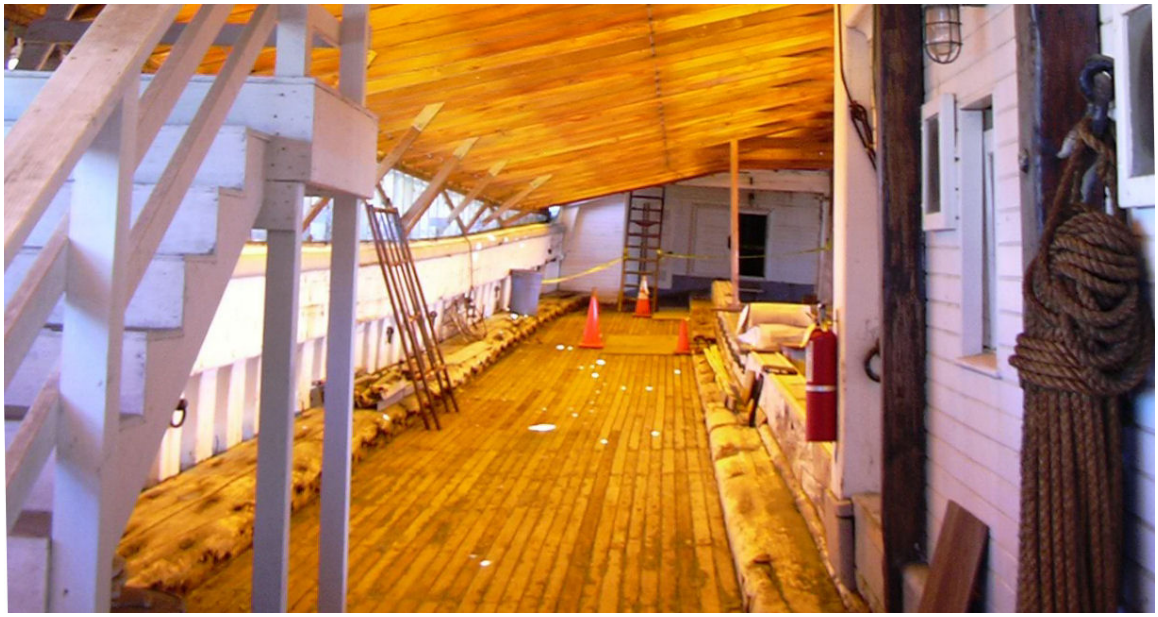

Figure 21 –Main Deck Looking Forward Showing Skew in Bow/Foc'sle

Figure 22 – Bow Overhang with respect to the Barge

Figure 23 – Deteriorated Deck Structure of the Foc'sle

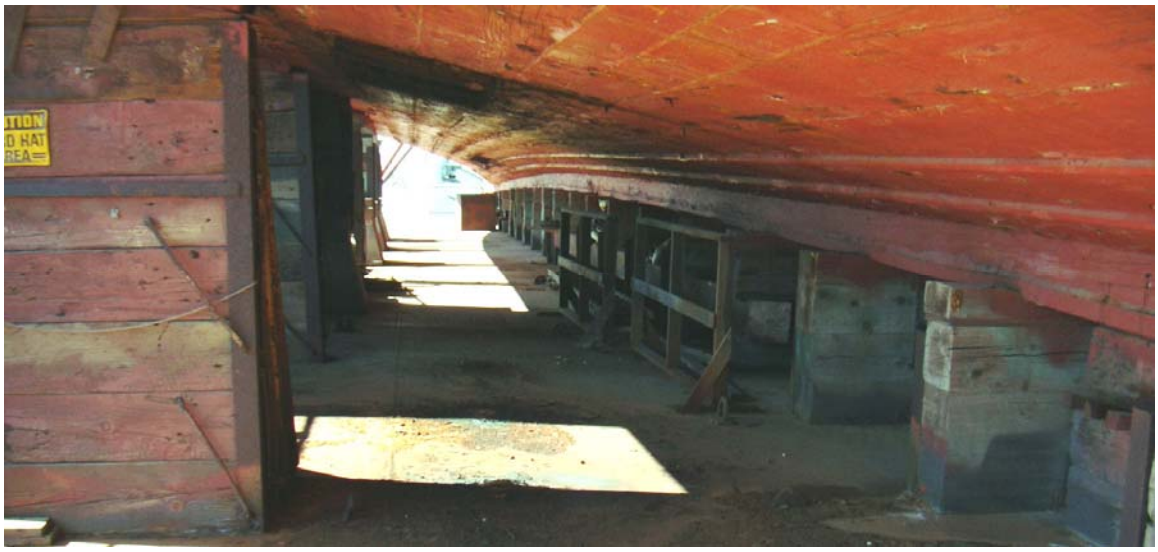

Figure 24 – Keel (looking fwd) Demonstrating Substantial Hog

Figure 25 – Collapse of aft end of Forward Tween Deck Supporting Structure within the Main Hold

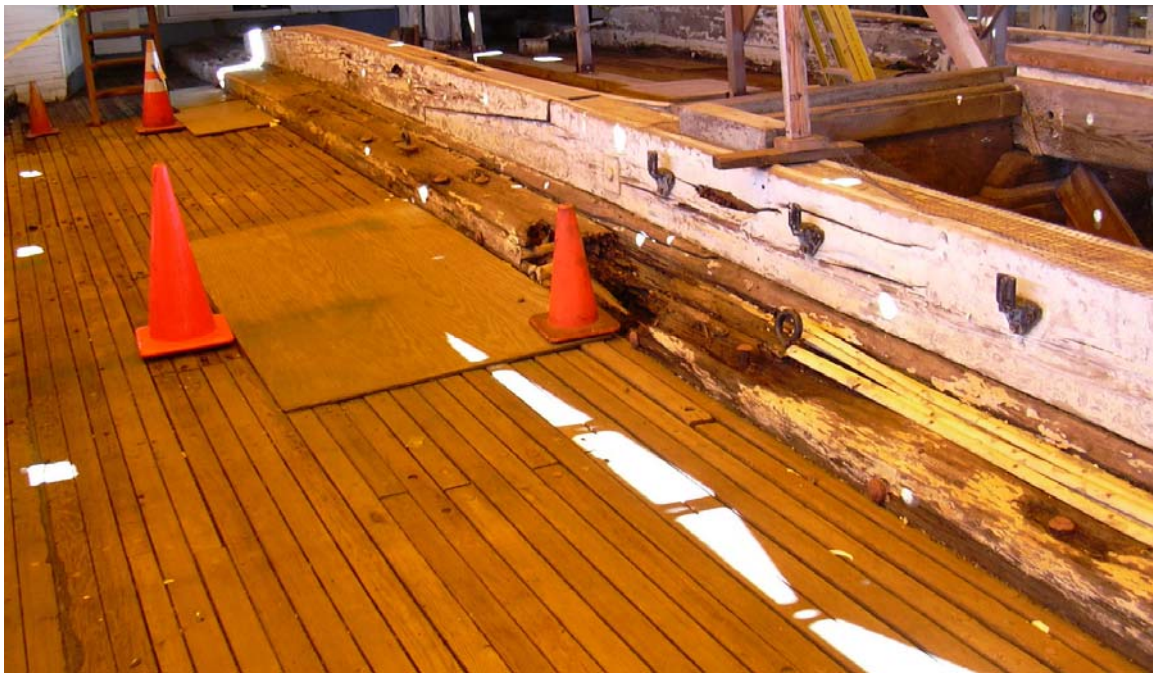

Figure 26 – Deterioration of Main Deck Stringers (Port Side)

Figure 27 – Deterioration of Main Deck Stringers & Poor Deck Planking Repair (Stbd Side)

Figure 28 – Sag in Main Deck and Main Deck Stringers next to Hatch Opening

Figure 29 – Deterioration of the Main Deck Bulwark, Frame Heads & Waterway

Figure 30 – Shoring within Hold below Deck Stringers

Figure 31 – Current Gangway onto Barge 214

Summary of the Detailed Analysis of the Vessel's Main Features

In order to assist the NPS /SAFR in their decision making process concerning the eventual disposition of the *Wapama,* a more detailed analysis of the vessel's main features was undertaken, with particular focus on the safety and strength aspects of the vessel and stability of the vessel and barge.

Structural Strength and Safety Aspects

Longitudinal Strength

In order to be considered an effective part of a vessel's hull girder, longitudinal strength members are required to run for a minimum of 40% of a vessel's midships length. In her current state, strength members that would normally be included in such an assessment of structural adequacy are broken, rotted and/or distorted in various locations in the forward half of the vessel, bringing the overall longitudinal strength of the vessel into question (see Figures 17, 19, 26, 27, 28, & 29). This damage includes:

- The main deck has lost much of its structure. The deck planking, deck stringers, and waterways all show significant deterioration. A large opening in the deck forward of the main hatch further weakens the deck. As a result, the deck has begun to sag at the hatch, as seen in Figure 28.
- The external hull planking above the waterline has extensive deterioration. In addition to creating a falling hazard, the damaged hull planking is no longer providing longitudinal strength.
- The keel was reportedly broken when *Wapama* was placed on the barge. Figure 24 shows the observable keel hog. As such, the ability of the keel to contribute to the longitudinal strength of the vessel is brought into question and expected to be greatly reduced.
- The ceiling planking, rider keelsons, and assistant keelsons are the primary members contributing to longitudinal strength. The visible surface of the ceiling planking appears to be in relatively good condition. There is evidence of some deterioration from dripping water at the aft end of the hatch opening as shown in Figure 32. This damage dates from the active days as a seagoing vessel. Experience with *C.A. Thayer* suggests that the inner surface of the ceiling planking, at the frames, is likely deteriorated.

The hog of the keel and sag of the deck are indicators that the vessel is settling down on itself, particularly in the mid and forward sections. Although hog on this type of cargo carrying vessel is typical due to increased midships section buoyancy and fore and aft loading in excess of the available buoyancy at those locations, it is not borne out on deck where considerable sag and distortion can be seen. This dichotomy indicates that the hull's topsides and deck have rotted away and are settling in to the more stable lower frames, bottom planking, and lower ceiling.

Figure 33 shows a midship section for the *Wapama* identifying the main structural elements that contribute to longitudinal strength. The effectiveness of each member has been evaluated using the factors discussed above. Using the data provided in Figures 33

and 34, an estimated section modulus of the vessel in its current state has been calculated and has been compared to the estimated section modulus of the ship when she was originally built[1]. The results of these calculations indicate that in her current state the Wapama retains just over 50% of her original longitudinal structural material in the midships section and less than 37% of her original section modulus. Also shown in Figure 33 are three specific areas of interest for further analysis. Due to concerns about the adequacy of the remaining ship's structure, in the next phase of study a more in depth assessment of the structural properties of the hull material in way of these locations, particularly between Frames 13 and 20 (at the aft end of the foc'sle deck), is recommended.

Since *Wapama* is configured with a hatch for loading lumber close to the midships the section modulus was likely minimal when the vessel was first built. The heavy longitudinal deck stringers indicate the builders concern for longitudinal strength and resistance to hogging. An estimated 60% reduction in section modulus is therefore significant. The internal shoring below the deck stringers is possibly assisting in resisting longitudinal bending.

These indicators, along with the knowledge gained with regard to hidden rot from past restoration efforts, lead to a bleak picture for at least the outer and forward portions of the *Wapama* and quite likely much of the aft hull portion of the vessel as well.

[1] An important step in routine ship design is the calculation of midship section modulus. It indicates the bending strength properties of the primary hull structure. The standard calculation is described in ABS (1987a), Section 6: "The section modulus to the deck or bottom is obtained by dividing the moment of inertia by the distance to the neutral axis to the molded deck line at side or to the base line, respectively."

In general the following items may be included in the calculation of section modulus, provided they are continuous or effectively developed.

- Deck plating (strength deck or other effective deck)
- Shell and inner bottom plating
- Deck and bottom girders
- Plating and longitudinal stiffeners of longitudinal bulkheads
- All longitudinals of decks, sides, bottom and inner bottom
- Continuous longitudinal hatch openings"

The designation of which members should be considered as effective is subject to difference of opinion. The members of the hull girder of a ship in a seaway are stressed alternatively in tension and compression. In general, however, only members which are effective in both tension and compression are assumed to act as part of the hull girder.

Figure 32 – Deterioration of Ceiling Planking below Aft End of Hatch Opening

Torsional Strength

As previously noted, the current overall state of the main frames is not known. The tops of these frames in many locations show signs of deterioration, as shown in Figure 34. Based on experience with the *C.A Thayer*, it is expected that many of these frames will have suffered significant deterioration at least to the turn of the bilge. This, combined with the deteriorated state of the main deck and hull planking, and the reported damage to the vessel's keel, have contributed to the bow of the vessel twisting to the starboard (when viewed from astern), as was shown in Figure 21. Attempting to prevent this is made more difficult with the bow hanging over the forward part of the barge, as shown in figure 22.

Because of the extent of deterioration, there is little remaining viable structure to arrest this twist in the hull. Under adverse environmental conditions, the bow could separate from the rest of the vessel.

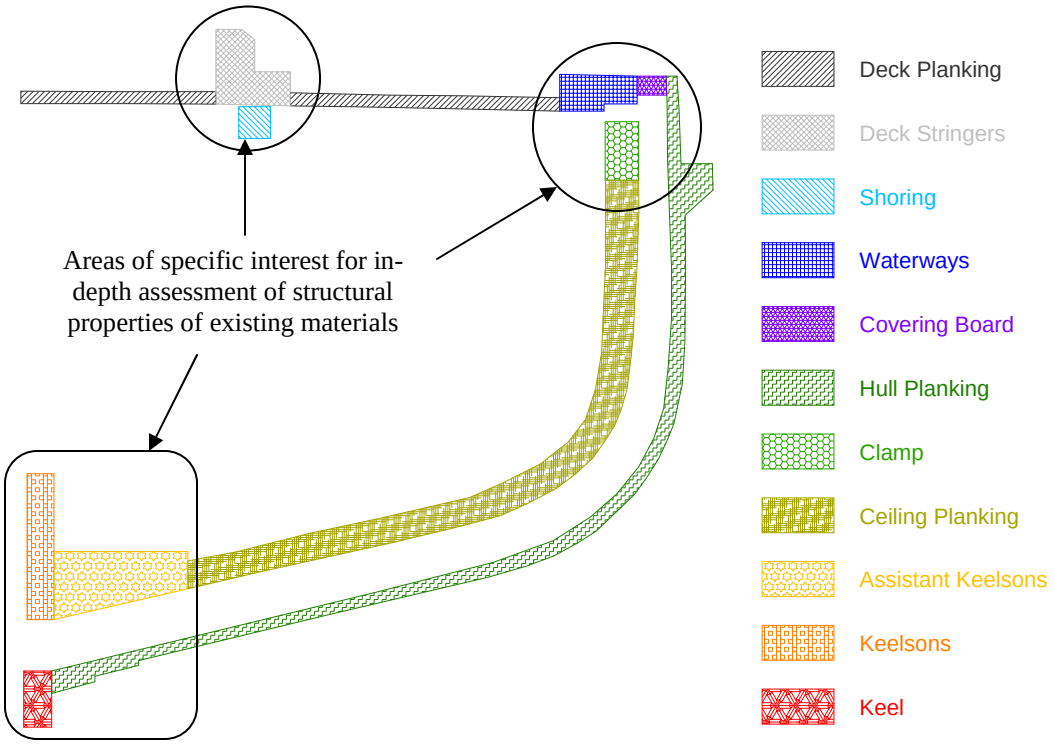

Figure 33 – Midship Section Showing Longitudinal Strength Members

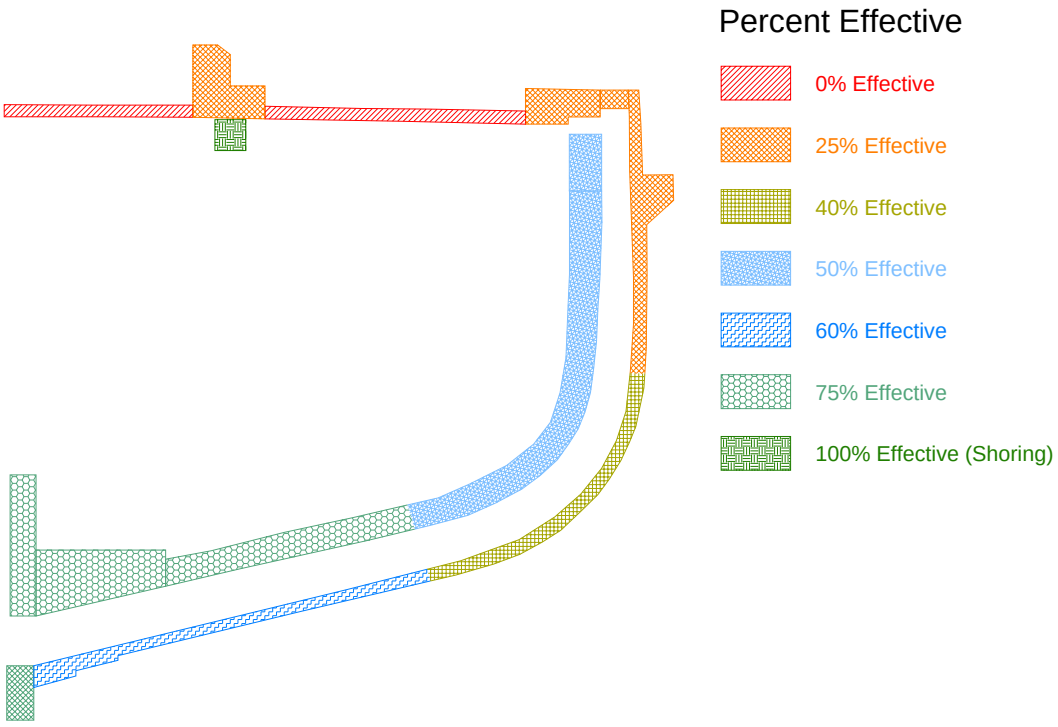

Figure 34 – Midship Section Showing Effectiveness of Longitudinal Members

Figure 35 – Wasted Waterway and Frame Tops @ Main Deck Level

Additional Structural Concerns

The current condition of the *Wapama* is troubling and presents a very real dilemma with respect to safety. There are some obvious hazards that can be quickly observed from the pier, from the deck of the barge, and from the deck of the vessel. Figures 18, 19, and 20 illustrate the potential for falling objects. The Foc'sle deck and Tween deck are clearly in danger of collapse, and were previously deemed suspect since equipment (winches, etc.) were removed from them and shoring added to stabilize them.

Shoring supports have been added throughout the vessel where structural members have deteriorated. In many places, this shoring appears to have saved regions from collapse. Significant shoring exists at the following locations:

- External shoring along the hull planking is providing transverse support to keep the *Wapama* in position onboard the barge. Shoring has been added to the bow area, as seen in Figure 22, to prevent this section from continuing to twist in relationship to the rest of the vessel. The deteriorating hull planking remains the weak point to any external shoring scheme. A likely catastrophic failure could be the hull planking collapsing around the external supports, ultimately allowing the bow to separate from the midbody.
- Shoring under the foc'sle deck appears to be carrying the load of this deck. The structural members show significant deterioration, and without the shoring this deck would likely have collapsed long ago.
- Shoring in the hold is supporting much of the main deck. As previously mentioned, much of the longitudinal strength in the deck is no longer effective and the shoring is possibly taking some of the longitudinal load. The shoring is undoubtedly preventing the deck from collapsing into the hold.

As such, the strength and rigidity of the hull to withstand the ravages of time and weather (wind, rain, and sun) and its own weight for many more months are definitely brought into question. How much longer are the deck beams likely to hold up the Main deck, Foc'sle deck, or Tween deck? How much longer can we expect the bow section to stay in place and not collapse or simply fall off? If not for the added internal wood bracing (shoring) in the hold the main deck may have collapsed into the hold long ago. If not for the additional steel supports and poppets (shoring) the bow may have already twisted and fallen off. Each of these remedies has had their effect in stabilizing the structure and are now carrying the lion's share of the load. How much longer can *Wapama*'s rotten structure hold out from falling around the stronger fixes that support it? From a safety view point the answer is simple; they cannot be expected to last any longer and actions need to be taken before a major catastrophe takes place.

Stability Aspects:

A stability analysis of the barge itself, as well as the barge with the vessel onboard has been conducted. In this analysis the intact stability characteristics of the barge were investigated to ensure that the barge could transport the *Wapama* in protected waters, in the event that a decision is made to transport the vessel from Pt. Richmond to a new location.

In general the results of this analysis are similar to the results of a previous stability analysis of *Wapama* and Barge 214 conducted by Hull and Cargo Surveyors Inc. described in Reference 2. Specifically, Barge 214 has adequate intact stability to support the vessel in her current protected location. From a damaged stability point of view, the worst-case condition is when the tank between frames 3 and 11 is flooded. Here, due in part to the added weight of the bow support structure, which appears to have been added to Barge 214 since the 1985 stability analysis, the forward trim that the barge would take on with the tank between frames 3 and 11 flooded, is enough to immerse the forward edge of the deck.

If the forward edge of the deck of the barge were to become immersed due to damage during towing, the loss in waterplane and righting energy could result in capsize or plunging of the barge in a seaway. To mitigate this, it is recommended that the forward tanks of the barge be pumped dry and ballast weight be added aft on the barge. Calculations indicate that in her current condition a weight of ballast between 80 to 130 long tons would be sufficient to provide for adequate margin to prevent the forward deck edge from becoming immersed in the event of damage forward.

If significant alterations were made to the vessel and barge, such as the addition of additional shoring, or the removal of the winches and other heavy pieces of deck machinery and fittings, then a further review of the damage stability characteristics of the barge and vessel would be warranted at that time.

Should the decision be made to disassemble all or part of the vessel in place onboard the barge, a careful analysis will have to be prepared, concurrent with disassembly, to ensure that adequate stability and trim characteristics are maintained throughout the process. This may necessitate either ballasting the barge or providing counter weights on deck to

accommodate the reduction in weight as the bow section is disassembled, preventing the barge from taking on an unsafe amount of heel or trim during the disassembly process.

If the decision is made to move *Wapama* while on the barge, a further study of the towing limits must be investigated. An analysis of the limiting states of roll and pitch will be conducted for Phase II

Actions

The SOW requests the contractor recommend actions to be taken to maintain a level of life safety for personnel on Barge #214 and *Wapama*. The following are the condition survey team's recommendations with respect to life safety.

Items requiring immediate action (at a ROM cost of $11K)

Falling objects (deck fittings, chain plates, rub rail, etc.) are the most observable and prevalent danger. These objects should be catalogued, removed from the vessel, and stored for restoration.

Falling wood should be removed and disposed of. It should be noted that some of this wood may contain hazardous materials and coatings (such as lead based paint), which will require special handling and disposal.

Restrict access to the deck of the barge by installation of a locking gate on the brow. This effort has been started based upon the team's earlier verbal recommendations made after the first condition survey.

Restrict access to the forward half of the vessel by signs and barriers. The condition of this portion of *Wapama* is precarious for the general public, as well as staff, and should be treated with extreme caution.

Post areas where asbestos is present and clean-up fuel oil spills.

Items requiring action within 1 Year (at a ROM cost of $321K)

Remove concentrated weight items from the deck and topsides (winches, excess paints, tar, oil, etc.). These objects should be catalogued, removed from the vessel, and then stored for restoration. Parts of the vessel deemed of historical interest and in a suitable condition for storage should be kept for interpretive uses.

Remove hazardous materials (asbestos, and fuel oil). Wood with lead based paint as removed from the vessel for safety should be handled and disposed of with caution.

Documentation of *Wapama* by laser survey and digital photography is recommended for the entire vessel's internal and external shape and the location of fitting and equipment on board. A check should be completed to ensure scantlings values match those recorded in the drawings.

Stabilization of the aft portion of the vessel's hull and decks to include support of the stern overhang and upper decks.

Continuous maintenance geared toward maintaining the ventilation and exclusion of rainwater from the aft cabins, engine room, etc.

Items requiring action within 3 Years (at a ROM cost of $2.5M)

Begin systematic and careful disassembly of the forward section of the vessel, from the pilothouse to the bow. Parts of the vessel deemed of historical interest and in suitable condition for storage should be kept for restoration.

Remove aft portion of the vessel from the barge and place under cover for restoration and rehabilitation based upon the option chosen by NPS / SAFR.

Recommendations and Conclusions

Due to her historical significance, our recommendation is to save the *Wapama* for display at the SAFR Park in some yet to be chosen format. Due to the severely deteriorated state of the structure in the forward half of the ship, there is likely little within that section of the ship that can be salvaged for re-use with the potential exception of some of the hanging knees within the cargo hold and the forward hatch beam with the registry number carved into it. Additionally, the severely deteriorated state of the structure in the forward half of the ship is an immediate safety concern that must be addressed in the very near term.

It is recommended that within the next six months, items that represent an immediate threat of falling, such as the cast iron deck fittings, chain plates, rub rails, etc. should be cataloged and removed from the vessel so that they can be stored for restoration. Any loose or falling wood should also be removed and properly disposed of, which may require special handling because of the presence of asbestos, fuel oil, lead based paints, and other potentially hazardous coatings Also, a lock should be provided for the gate on the brow to restrict access to the deck of the barge. Access to the forward portion of the vessel should also be restricted by means of signs and barriers.

Within one year concentrated weight items such as winches and the excess paint and tar buckets currently onboard the vessel should be cataloged, removed, and stored for later interpretive uses. Documentation of *Wapama* by laser survey, and digital photography would also be recommended at this time for the entire vessel's internal and external shape and the location of fitting and equipment on board. Stabilization of the aft portion of the vessel to include support of the stern overhang and upper decks should also be undertaken. Additionally continuous maintenance geared toward maintaining the ventilation and exclusion of rainwater from the aft cabins, engine room, should also be accomplished.

Finally within the three-year time frame it is strongly recommended that work be initiated on the systematic and careful disassembly of the forward section of the vessel, from the pilothouse to the bow. Parts of the vessel deemed of historical interest (such as the forward hatch beam which has the vessel's official number and gross tonnage measurement inscribed on it) or in suitable condition for re-use (such as some of the hanging knees) should be kept for restoration. Upon completion of that work the aft portion of the vessel could then be removed from the barge and relocated to a covered facility for any restoration and rehabilitation work that may be considered.

S.S. WAPAMA NHL STEAM SCHOONER SURVEY & EVALUATION
Richmond Reserve Shipyard
Richmond, California

Hazardous Materials Survey Report

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SECTION 1

REPORT SUMMARY

REPORT SUMMARY

INTRODUCTION

Winzler & Kelly Consulting Engineers performed a limited Hazardous Materials Survey of the Steam Schooner S.S. Wapama (Wapama) a National Historic Landmark (NHL) vessel that is located on floating Barge 214 in a flooded graving dock at the Richmond Reserve Shipyard, Richmond, CA. The purpose of this investigation was to screen for asbestos, lead and/or other potentially hazardous waste materials which could present environmental hazards during planned maintenance, restoration, or demolition activities or unplanned events due to vessel deterioration.

Winzler & Kelly performed this Screening Level Hazardous Materials Survey of the Wapama on June 14, 2005. The investigation was conducted by Lionel S. Reynolds, CIH and Manuel F. Luna who are both California Certified Asbestos Consultants and Lead Inspector/Risk Assessors. This work was conducted in accordance with our proposal dated April 11, 2005. We understand this work is being conducted under National Park Service (NPS) Contract C9000031900 for Architect Engineering Services throughout the Pacific West Region.

All findings and conclusions presented in this report are based on a review of our review of the 1986 Historic Structure Report, on-site visual survey, sampling and testing results, and a review of the draft proposed options for the vessel.

METHODOLOGY

General Survey Conditions.

Winzler & Kelly was unable to access confined or highly restricted spaces including barge tanks, bunker oil fuel tanks, boiler/boiler stack and bilges. We also had limited access in certain areas including fo'c'sle compartments and deck, and cabin decks (and above) due to structurally unsound decking and railing. Accessible deck areas of Barge 214 were also included in the survey as any maintenance, restoration or demolition work on the Wapama might be expected to also impact barge coatings.

Asbestos – Survey Methodology

Visual identification was performed by assessing visible and accessible marine architectural and mechanical components for the presence of suspect asbestos-containing materials (ACM). The survey was conducted in a non-destructive manner meaning that exposed materials and finishes were not disturbed to search for potential materials concealed beneath or behind the surface material. Paint, caulking, thermal system insulation and other materials were sampled at locations of existing damaged, loose, or delaminating materials.

The most obvious and significant suspect ACM identified as part of this screening was bulk sampled in using sampling guidelines established by the Environmental Protection Agency (EPA). Bulk sample collection was conducted using the methods described in Appendix K of 8 California Code of Regulations (CCR) Section 1529 asbestos.

The following summarizes the asbestos sampling procedures utilized.

- A sampling scheme was developed based upon the location and extent of the various suspect ACM materials based on visual observation.
- Trained personnel using appropriate sampling tools and leak-tight containers collected bulk samples.
- Bulk sampling tools were decontaminated after the collection of each bulk sample to prevent the spread of secondary contamination to subsequent bulk samples.
- Each bulk sample was labeled with a unique sample identification number and recorded on a Bulk Sample Log.
- A Chain of Custody Record was maintained for bulk samples collected.

Asbestos - Analytical Methodology

Samples of suspect ACM were sent to the Forensic Analytical (Forensic) laboratory in Hayward, California. The Forensic is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards & Technology (NIST) and the California Environmental Laboratory Accreditation Program (Cal-ELAP) for asbestos analysis. The samples were submitted for analysis by Polarized Light Microscopy (PLM) utilizing dispersion staining techniques in accordance with the EPA's "Method for the Determination of Asbestos in Bulk Building Materials" U.S. EPA/600/R-93/116, dated July 1993 and adopted by the NVLAP as Test Method Code 18/A01. Using this method, the asbestos content of each discernable material layer is analyzed and reported.

Lead – Survey/Analytical Methodology

This survey included limited testing for lead-based paint (LBP) using a Niton XL300 (serial # U4287NR5566) X-Ray Fluorescence (XRF) direct read instrument and results presented herein are largely representative (but not all inclusive) of typical painted/coated surfaces present this vessel. In addition, two paint chip samples were collected of laboratory analysis of representative coatings that reported low lead levels based on the XRF testing. One of the two paint chip samples analyzed represented the red bottom paint and the other the red barge deck paint. Both samples were sent to laboratory accredited by the American Industrial Hygiene Association (AIHA) under the EPA's Environmental Lead Laboratory Accreditation Program (ELLAP). Any untested painted/coated surfaces should be assumed to be lead-based or lead-containing paint or coating unless paint chip analytical results are below detection levels.

To provide a preliminary evaluation of the presence of lead in coatings, and assist in compliance with 8 CCR 1532.1, 1536, and 1537, the XRF test results and bulk paint chip sample data were interpreted as follows:

- Positive results (lead-containing) were determined when analytical results revealed a lead concentration greater than the laboratory analytical detection limit. Any coating with detectable lead is considered to be a Lead Containing Paint (LCP) subject to Cal/OSHA and Cal/EPA regulation. When the lead content of a LCP exceed the threshold discussed below it is considered to be Lead-Based Paint.

- Negative results were determined when analytical results revealed a lead concentration less than the detection limit of the laboratory analytical procedure. *Note: Negative results based on XRF are not sufficient to conclude that no detectable lead would be present based on the laboratory wet chemistry analysis methods due a much lower sensitivity of the non-destructive method.*

Lead-Containing Paints (LCPs) are coatings that contain any detectable lead as defined by Cal/OSHA. Lead-Based Paint (LBP) is defined as any painted surface exceeding 5,000 ppm or 1.0 mg/cm² or greater as set forth in the Housing and Urban Development (HUD) and Environmental Protection Agency (EPA) regulations for residential and facilities frequented by young children. The same criteria were adopted in the California Department of Health Services regulations (DHS) for public and commercial buildings.

Other Potential Hazardous Materials

Toxic Metals: In addition to lead, the paints are likely to contain other toxic metals that may impact surface preparation, vessel stabilization, restoration, and/or any demolition activities. In order to evaluate this potential, samples of representative coatings were evaluated by composite sampling and analysis. Composite samples of the exterior hull paint (red) below the water line and the exterior topside hull, bulwark and cabin paint (white) were collected and analyzed for the 17 Title 22 metals. These included the following toxic metals: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. The two samples were sent to a California certified laboratory for analysis of the metals by EPA method 3050B/6010B (all metal except mercury) and EPA method 7471A for mercury.

Other Hazardous Materials: No other materials were sampled, however the existing fuel tanks in the Wapama contain residual fuel reported to be bunker C and there appears to be a similar black, oily type material seeping out of the hull on the port side, aft end in the general vicinity of the fuel tanks. The barge is reported to have been used as a fuel tank barge carrying bunker C fuel and is likely to have some residual fuel in its tanks.

No other suspect hazardous materials were noted however there may be some undetected or concealed hazardous materials in ship spaces and/or equipment

RESULTS

Asbestos

Winzler & Kelly collected 21 bulk suspect asbestos samples from the Wapama and one (1) sample from Barge 214. Suspect ACMs sampled during this survey are listed in Section 2 – Suspect Asbestos-Containing Material Sample Results. Laboratory analytical results for suspect ACMs are listed in Section 4 - Laboratory Analytical Reports. Photographs of selected ACM conditions detected are provided in Section 5 - Photographs

Barge 214: No asbestos was detected in the one sample of non-skid deck coating on the Barge.

Wapama:
Asbestos was detected in the following materials on the vessel:

- Pipe insulation in Engine Room (Lower Level)
- Tank insulation in Engine Room (Lower Level)
- Boiler system firebox insulation (various) in Engine Room (Lower Level)
- Sheet gasket material (not installed) in Engine Room Upper Level
- Sheet gasket or heat shield material, under sheet metal on ceiling at aft bulkhead, Upper level Engine Room

The following materials had no detectible asbestos in samples collected on the Wapama:

- Hull caulking, putty and oakum
- Cement fill and plugs sampled
- Hull paint
- Concrete flooring material in Galley
- Tar-like deck sealant between planks
- Refractory Brick & Cement mortar (however associated insulation contained asbestos & therefore the brick/mortar should be considered contaminated)

In addition, the following materials are presumed to contain asbestos: All un-sampled insulation on piping, manifolds, etc in the engine room; white woven gaskets in upper level engine room cabinet; and window glazing compounds.

Lead

Winzler & Kelly performed a total of 61 XRF Lead-Based Paint (LBP) screening tests and two (2) paint chip samples from the Wapama and associated Barge. These included four tests of the barge including the associated steel shoring providing additional support to the Wapama hull and 57 tests of various painted surfaces on the Wapama. The results of the XRF testing and paint chip sampling are tabulated in Section 3 – XRF Lead-Based Paint Test Results. The laboratory reports for the paint chips are provided in Section 4 – Laboratory Analytical Reports. A photograph of the starboard side of the vessel in included in Section 4.0 – Photographs.

The following painted components were found to have a lead level of 1.0 mg/cm² or greater and are therefore considered to be Lead-Based Paint:

- White paint on bulwarks, cabin sheathing, engine room sheathing, Fo'c'sle sheathing (siding) , main deck rail, doors, hand rails, , baluster, window casing, officers quarters wall (interior), engine room bulkhead (interior), and galley door frame. Other similar white painted wood components, including exterior hull should also be considered to be LBP unless exhaustively tested. Also see results of composite paint sample analysis for Title 22 metals.
- Grey paint on bulwarks, engine room sheathing, engine room lower plate and covering board. Other grey painted wood components, including the topside exterior hull, should be considered to be LBP unless exhaustively tested.

- Blue paint on poop deck overhead wood beam.
- Black paint on painted metal components including bitt, winch, boiler stack, stove duct, hand rail and pipe valve support. Painted metal components should be considered LBP unless exhaustively tested.
- Red paint on wood wall, ceiling, and floor in Dining Salon.

Other coatings tested contained lead levels lower than the lead-based paint criteria but should still be considered lead containing coatings or coatings with detectable levels of lead. These include the red hull paint, red barge paint, grey paint on barge shoring supporting the Wapama hull, and the interior green wall/ceiling panel coating. The lead paint chip for the barge deck and the composite sample of red hull paint analyzed for Title 22 metals confirm that there are low but detectable levels of lead in the bottom hull paint of the Wapama and in the red barge deck paint.

Title 22 Metals:

The following is a summary of the analytical results for two composite paint samples analyzed for the 17 Title 22 metals. A copy of the laboratory report is provided in Section 4 – Laboratory Analytical Reports.

- ***Red bottom paint (Wapama)***: The results for the red bottom paint report levels of arsenic at 1,300 milligrams per kilogram (mg/kg), copper at 49,000 mg/kg, and mercury at 67 mg/kg. These results exceed the California Title 22 Total Threshold Limit Concentrations (TTLC) of 1,300 mg/kg for arsenic, 2,500 mg/kg for copper, and 20 mg/kg for mercury respectively. The results also indicate that red bottom paint wastes also need to be tested by the California Waste Extraction Test (WET) and the EPA Toxicity Characteristic Leaching Procedure (TCLP) for lead and zinc (WET only) and possibly cadmium at minimum. All other metals appear to be within regulatory levels for waste disposal.

- ***White top side paint (Wapama)***: The results for the white topside paint report the levels of lead at 64,000 mg/kg which exceeds the TTLC of 1000 mg/kg for lead; and reports the level of zinc at 4,700 mg/kg which nearly exceeds the TTLC of 5,000 mg/kg for zinc. Based on the Title 22 results, the white paint waste would also need to be tested by the California WET test for chromium, mercury, zinc; EPA TCLP test for chromium, and mercury only; and probably cadmium for both tests. All other metals appear to be within regulatory levels for disposal.

Other Suspect Materials

Winzler & Kelly has visually identified Bunker C fuel oil residue in bottom of fuel tanks and as the suspected petroleum hydrocarbon based substance observed to be seeping from the Wapama hull on to a localized area of the Barge deck. It is also anticipated based on reports by others that a limited amount of Bunker C fuel oil (or other petroleum hydrocarbon residue) is likely present in the Barge tanks.

CONCLUSIONS AND RECOMMENDATIONS

Asbestos

Asbestos was confirmed to be present in the engine room on piping, tanks, the boiler system (fire box), heat shield, and gasket materials in the engine room. The thermal system insulation and was in poor conditions and there was evidence of debris below areas of damage. Prior to restoration, stabilization or demolition activities that are like to disturb identified and presumed asbestos containing materials, all impacted known and presumed ACM must be removed by a California registered asbestos contractor. Because of the poor condition of most of the thermal system insulation on piping and mechanical systems and the advance state of the firebox deterioration with spillage of refractory brick mixed with associated asbestos insulation materials, we recommend that all such thermal system insulation and debris be removed and that the engine room be decontaminated regardless of what option selected by the National Park Service for continued storage, restoration or demolition of the vessel.

Pending the asbestos removal and clean-up, the engine room should be restricted to personnel with need to enter only. Further, personnel that need to enter should have, at minimum, hazard communication training for the existing asbestos conditions and be provide any necessary protective equipment required depending on the likelihood of disturbance of the thermal insulation material or debris.

We recommend that all required abatement operations be conducted and overseen by a Certified Asbestos Consultant (CAC) according to a work scope and abatement plans and specification. The selected Contractor should perform all work in compliance with project specifications prepared by a CAC and the most recent edition of all applicable Federal, State, and local regulations, standards, and codes governing abatement, transport, and disposal of asbestos-containing materials.

Lead

All renovation involving potential and identified LBP/LCP surfaces should be conducted in accordance with Title 8, California Code of Regulations (CCR), Section 1532.1 and Title 17, CCR, Division 1, Chapter 8

If the lead content of the LCP is 600 parts per million or greater, an initial exposure assessment is required by Cal/OSHA for any work disturbing the paint. . For certain higher risks tasks listed in 8 CCR 1532.1, an initial assessment is required regardless of lead level as long is lead is detected. For these tasks, often referred to as “trigger tasks”, additional minimum worker protection measures including lead hazard communication training, appropriately selected respiratory protection, protective clothing & equipment, biological monitoring, change areas and hand washing facilities are required during the initial exposure assessment. These “trigger” tasks include, but are not limited to: manual demolition, paint scraping, sanding, heat gun applications, power tool cleaning; lead burning, abrasive blasting (and associated clean up), welding, cutting, and torching operations where lead or LCC is present. Certain work practices apply regardless of exposure levels such as use of wet methods and/or HEPA filtered vacuums when feasible.

Depending on exposure assessment results, additional worker protective requirements may apply.

At present there are no applicable local, state or federal laws requiring mandatory abatement of lead or lead coatings following the identification of lead-containing materials and coatings. However, the disturbance of the identified lead containing materials requires compliance with worker protection rules including agency notification prior to start up. Cal OSHA requires notification prior to disturbing more than 100 square feet of LBP and DHS requires notification of any hazard abatement activity involving any quantity of LBP. Work associated with LBP hazard reduction or involving personnel exposures over the Cal/OSHA permissible exposure limit (PEL) should be completed by DHS Certified Lead Workers. In addition, based on the results of this survey, most of the paint coatings tested have lead content that exceeds limits that require special storage, transport and disposal as hazardous waste. The loose, peeling paint on the Wapama also poses a significant risk of environmental release due to the immediate proximity of surface waters of the bay. This risk is further exacerbated by the possible catastrophic structural failure or collapse of the vessel.

Removal of loose lead containing paint and/or components (e.g. planking) will require containment to prevent release during removal operations. Any lead-related construction including surface preparation, component removal or demolition should be conducted according to construction documents properly prepared by a certified lead project designer and overseen by a certified lead inspector, risk assessor or monitor.

Contractor personnel should perform all lead-related remediation, stabilization, or demotion work in compliance project specifications prepared by a certified lead project designer and in conformance with the most recent edition of all applicable Federal, State, and local regulations, standards, and codes governing abatement, transport, and disposal of lead containing/contaminated materials.

***Title 22 Metals**:*

Winzler & Kelly's limited composite sampling of loose paints found that representative paint coatings contained toxic metals above California hazardous waste TTLC criteria for various metals depending on type of paint. Toxic metals likely involved at hazardous concentrations based on this study include arsenic, copper, lead, mercury, zinc and possibly cadmium and chromium. These findings indicate the additional environmental risks to be mitigated in association with any work that disturbs existing painted surfaces. This includes surface preparation for stabilization/painting of existing coatings and/or construction activities associated with the restoration or demolition vessel in part or whole. The toxic metals detected in the typical Wapama paints tested present an added environmental release risk to that noted above for lead. Needless to say, both environmental and worker protection controls will be required for any work to undertaken prepare the vessel for safe storage, restoration, or demolition. However, the same protective measures and controls required for the lead paint should also be sufficient for these other toxic metals present during paint disturbing activities.

Other Materials:

The small amount of fuel oil seepage noted should be cleaned up as soon as possible. Remaining fuel oil in the fuel oil tanks and bilges will need to be cleaned up prior to moving, restoring or demolishing the vessel. Special care is required to ensure release to surface waters does not occur during continued storage maintenance, stabilization, restoration or demolition of the vessel. Fuel oil residue and contaminated cleaning materials require proper testing and disposal and/or recycling.

Should materials similar to those identified in this report or, other forms of suspect hazardous materials be identified, maintenance personnel/contractors should be instructed to cease work any activities that may initiate an exposure episode, and notify the appropriate NPS National Historic Landmark personnel so that the suspect condition can be investigated.

Other Safety Factors

Physical safety was not within Winzler & Kelly's survey scope and no attempt was made to conduct a general safety survey beyond that necessary to conduct our team's work on the vessel. However, we would be remiss if we did not point out that the continual degradation of the structural integrity of the vessel appears to present a significant safety risk to NPS personnel and any authorized or unauthorized visitors. Deterioration of the various deck areas and rails creates hazards that make unrestricted access inadvisable. In addition, there appears to be an increasing danger of falling objects that could seriously injure persons working or standing below on the barge deck. The barge deck, while posted, is currently physically accessible to anyone who cares to trespass. In our opinion, the overall the combination of physical and environmental hazards associated with the vessel's continual deterioration requires a rapid, high priority response to mitigate the hazard and associated liability. Regardless of what option the NPS selects for the Wapama's future use (or disposal) these conditions need priority consideration.

If you have any questions or concerns regarding this document please do not hesitate to call us at (510) 667-6440.

Respectfully Submitted,

Winzler & Kelly Consulting Engineers

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Reviewed & Approved By

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SECTION 2

SUSPECT ASBESTOS-CONTAINING MATERIAL SAMPLE RESULTS

SUSPECT ASBESTOS CONTAINING MATERIAL SAMPLE RESULTS

Project Name: S.S. Wapama NHL Steam Schooner Survey & Evaluation
Project Number: 103025001-35-187

Sample #	Material Type	Material Description (by layer)	Sample Location	Material Location	Sample Result (% Asbestos) *
A-1	Caulking	Grey putty Red Paint	Rudder at Gudgeon Red	Hull, where occurs	ND ND
A-2	Cement Fill	Grey cement Red Paint	Rudder Post	Hull, where occurs	ND ND
A-3	Caulking, Oakum	Grey Non-fibrous matl. Red Paint Brown fibrous matl.	Hull, Stbd. Side between strakes	Hull Seams, where occurs	ND ND ND
A-4	Putty	Grey Putty Red Paint	Stbd. Hull at garboard strake, near keel	Hull, where occurs	ND ND
A-5	Cement Plug	Grey cement Red Paint	Stbd. Hull Fastener Plug	Hull, where occurs	ND ND
A-6	Caulking, Oakum	Grey non-fibrous matl. Red Paint Brown fibrous matl.	Stbd. Hull Seam between strakes	Hull, where occurs	ND ND ND
A-7	Putty	Grey putty Red paint	Stbd. Hull	Hull, where occurs	ND ND
A-8	Caulking	Grey putty Red Paint	Port Hull at Seam	Hull, where occurs	ND ND
A-9	Non-Skid Coating	Grey material Paint	Barge deck, port side	Barge deck, where occurs	ND ND
A-10	Putty	White putty Paint	Main Deck at base of Engine Room House	Where occurs	ND ND

* ND – None Detected; ** % asbestos = percent chrysotile (chry.) asbestos unless otherwise noted; Amos.= Amosite asbestos

SUSPECT ASBESTOS CONTAINING MATERIAL SAMPLE RESULTS

Project Name: S. S. Wapama NHL Steam Schooner Survey & Evaluation
Project Number: 103025001-35-187

Sample #	Material Type	Material Description (by layer)	Sample Location	Material Location	Sample Result (% Asbestos) *
A-11	Concrete deck	Grey cement Paint	Galley floor	Galley over wood deck	ND
A-12	Sealant	Black tar	Poop deck, port side	Deck plank seams, where occur	ND
A-13	Thermal System Insulation (TSI)	Preformed TSI, beige/tan	Engine Room, Lower Level, Stbd Side above Generators	Engine Room piping, where occurs	25%
A-14	TSI	Preformed TSI, beige	Engine Room, Lower Level, Port Side, above Pumps	Engine Room piping, where occurs	35% chry + 7% Amos.
A-15	TSI	Tank TSI, beige	Engine Room, Port Side, hot water tank	Engine Room, Hot Water Tank	20% Chry. + & 7% Amos.
A-16	Refractory Brick	Refractory Brick, pink/tan	Engine Room, Lower Level, Boiler Firebox	Refractory Debris at base of Stbd Boiler fire box	ND
A-17	TSI	Boiler firebox insulation, white/grey	Engine Room, Lower Level, Boiler Firebox	With refractory Debris at base of Stbd Boiler fire box	35%
A-18	TSI	Boiler firebox insulation, grey fluffy matl	Engine Room, Lower Level, Boiler Firebox	With refractory Debris at base of Stbd Boiler fire box	60%
A-19	Mortar	Mortar, pink/tan cement	Engine Room, Lower Level, Boiler Firebox	With refractory Debris at base of Stbd Boiler fire box	ND
A-20	TSI	Fluffy, fibrous, red	Engine Room, Lower Level, Boiler Firebox	With refractory Debris at base of Stbd Boiler fire box	50%

* ND – None Detected; ** % asbestos = percent chrysotile (chry.) asbestos unless otherwise noted; Amos.= Amosite asbestos

SUSPECT ASBESTOS CONTAINING MATERIAL SAMPLE RESULTS

Project Name: S.S. Wapama NHL Steam Schooner Survey & Evaluation
Project Number: 103025001-35-187

Sample #	Material Type	Material Description (by layer)	Sample Location	Material Location	Sample Result * (% Asbestos) **
A-21	Gasket Sheet	Ankrorite Sheet, white	Engine Room, Upper Level, fwd of Steam Chest	Sample location only	90%
A-22	TSI sheet	TSI heat shield sheet, grey	Engine Room, Upper Lever, under sheet metal heat shield above stove duct at bulkhead.	Sample location only	90%

* ND – None Detected; ** % asbestos = percent chrysotile (chry.) asbestos unless otherwise noted; Amos.= Amosite asbestos

SECTION 3

XRF LEAD-BASED PAINT TEST RESULTS

XRF Lead-Based Paint Test Results
SS Wapama - Steam Schooner

Location	Side/Sample Location	Substrate	Feature	Color	Condition	XRF Result (mg/cm2)	Flame AA Sample Number	Flame AA Result (wt%))
Hull	Port, Exterior	Wood	Plank	Red	Poor	0.01	P-2	<0.006
Hull	Port, Exterior	Wood	Keel	Red	Poor	0.01	NA	NA
Barge	Port, Exterior	Metal	Deck	Red	Poor	0	P-1	0.011
Rudder	Port, Exterior	Metal	gudgeon	Red	Poor	0	NA	NA
Rudder	Port, Exterior	Metal	pindle	Red	Poor	0.02	NA	NA
Hull	Stbd. Exterior	Wood	Plank	Red	Poor	0.04	NA	NA
Barge	Port, Exterior	Metal	Deck	Red	Poor	0.02	NA	NA
Barge	Port, Exterior	Metal	Shoring	Gray	Poor	0.02	NA	NA
Barge	Port, Exterior	Metal	Shoring	Gray	Intact	0.02	NA	NA
Main Deck	**Port, Exterior**	**Wood**	**Bulwark**	**White**	**Fair**	**4.79**	**NA**	**NA**
Main Deck	Port, Exterior	Wood	Cap Rail	White	Fair	0.09	NA	NA
Main Deck	**Port, Exterior**	**Wood**	**Bulwark**	**Gray**	**Poor**	**4.63**	**NA**	**NA**
Main Deck	**Port, Exterior**	**Wood**	**Bulwark**	**Gray**	**Poor**	**1.3**	**NA**	**NA**
Main Deck	**Port, Exterior Engine Room House**	**Wood**	**Sheathing**	**Gray**	**Poor**	**16**	**NA**	**NA**
Main Deck	Port, Exerior Engine Room House	Wood	Lower Plate	Gray	Poor	0.48	NA	NA
Main Deck	Port, Exterior Engine Room House	Wood	Deck level, Covering Board	Gray	Poor	0.4	NA	NA
Main Deck	**Port, Exterior Engine Room House**	**Wood**	**Sheathing**	**White**	**Poor**	**5.1**	**NA**	**NA**
Main Deck	Port, Exterior, Fo'c'sle	Wood	Door	White	Fair	0.12	NA	NA
Main Deck	**Port, Exterior, Fo'c'sle**	**Wood**	**Sheathing**	**White**	**Fair**	**7.6**	**NA**	**NA**

XRF Lead-Based Paint Test Results
SS Wapama - Steam Schooner

Location	Side/Sample Location	Substrate	Feature	Color	Condition	XRF Result (mg/cm2)	Flame AA Sample Number	Flame AA Result (wt%))
Main Deck	**Port, Exterior**	**Wood**	**Main Rail**	**White**	**Poor**	**2.1**	**NA**	**NA**
Main Deck	Stbd. Exterior	Wood	Cap Rail	White	Poor	0.12	NA	NA
Main Deck	**Stbd. Exterior**	**Wood**	**Bulwark**	**Gray**	**Poor**	**5.1**	**NA**	**NA**
Main Deck	**Stbd. Exterior**	**Wood**	**Bulwark**	**White**	**Poor**	**7.3**	**NA**	**NA**
Main Deck	**Stbd. Exterior**	**Wood**	**Waterway**	**White**	**Poor**	**6.8**	**NA**	**NA**
Main Deck	**Engine Room House, Stbd. Exterior**	**Wood**	**Door**	**White**	**Poor**	**2.7**	**NA**	**NA**
Main Deck	**Stbd. Exterior**	**Wood**	**Siding**	**White**	**Poor**	**5.7**	**NA**	**NA**
Poop Deck	**Stbd. Exterior**	**Wood**	**Siding**	**White**	**Poor**	**6.6**	**NA**	**NA**
Poop Deck	**Stbd. Exterior**	**Wood**	**Beam**	**Blue**	**Poor**	**3.1**	**NA**	**NA**
Poop Deck	**Stbd. Exterior**	**Metal**	**Bitt**	**Black**	**Poor**	**5.1**	**NA**	**NA**
Poop Deck	**Stbd. Exterior**	**Wood**	**Hand Rail**	**White**	**Poor**	**3.7**	**NA**	**NA**
Poop Deck	**Stbd. Exterior**	**Wood**	**Baluster**	**White**	**Poor**	**7.6**	**NA**	**NA**
Poop Deck	**Stbd. Exterior**	**Wood**	**Wall**	**Black**	**Intact**	**16**	**NA**	**NA**
Cabin Deck	**Starbord, Exterior**	**Wood**	**Door**	**White**	**Intact**	**2.4**	**NA**	**NA**
Cabin Deck	**center, aft.**	**Metal**	**Winch**	**Black**	**Poor**	**1.8**	**NA**	**NA**
Cabin Deck	Port, cabin	Wood	Sheathing	White	Poor	5.7	NA	NA

XRF Lead-Based Paint Test Results
SS Wapama - Steam Schooner

Location	Side/Sample Location	Substrate	Feature	Color	Condition	XRF Result (mg/cm2)	Flame AA Sample Number	Flame AA Result (wt%))
Cabin Deck	**Port**	**Wood**	**Window Casing**	**White**	**Intact**	**3.4**	**NA**	**NA**
Cabin Deck	Port, Cabin	Wood	Bunk Bed	Varnish	Intact	0	NA	NA
Cabin Deck	Port	Metal	Winch AFT	Black	Intact	0.07	NA	NA
Boat Deck	**Wheel House**	**Metal**	**Boiler Stack**	**Grey**	**Intact**	**5.1**	**NA**	**NA**
Boat Deck	Wheel House	Wood	Sheathing	Green	Intact	0.34	NA	NA
Boat Deck	Wheel House	Wood	E	Green	Intact	0.6	NA	NA
Boat Deck	Officer's Quarters	Wood	Bunk/Bed	Varnish	Intact	0.01	NA	NA
Boat Deck	Officer's Quarters	Wood	Door	Varnish	Intact	0	NA	NA
Boat Deck	**Officers Bathroom**	**Wood**	**Wall**	**White**	**Intact**	**13**	**NA**	**NA**
Boat Deck	Officers Quarters	Wood	Ceiling	Green	Intact	0.11	NA	NA
Boat Deck	Officers Quarters	Wood	Ceiling	Green	Fair	0.23	NA	NA
Engine Room	Engine Steam Chest	Metal	Piston Head Cover	Black	Fair	0.7	NA	NA
Engine Room	**Bulk Head**	**Metal**	**AFT Bulk Head**	**White**	**Intact**	**13**	**NA**	**NA**
Engine Room	**Overhead**	**Metal**	**Stove Duct**	**Black**	**Intact**	**13**	**NA**	**NA**
Engine Room	**Engine Support**	**Wood**	**Support**	**White**	**Intact**	**3.8**	**NA**	**NA**
Engine Room	**Hand Rail**	**Metal**	**Handrail**	**Black**	**Intact**	**3.4**	**NA**	**NA**

XRF Lead-Based Paint Test Results
SS Wapama - Steam Schooner

Location	Side/Sample Location	Substrate	Feature	Color	Condition	XRF Result (mg/cm2)	Flame AA Sample Number	Flame AA Result (wt%))
Engine Room	Valve	Metal	Valve Support	Yellow	Intact	0.75	NA	NA
Engine Room	**Valve**	**Metal**	**Valve Support**	**Black**	**Intact**	**3.5**	**NA**	**NA**
Engine Room	**Bulk Head**	**Wood**	**Bulkhead**	**White**	**Fair**	**3**	**NA**	**NA**
Dining Salon	**Table**	**Wood**	**Table Top**	**Red**	**Fair**	**0.21**	**NA**	**NA**
Galley	Stbd Side	Wood	Hand Rail	Red	Fair	0.08	NA	NA
Dining Salon	Stbd. Side	Wood	Deck	Red	Fair	0.09	NA	NA
Dining Salon	**Stbd. Side**	**Wood**	**Wall**	**Red**	**Fair**	**1.17**	**NA**	**NA**
Dining Salon	**Stbd Side**	**Wood**	**Ceiling**	**Red**	**Fair**	**1.14**	**NA**	**NA**
Galley	**Main Deck**	**Wood**	**Floor**	**Red**	**Fair**	**1.33**	**NA**	**NA**
Galley	**Main Deck**	**Wood**	**Door Frame**	**White**	**Fair**	**1.12**	**NA**	**NA**

NA = Not Applicable PPM = Parts Per Million mg/cm^2 = milligrams/centimeters square

SECTION 4

LABORATORY ANALYTICAL REPORTS

Forensic Analytical

Final Report

Bulk Asbestos Analysis

(EPA Method 600/R-93-116, Visual Area Estimation)

Winzler & Kelly
Project Manager
2984 Teagarden St.

San Leandro, CA 94577

Client ID: 2735
Report Number: B074241
Date Received: 06/21/05
Date Analyzed: 06/23/05
Date Printed: 06/23/05
First Reported: 06/23/05

Job ID/Site: 1030205001 - Steam Schooner "Wapama`

FASI Job ID: 2735-128

Date(s) Collected: 06/20/2005

Total Samples Submitted: 22
Total Samples Analyzed: 22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
A-1	10425301						
Layer: Grey Putty			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-2	10425302						
Layer: Grey Cementitious Material			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-3	10425303						
Layer: Grey Non-Fibrous Material			**ND**				
Layer: Paint			**ND**				
Layer: Brown Fibrous Material			**ND**				
Total Composite Values of Fibrous Components: Cellulose (10 %)		**Asbestos (ND)**					
A-4	10425304						
Layer: Grey Putty			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-5	10425305						
Layer: Grey Cementitious Material			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-6	10425306						
Layer: Grey Non-Fibrous Material			**ND**				
Layer: Paint			**ND**				
Layer: Brown Fibrous Material			**ND**				
Total Composite Values of Fibrous Components: Cellulose (10 %)		**Asbestos (ND)**					

Report Number: B074241
Client Name: Winzler & Kelly **Date Printed:** 06/23/05

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
A-7	10425307						
Layer: Grey Putty			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-8	10425308						
Layer: Grey Putty			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-9	10425309						
Layer: Grey Non-Fibrous Material			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-10	10425310						
Layer: White Putty			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-11	10425311						
Layer: Grey Cementitious Material			**ND**				
Layer: Paint			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-12	10425312						
Layer: Black Tar			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-13	10425313						
Layer: Tan Semi-Fibrous Material		Chrysotile	**25 %**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (25%)**					
A-14	10425314						
Layer: Off-White Semi-Fibrous Material		Chrysotile	**35 %**	Amosite	**7 %**		
Layer: Beige Woven Material			**ND**				
Total Composite Values of Fibrous Components: Cellulose (10 %)		**Asbestos (38%)**					
A-15	10425315						
Layer: Off-White Semi-Fibrous Material		Chrysotile	**20 %**	Amosite	**7 %**		
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (27%)**					

Forensic Analytical

Report Number: B074241
Client Name: Winzler & Kelly **Date Printed:** 06/23/05

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
A-16	10425316						
Layer: Tan Cementitious Material			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-17	10425317						
Layer: Off-White Semi-Fibrous Material		Chrysotile	**35 %**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (35%)**					
A-18	10425318						
Layer: Beige Semi-Fibrous Material		Chrysotile	**60 %**				
Total Composite Values of Fibrous Components: Cellulose (10 %)		**Asbestos (60%)**					
A-19	10425319						
Layer: Tan Cementitious Material			**ND**				
Total Composite Values of Fibrous Components: Cellulose (Trace)		**Asbestos (ND)**					
A-20	10425320						
Layer: Red-Brown Semi-Fibrous Material		Chrysotile	**50 %**				
Total Composite Values of Fibrous Components: Cellulose (10 %)		**Asbestos (50%)**					
A-21	10425321						
Layer: Light Grey Fibrous Material		Chrysotile	**90 %**				
Total Composite Values of Fibrous Components: Cellulose (2 %)		**Asbestos (90%)**					
A-22	10425322						
Layer: Light Grey Fibrous Material		Chrysotile	**90 %**				
Total Composite Values of Fibrous Components: Cellulose (2 %)		**Asbestos (90%)**					

James Flores, Laboratory Supervisor, Hayward Laboratory

Note: Limit of Quantification ('LOQ') = 1%. 'Trace' denotes the presence of asbestos below the LOQ. 'ND' = 'None Detected'.

Forensic Analytical #2735 — Analysis Request Form

Client Name & Address: Winzler & Kelly 2984 Treadaden St. San Leandro, CA 94577	P.O. #: 1030205001 Date: 6/21/05 Turn Around Time: 24hr / 12hr / 24hr / (48 hr) / ext: Due Date: 6/23/05 Due Time: : am/pm ☒ PLM: ☒ Standard / ☐ Point Count ☐ PCM: NIOSH 7400
Contact: Butch Reynolds Phone #: (510) 667-6440 Fax#: (510) 667-6444	☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402 ☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield ☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Wt % ☐ TEM Microvac ☐ Special Project:
Site: Steam Schooner "Wapama" Job:	☐ Metals Analysis: Method Matrix: Analytes:

Comments:

Sample ID	Date/ Time	Sample Location/Description	FOR AIR SAMPLES ONLY Type	Time On/Off	Avg. LPM	Total Time	Sample Area or Air Volume
A-1	Stbd Side	Calking - Tan & White Rudder Hinged Plate	A P C				
A-2	Stbd Side	Cement Like, at Rudder Support, Below Screw	A P C				
A-3	Stbd Side	Calking Fiber (Oaking) Between Strakes	A P C				
A-4	Starboard	Gray Putty (w/Red Paint) at Garboard (near keel)	A P C				
A-5	Starboard	Plug over knot hole (Fastner Plug)	A P C				
A-6	Starboard	Fiber Calking (Oaking) Seam Between Strakes	A P C				
A-7	↓	Gray Putty (w/Red Paint)	A P C				
A-8	↑ Port Side	Gray Calking, Red Paint and Fiber (Oaking)	A P C				
A-9	Port Side	Barge Metal Deck - (Non-Skid Surface)	A P C				
A-10	Port	White Putty - Bottom of Engine Rm House (Main Deck	A P C				

Sampled by: L. S. Reynolds Date: 6/14/05 Time: :

Shipped via: ☐ FedEx ☐ Airborne ☐ UPS ☐ US Mail ☐ Courier ☐ Drop Off ☐ Other:

Relinquished by:	Relinquished by:	Relinquished by:
Date / Time: 6-21-05	Date / Time:	Date / Time:
Received by:	Received by:	Received by:
Date / Time: 06/21/05 1PM	Date / Time:	Date / Time:
Condition Acceptable? ☑ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

San Francisco Office: 3777 Depot Road, Suite 409, Hayward, California 94545 / Telephone: (510)887-8828 (800)827-FASI / Fax: (510)887-4218
Los Angeles Office: 2959 Pacific Commerce Drive, Rancho Dominguez, California 90221 / Telephone: (310)763-2374 / Fax: (310)763-8684
St. Paul Office: 800 Transfer Road, Suite 7A, St. Paul, Minnesota 55114 / Telephone: (612)644-1007 / Fax: (612)644-1011

Forensic Analytical # 2735

Analysis Request Form

Client Name & Address:
Winzler & Kelly
2984 Teagarden St.
San Leandro, CA. 94577

Contact: Butch Reynolds
Phone #: (510) 667-6440
Fax#: (510) 667-6444
Site: Steam Schooner "Wapama"
Job:

P.O. #: 1030205001 **Date:** 6/21/05
Turn Around Time: 4H hr/ 12hr / 24hr / (48 hr) / ext:
Due Date: 6/23/05 **Due Time:** : am/pm
☒ **PLM:** ☐ Standard / ☐ Point Count ☐ **PCM:** NIOSH 7400
☐ **TEM Air:** ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ **TEM Bulk:** ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ **TEM Water:** ☐ Potable / ☐ Non-Potable / ☐ Wt %
☐ **TEM Microvac**
☐ **Special Project:**
☐ **Metals Analysis: Method**
Matrix:
Analytes:

Comments:

Sample ID	Date/ Time	Sample Location/Description	FOR AIR SAMPLES ONLY Type	Time On/Off	Avg. LPM	Total Time	Sample Area or Air Volume
A-11	Port Side Engine Room	Concrete Finish over wood Deck - (Galley)	A P C				
A-12		Black Tar Between Boat Deck Deck Planes.	A P C				
A-13		Pipe Insulation (TSI) Pipe on top of Generator	A P C				
A-14		Pipe Insulation (TSI) Pipes Above Pumps	A P C				
A-15		Insulation over Tank (Port Side)	A P C				
A-16		Boiler Refratory Brick (Inside Fire Box) (Pink)	A P C				
A-17		Boiler Fire box - White & Gray Insulation	A P C				
A-18		Boiler Fire Box - "Fluffy" Insulation (Gray)	A P C				
A-19		Fire Box Mortar (Pink)	A P C				
A-20		Fire Box Insulation (Red)	A P C				

Sampled by: B.S. Reynolds Date: 6/14/05 Time: :

Shipped via: ☐ FedEx ☐ Airborne ☐ UPS ☐ US Mail ☐ Courier ☐ Drop Off ☐ Other:

Relinquished by:	Relinquished by:	Relinquished by:
Date / Time: 6-21-05	Date / Time:	Date / Time:
Received by:	Received by:	Received by:
Date / Time: 06/21/05 1PM	Date / Time:	Date / Time:
Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

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Los Angeles Office: 2959 Pacific Commerce Drive, Rancho Dominguez, California 90221 / Telephone: (310)763-2374 / Fax: (310)763-8684
St. Paul Office: 800 Transfer Road, Suite 7A, St. Paul, Minnesota 55114 / Telephone: (612)644-1007 / Fax: (612)644-1011

Forensic Analytical #2735 — Analysis Request Form

Client Name & Address:
WINZLE & KELLY
2984 TEAGARDEN ST.
SAN LEANDRO, CA. 94577

Contact: Burch Reynolds
Phone #: (510) 667-6440
Fax#: (510) 667-6444
Site: STEAM SCHOONER "WAPAMA"
Job:

P.O. #: 103020500l **Date:** 6 / 21 / 05
Turn Around Time: 4hr / 12hr / 24hr / (48 hr) / ext:
Due Date: 6 / 23 / 05 **Due Time:** : am/pm
☒ PLM: ☐ Standard / ☐ Point Count ☐ PCM: NIOSH 7400
☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Wt %
☐ TEM Microvac
☐ Special Project:
☐ Metals Analysis: Method
Matrix:
Analytes:

Comments:

Sample ID	Date/ Time	Sample Location/Description	FOR AIR SAMPLES ONLY Type	Time On/Off	Avg. LPM	Total Time	Sample Area or Air Volume
A-21		ENGINE ROOM UPPER LEVEL "ANKRORITE" MATERIAL	A P C				
A-22		UPPER LEVEL, TOP OF PORT ENGINE HEAD - UNDER SHEET METAL HEAT SHIELD	A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				

Sampled by: C. S. Reynolds Date: 6/14/05 Time: :

Shipped via: ☐ Fed Ex ☐ Airborne ☐ UPS ☐ US Mail ☐ Courier ☐ Drop Off ☐ Other:

Relinquished by:	Relinquished by:	Relinquished by:
Date / Time: 6-21-05	Date / Time:	Date / Time:
Received by:	**Received by:**	**Received by:**
Date / Time: 06/21/05 1PM	Date / Time:	Date / Time:
Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

San Francisco Office: 3777 Depot Road, Suite 409, Hayward, California 94545 / Telephone: (510)887-8828 (800)827-FASI / Fax: (510)887-4218
Los Angeles Office: 2959 Pacific Commerce Drive, Rancho Dominguez, California 90221 / Telephone: (310)763-2374 / Fax: (310)763-8684
St. Paul Office: 800 Transfer Road, Suite 7A, St. Paul, Minnesota 55114 / Telephone: (612)644-1007 / Fax: (612)644-1011

Forensic Analytical

Final Report

Metals Analysis of Paints

Winzler & Kelly
Butch Reynolds
2984 Teagarden St.

San Leandro, CA 94577

Client ID: 2735
Report Number: M071392
Date Received: 06/21/05
Date Analyzed: 06/22/05
Date Printed: 06/22/05
First Reported: 06/22/05

Job ID / Site: 1030205001 - Steam Schooner `Wapama`

FASI Job ID: 2735-128

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit	Method Reference
P-1	30230361	Pb	0.011	wt%	0.007	EPA 3050B/7420
P-2	30230362	Pb	< 0.006	wt%	0.006	EPA 3050B/7420

Dave Sandusky, Laboratory Supervisor, Hayward Laboratory

3777 Depot Road, Suite 409, Hayward, California 94545-2761 Telephone: 510/887-8828 800/827-FASI Fax: 510/887-4218

Forensic Analytical #2735-128 Analysis Request Form

Client Name & Address: Winzler & Kelly 2994 Treadwell St San Leandro, CA 94577	P.O. #: Date: 6/21/05 Turn Around Time: 4V hr/ 12hr / 24hr (48 hr) / ext: Due Date: 6/23/05 Due Time: : am/pm ☐ PLM: ☐ Standard / ☐ Point Count ☐ PCM: NIOSH 7400
Contact: Burk Reynolds Phone #: (510) 667-6440 Fax#: (510) 667-6444	☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402 ☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield ☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Wt % ☐ TEM Microvac ☐ Special Project:
Site: Steam Schooner "Wapama" Job:	☒ Metals Analysis: Method Matrix: Paint chip Analytes: AA - Flame - Lead
Comments: Paint Chips - Lead	

Sample ID	Date/ Time	Sample Location/Description	FOR AIR SAMPLES ONLY				Sample Area or Air Volume
			Type	Time On/Off	Avg. LPM	Total Time	
P-1		Paint on Barge Metal Deck (Red	A P C				
P-2		Paint on Bottom of Hull (Red)	A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				

Sampled by: L. S. Reynolds Date: 6/14/05 Time: :

Shipped via: ☐ Fed Ex ☐ Airborne ☐ UPS ☐ US Mail ☐ Courier ☐ Drop Off ☐ Other:

Relinquished by:	Relinquished by:	Relinquished by:
Date / Time:	Date / Time:	Date / Time:
Received by: [signature] Date / Time: 6/21/05 1845	Received by: Date / Time:	Received by: Date / Time:
Condition Acceptable? ☑ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

San Francisco Office: 3777 Depot Road, Suite 409, Hayward, California 94545 / Telephone: (510)887-8828 (800)827-FASt / Fax: (510)887-4218
Los Angeles Office: 2959 Pacific Commerce Drive, Rancho Dominguez, California 90221 / Telephone: (310)763-2374 / Fax: (310)763-8684
St. Paul Office: 800 Transfer Road, Suite 7A, St. Paul, Minnesota 55114 / Telephone: (612)644-1007 / Fax: (612)644-1011

Forensic Analytical

Final Report

Metals Analysis of Bulks

Winzler & Kelly
Butch Reynolds
2984 Teagarden St.

San Leandro, CA 94577

Client ID: 2735
Report Number: M071393
Date Received: 06/21/05
Date Analyzed: 06/28/05
Date Printed: 06/29/05
First Reported: 06/29/05

Job ID / Site: 1030205001 - Steam Schooner `Wapama`

FASI Job ID: 2735-128

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit	Method Reference
T22-1	30230363	Ag	2.0	mg/kg	0.5	EPA 3050B/6010B
		As	1300	mg/kg	3	EPA 3050B/6010B
		Ba	530	mg/kg	10	EPA 3050B/6010B
		Be	0.6	mg/kg	0.5	EPA 3050B/6010B
		Cd	6	mg/kg	1	EPA 3050B/6010B
		Co	8	mg/kg	1	EPA 3050B/6010B
		Cr	51	mg/kg	2	EPA 3050B/6010B
		Cu	49000	mg/kg	200	EPA 3050B/6010B
		Hg	67	mg/kg	5	EPA 7471A
		Mo	3	mg/kg	3	EPA 3050B/6010B
		Ni	32	mg/kg	3	EPA 3050B/6010B
		Pb	120	mg/kg	2	EPA 3050B/6010B
		Sb	< 3	mg/kg	3	EPA 3050B/6010B
		Se	< 5	mg/kg	5	EPA 3050B/6010B
		Tl	< 10	mg/kg	10	EPA 3050B/6010B
		V	80	mg/kg	2	EPA 3050B/6010B
		Zn	1600	mg/kg	3	EPA 3050B/6010B

3777 Depot Road, Suite 409, Hayward, California 94545-2761 Telephone: 510/887-8828 800/827-FASI Fax: 510/887-4218

Metals Analysis of Bulks

Winzler & Kelly
Butch Reynolds
2984 Teagarden St.

San Leandro, CA 94577

Client ID: 2735
Report Number: M071393
Date Received: 06/21/05
Date Analyzed: 06/28/05
Date Printed: 06/29/05
First Reported: 06/29/05

Job ID / Site: 1030205001 - Steam Schooner `Wapama`

FASI Job ID: 2735-128

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit	Method Reference
T22-2	30230364	Ag	< 0.5	mg/kg	0.5	EPA 3050B/6010B
		As	31	mg/kg	3	EPA 3050B/6010B
		Ba	340	mg/kg	10	EPA 3050B/6010B
		Be	< 0.5	mg/kg	0.5	EPA 3050B/6010B
		Cd	6	mg/kg	1	EPA 3050B/6010B
		Co	84	mg/kg	1	EPA 3050B/6010B
		Cr	220	mg/kg	2	EPA 3050B/6010B
		Cu	110	mg/kg	2	EPA 3050B/6010B
		Hg	2.3	mg/kg	0.2	EPA 7471A
		Mo	< 3	mg/kg	3	EPA 3050B/6010B
		Ni	3	mg/kg	3	EPA 3050B/6010B
		Pb	64000	mg/kg	200	EPA 3050B/6010B
		Sb	< 3	mg/kg	3	EPA 3050B/6010B
		Se	< 5	mg/kg	5	EPA 3050B/6010B
		Tl	< 10	mg/kg	10	EPA 3050B/6010B
		V	5	mg/kg	2	EPA 3050B/6010B
		Zn	4700	mg/kg	3	EPA 3050B/6010B

Dave Sandusky, Laboratory Supervisor, Hayward Laboratory

3777 Depot Road, Suite 409, Hayward, California 94545-2761 Telephone: 510/887-8828 800/827-FASI Fax: 510/887-4218

Forensic Analytical #2735 - 128 Analysis Request Form

Client Name & Address:
WINZLER & KELLY
2984 TEAGARDEN ST.
SAN LEANDRO, CA 94577

P.O. #: 103020SW1 Date: 6 / 21 / 05
Turn Around Time: 5 DAY / 12hr / 24hr / 48 hr / ext:
Due Date: 6 / 28 / 05 Due Time: : am/pm
☐ PLM: ☐ Standard / ☐ Point Count ☐ PCM: NIOSH 7400

Contact: Butch Reynolds
Phone #: (510) 667- 6440
Fax#: (510) 667- 6444
Site: STEAM SCHOONER "WAPAMA"
Job:

☐ TEM Air: ☐ AHERA / ☐ Yamate2 / ☐ NIOSH 7402
☐ TEM Bulk: ☐ Quantitative / ☐ Qualitative / ☐ Chatfield
☐ TEM Water: ☐ Potable / ☐ Non-Potable / ☐ Wt %
☐ TEM Microvac
☐ Special Project:
☒ Metals Analysis: Method ICP/Hg by Cold Vapor
Matrix: BULK - CAM 17 - Title 22
Analytes: CAM17

Comments: Composite Samples - Please Homogenize

Sample ID	Date/ Time	Sample Location/Description	FOR AIR SAMPLES ONLY Type	Time On/Off	Avg. LPM	Total Time	Sample Area or Air Volume
T22 - 1		BOTTOM PAINT	A P C				
T22 - 2		BOAT DECK PAINT - (STARBOARD SIDE) WHITE	A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				
			A P C				

Sampled by: L. S. Reynolds Date: 6 / 14 / 05 Time: :
Shipped via: ☐ Fed Ex ☐ Airborne ☐ UPS ☐ US Mail ☐ Courier ☐ Drop Off ☐ Other:

Relinquished by:	Relinquished by:	Relinquished by:
Date / Time: 6/21/05	Date / Time:	Date / Time:
Received by:	Received by:	Received by:
Date / Time: 06/21/05 1PM	Date / Time:	Date / Time:
Condition Acceptable? ☑ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No	Condition Acceptable? ☐ Yes ☐ No

San Francisco Office: 3777 Depot Road, Suite 409, Hayward, California 94545 / Telephone: (510)887-8828 (800)827-FASI / Fax: (510)887-4218
Los Angeles Office: 2959 Pacific Commerce Drive, Rancho Dominguez, California 90221 / Telephone: (310)763-2374 / Fax: (310)763-8684
St. Paul Office: 800 Transfer Road, Suite 7A, St. Paul, Minnesota 55114 / Telephone: (612)644-1007 / Fax: (612)644-1011

SECTION 5

PHOTOGRAPHICS

PROJECT NAME – SS WAPAMA NHL STEAM SCHOONER

MATERIAL: SS WAPAMA, STBD VIEW – DETERIATED EXTERIOR PAINT
CONTAMINANT: LEAD CONTAINING AND TOXIC MATERIALS

MATERIAL: PIPE RISER WITH DAMAGED INSULATION
CONTAMINANT: ASBESTOS

PROJECT NAME - SS WAPAMA NHL STEAM SCHOONER

MATERIAL: PIPE RISER WITH DAMAGED INSULATION
CONTAMINANT: ASBESTOS

MATERIAL: PIPE INSULATION (DAMAGED) OVER GENERATORS (PORT SIDE)
CONTAMINANT: ASBESTOS

PROJECT NAME - SS WAPAMA NHL STEAM SCHOONER

MATERIAL: PIPE INSULATION AT WATER TANK
CONTAMINANT: ASBESTOS

MATERIAL: PIPE INSULATION, DAMAGED
CONTAMINANT: ASBESTOS

PROJECT NAME - SS WAPAMA NHL STEAM SCHOONER

MATERIAL: BOILER INSULATION DEBRIS, STBD FIRE BOX AT DECK
CONTAMINANT: ASBESTOS

MATERIAL: BOILER INSULATION, STBD FIRE BOX AT BOILER
CONTAMINANT: ASBESTOS