

ARCO MARINE, INC.

AIR SAMPLING STUDY FOR ASBESTOS FIBER CONCENTRATIONS

SUMMARY REPORT

INTRODUCTION

In June of 1991, a study was initiated to measure the ambient air in work and living spaces on board ARCO Marine, Inc. vessels for the presence of asbestos fibers. This was a follow-up to other studies that have been conducted in the past. The study was designed to determine the potential risk of exposure to asbestos fibers in air on AMI vessels today while the vessels were at sea.

Clayton Environmental Consultants was retained to conduct the air sampling program. Eight AMI vessels were included in the monitoring program. The two 190,000 DWT vessels were not included in the study, as they were not constructed with materials which have the potential to release asbestos fibers to air. The first ship was surveyed in June of 1991, and the final vessel sampling was completed in February of 1992. Asbestos awareness training was conducted on board while the sampling was being conducted.

METHODS

Air Sampling: All air sampling was conducted while the ship was underway during the northbound voyage of the vessels under ballast. This was done to evaluate the worst-case potential to dislodge asbestos (due to vibration) from insulation and other construction materials, potentially contributing to atmospheric levels of asbestos fibers.

The primary objective of the study was to measure the ambient air for asbestos fibers throughout the living and working spaces during normal shipboard operations. The study was not designed to evaluate the potential for exposure to asbestos during shipboard maintenance tasks on asbestos-containing materials.

The air sampling protocol called for a minimum of two area measurements to be taken in each of the following locations: Crew quarters; Crew/Officer's lounge; Crew/Officer's mess; Passageways; Cargo control room; and Engine room spaces (at least two different locations). Other area samples were collected at the request of shipboard personnel, including samples in the galley, gym, hospital, etc.

Measurement of asbestos fibers were also conducted during the removal of a ceiling tile for access to the overhead space. A total of four air samples were collected on two vessels during ceiling panel removal to assist in evaluating protective equipment requirements during this task.

Samples were collected and analyzed for asbestos fiber concentrations by an accredited laboratory using PCM (Phase Contrast Microscopy). PCM is the accepted method for asbestos fiber measurement, although it does not provide positive identification of asbestos fibers. PCM will measure overall fiber concentration, including non-asbestos fibers. In all cases where air measurements were above 0.01 f/cc (fibers of asbestos per cubic centimeter of air), the sample was further analyzed

by TEM (Transmission Electron Microscopy) to determine conclusively if the fibers were asbestos.

Bulk Asbestos Analysis: Samples of insulation, valve packing, pipe lagging, etc. were collected during the survey for analysis of asbestos content. These materials were selected for sampling by ship crew members due to their questions or lack of documentation of potential asbestos content. Samples were analyzed using PLM (polarized light microscopy).

EXPOSURE LIMITS

The EPA has established a recommended exposure limit of 0.01 f/cc as an acceptable limit for airborne asbestos fiber concentrations after asbestos abatement activities and prior to reoccupancy of living and working spaces. EPA's recommended exposure limit is used for this study as a recommended "background" limit for shipboard living and working spaces. OSHA has mandated a level of 0.2 f/cc for an 8-hour working exposure limit, with an excursion limit of 1.0 f/cc for a 30-minute exposure period. These limits are presently used throughout industry as accepted practice for living and working exposure limits, because they are based upon the most current information regarding asbestos health risks.

The U.S. Coast Guard has recommended exposure limits for shipboard employees, which are based upon the old OSHA exposure limits. The recommended U.S. Coast Guard limit for working environments is 2.0 f/cc for an 8-hour time weighted average, and the recommended limit for living environments is 0.1 f/cc.

RESULTS & CONCLUSIONS

The results of air sampling are summarized in Table 1 and 2. As noted in the tables, all samples were below the recommended EPA limit of 0.01 f/cc. Although a number of samples contained an overall fiber concentration at or above 0.01 f/cc on PCM analysis, further analysis with TEM showed asbestos fiber concentrations to be well below this level. This means that fibers originally identified in PCM analysis were non-asbestos fibers. Generally, these higher PCM readings were found in staterooms and lounges, where dust from clothing, bed and window coverings can contribute to the initial fiber count. TEM analysis allows for positive identification of these fibers as clothing fibers or other fibrous debris. These data indicate that ambient, background levels of asbestos fibers in living and working spaces are well within acceptable limits on AMI 265, 120, 90, and 70 MDWT vessels.

Measurements made during ceiling panel removal indicated an asbestos fiber concentration between <0.002 and 0.006 f/cc using PCM analysis on the ARCO Anchorage. A sample on the ARCO Sag River during ceiling panel removal indicated an asbestos concentration of 0.0021 f/cc upon TEM analysis. These samples were collected over a period between 85 and 120 minutes. The measurements showed an increase in asbestos fiber concentrations during the removal of ceiling panels, although levels measured were below the accepted limit for living and working environments, and well below the OSHA excursion limit. It is, however, advisable to continue the precautionary use of personal protection and procedures to prevent contamination of the general area during ceiling panel removal. As asbestos bearing material can be found on board all AMI vessels, proper precautions must be followed in all cases where the material is handled directly. Refer to AMI procedures for asbestos handling.

Note: The reports prepared by Clayton Environmental Consultants on the individual ship surveys are available for review on the ships that were surveyed and through the AMI or ATC SHEP group.

SUMMARY OF ASBESTOS MONITORING RESULTS

Ship	Total Samples Collected	Asbestos Fiber Concentration by PCM f/cc	Asbestos Fiber Concentration by TEM f/cc
ARCO Spirit	24	(23) 0.001-0.006	(1) < 0.00026
ARCO Independence	22	(19) 0.001-0.009	(3) < 0.00022
ARCO Fairbanks	20	(20) 0.001-0.010	None submitted for TEM
ARCO Anchorage	23	(22) 0.001-0.006	(1) < 0.00034
ARCO Juneau	20	(19) 0.001-0.002	(1) < 0.00023
ARCO Sag River	33	(29) 0.001-0.008	(3) < 0.0053 (1) 0.0021 - Measured during ceiling panel removal
ARCO Prudhoe Bay	18	(17) 0.001-0.005	(1) < 0.001
ARCO Texas	18	(18) 0.001-0.007	None submitted for TEM

Number of Samples in parenthesis (#)
 PCM = Phase Contrast Microscopy
 TEM = Transmission Electron Microscopy
 f/cc = Fibers of asbestos, per cubic centimeter of air

Fiber Concentration Standards:
 OSHA PEL = 0.2 f/cc
 EPA Recommended Clearance Level = 0.01 f/cc
 Coast Guard (Working Environment) = 2.0 f/cc
 Coast Guard (Living Environment) = 0.1 f/cc

SUMMARY OF ASBESTOS BULK SAMPLE ANALYSIS

Ship	Sample Location	Asbestos Concentration
ARCO Independence	(1) Radio Room Debris under radio panel	ND
	(3) Engine Room Insulation and lagging	ND
	(1) Engine Room Valve packing	70-75%
ARCO Anchorage	(1) Engine Room Blanket Insulation	ND
	(1) Engine Room Pipe lagging	ND
	(3) Cloth lagging throughout ship	ND
	(2) Engine Room Pipe/Tank Insulation	ND
ARCO Sag River	(3) Ceiling Panels	30-40%
	(4) Cloth lagging throughout ship	65-70%

Number of Samples in parenthesis (#)
 ND = None Detected