

Transportation of coal by barge: history and safety



**ASSIGN
BUSTER**

Introduction

The use of canals or rivers as a mode of transportation of goods, services, and people can be dated back to around 4000 BC. While the transportation devices have changed the, use of inland waterways have not. To date, barge transportation still provides the most-fuel efficient way to move goods; on average barges can move goods four times farther than trucks on the same amount of fuel. The United States inland “ water highway” is composed of 25, 000 miles of inland waterways and 239 locks. (Engineers, 2019) This intricate waterway system provides more than half a million jobs and transports roughly 600 million tons of cargo each year, about 14% of the United States total domestic freight. (ASCE, 2017) The break down of this cargo includes: 18% Crude Material, 12% Food & Farm, 8% Chemicals, 29% Coal, 27% Petroleum and 6% Other materials or goods.

The Army Corp of Engineers maintains, and the U. S. Coast Guard oversees the waterways but it is OSHA/Maritime’s responsibility to keep the half a million employees safe. The employees include approximately 4, 000 deckhands who physically operate the barges in the United States.

Employees working on these vessels face similar hazards that one might see in a production facility but on water, which only compounds the danger.

OSHA has documented from 1997 to 2006, 305 employees were killed on a barge/tow combination, and 379 explosions or fires occurred, killing 14 employees (OSHA, 2009). To counteract these events OSHA has provided a DeckHand Safety manual, which addresses the top hazards while working on a barge (OSHA 3358-01N). In conjunction with the EPA and Maritime Authorities, OSHA has also provided barge safety standards for loading,

<https://assignbuster.com/transportation-of-coal-by-barge-history-and-safety/>

unloading and transporting materials via waterway. Since the implementation of OSHA standards, the annual number of fatalities for all accident types have steadily decreased (Guard, 2018). In 2017, the U. S. Coast Guard found that there were six total operational towing crew fatalities and while OSHA strives to hit zero fatalities this data shows an overall improvement with barge safety.

Hazardous Materials

By definition, a hazardous material is any item or agent (biological, chemical, radiological and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Bituminous more commonly known as coal, is listed as a category 2 GHS classification, repeat exposure to coal can cause eye/skin irritation and may cause damage to organs, including the respiratory system (Carolina, 2015). Due to this classification and coal containing heavy metals such as arsenic, cadmium, lead and chromium OSHA considers it to be a hazardous material per 1910. 1000 Table Z-1. Over exposure to heavy metals such as the ones listed above have been related to cancer, chronic bronchitis, decreased lung functions, asthma and in extreme cases death (Ahearn, 2016). The second part of handling raw coal is to limit the amount of coal dust operators encounter. Depending on the type of coal, the dust may include 15 to 60% silica making it extremely dangerous for operators (Farifax, 2005). Due to these risk OSHA provides operators guidelines under 29 CFR 1910. 1000, this section discuss proper handling procedures, required personal protection equipment (PPE) and exposure limits. In

conjunction with OSHA's 29 CFR 1910. 1000 Maritime has provided section 29 CFR 1915. 1000 which includes the proper coal transportation guidelines.

Transportation

Most of the coal shipped within the United States is transported using dry hopper barges. These vessels are double-hull construction, which allows the sides and bottom of the cargo hold to be separated from the outer skin by air pockets. These air pockets reduce moisture draw and provide additional protection from water that might leak through the hull. Additional roll or hard covers may be placed over the hoppers to protect the raw coal from excess rainfall or splashing water. The standard hopper barge measures 195ft by 35ft and can carry approximately 1500 tons of materials, tonnage varies based on the construction of the barge being loaded. Barges are connected using steel linkage which is attached to a tug or tow barge. The tow barge houses the engine and operators, which allows the barges to move through the waterways.

Limitations/Safety Precautions

Safety precautions with raw coal starts during loading and does not end until the material has been unloaded. During loading all unnecessary employees should be removed from the general area. This is mainly due to the dust that is displaced while the raw coal is being moved. Per OSHA standards employees handling coal should have a respirator and the material should be lightly sprayed with water to reduce free flying dust/particles. Before any coal is loaded the Master or Captain should be provided with the cargo information form and MSDS. The Master should be fully aware of the type of <https://assignbuster.com/transportation-of-coal-by-barge-history-and-safety/>

coal and its limitation, per Maritime law all coal will fall into one or more of the following categories: Gas Emitting (Methane), Spontaneous Combustion or Corrosion. The final requirement is to set a non-smoking area around the barge and signage displaying the hazard or hazards. Once the Master understands the restrictions the hopper should be prepared including: fully cleaned from any past residue, placed away from any item producing heat, covered, and/or vented. Once the coal has been loaded onto the barge onboard instruments should be set up around the cargo to measure methane, oxygen and carbon monoxide gasses. These measurements are sent directly to the control room for the Master to review throughout the duration of the trip.

Methane Emissions

Methane emissions from coal varies depending on the type and the time since it was mined. Newly mined coal will emit the highest levels of methane and should be monitored very closely as a naked flame or spark can cause ignition. The Master should be aware of methane emission levels and should provide appropriate signage to warn employees. They should also be aware if there was required additional ventilation around the barge. If methane levels become unacceptable per Maritime standards (50, 000ppm or greater) the ventilation system should be turned on or the cover rolled back to allow for venting (BCBI, 1994). In addition to minimizing combustion individual methane exposure should be watched as well. Per NIOSH an individual exposure level is 1000ppm over an 8-hour time frame, if measurements are showing higher than normal emissions the captain should advise the crew and provide them with appropriate PPE.

Spontaneous Combustion

While methane emissions can cause combustion, spontaneous combustion can occur based on the type and material breakdown of the coal being transported. Newly mined, soft coal such as the kind normally found in the United States can be very susceptible to exothermic oxidation, a reaction involving moisture that produces heat (Handybulk, 2019). If this heat is not removed the internal temperature of the coal can rise and may cause the pile to combust. To combat spontaneous combustion coal should be tightly packed to limit moisture and air exposure, additionally barge temperatures and carbon monoxide levels should be monitored for abnormal spikes. If abnormal spikes are noticed the captain should notify proper authorities and try to cool the coal stack by using the air pockets inside the barge.

Corrosion

Corrosion of steel barge hulls and containers is inevitable while on the water but some materials such as high sulfur coal can drastically speed up the process. When wet high content sulfur coal produces a chemical reaction that produces acids and hydrogen gases as a byproduct (Handybulk, 2019). These acids can corrode barge hulls and containers which result in cargo getting wet and even barges sinking. To counteract this process barge hulls should be fully cleaned, and rust areas repaired. High sulfur coal should be covered to reduce wetness and monitor for hydrogen gases. If hydrogen gases are found the hull and container should be checked for weak spots and ventilation should be used to remove excess moisture from the load (Organization, 2004).

References

- Ahearn, A. (2016, June 21). *What Coal-Train Dust Means For Human Health* . Retrieved from OPB: <https://www.opb.org/news/article/coal-dust-a-closer-look/>
- ASCE. (2017). *Infrastructure Report Card* . United States : ASCE. Retrieved from <https://www.infrastructurereportcard.org/cat-item/inland-waterways/>
- BCBI. (1994, Feb 1). *Emergency and Continuous Exposure Limits for Selected Airborne Contaminants* . Retrieved from NCBI: <https://www.ncbi.nlm.nih.gov/books/NBK208285/>
- Carolina. (2015). *Safety Data Sheet – Coal, Bituminous* . Washington: Carolina Biological Supply .
- Engineers, U. A. (2019, June 19). *Ports and Waterways-Webtool* . Retrieved from Institute for Water Resources : <https://www.iwr.usace.army.mil/About/Technical-Centers/WCSC-Waterborne-Commerce-Statistics-Center/>
- Farifax, R. E. (2005, April 27). *Standard Interpretations* . Retrieved from Occupational Safety and Health Administration: <https://www.osha.gov/laws-regs/standardinterpretations/2005-04-27>
- Guard, U. C. (2018). *American Waterways Operators Annual Safety Report* . United States Waterways: U. S. Coast Guard .
- Handybulk. (2019, June 26). *Coal Transportation Risks* . Retrieved from Handybulk: <https://www.handybulk.com/coal-transportation-risks>
- Organization, I. M. (2004, Dec 1). *Bulk Carrier Safety* . Retrieved from International Maritime Organization: <http://www.imo.org/en/OurWork/Safety/Regulations/Pages/BulkCarriers.aspx>

- OSHA. (2009). *Deck Barge Safety*. Washington : U. S. Department of Labor . Retrieved from WWW. OSHA. GOV.