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VOLCANIC ASH INFORMATION 13

Prepared by Oregon State University's Agricultural Experiment Station and Extension Service. For more information, consult the OSU Extension Service in your county or the nearest branch Agricultural Experiment Station.

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PROTECTING MARINE ENGINES FROM VOLCANIC ASH

Introduction

The volcanic ash fallout from Mt. Saint Helens has the possibility of exposing boats to very unusual operating conditions. To date, only parts of the Columbia and Snake Rivers have been exposed to ash situations. This report is to advise boat operators in the event of future ash fallout over waterways.

The ash, a fine powder consisting of hard, abrasive particles, is potentially quite harmful to internal combustion engines. While some boat operators have air filters on their engines, a high percentage of marine engines have only a silencer or, on gasoline engines, a flame arrester. A typical paper-type air filter is effective in removing ash particles as small as 10 to 20 microns. Air filters are the most effective way of keeping air-borne ash from entering an engine.

Oil systems are generally pressurized and are thus sealed from direct contamination from the ash. Yet, ash which becomes trapped in the oil film coating cylinder walls can quickly contaminate the oil and cause damage throughout the engine. The typical oil filter will remove particles as small as five to ten microns. The size distribution of ash particles varies with distance from the mountain and air currents; the nearer the mountain, the larger the percentage of large particles. Complete data concerning size distribution is not yet available, but preliminary measurements on ash collected in Yakima Washington (80 miles from St. Helens) showed 30% of the particles between two and fifty microns.* Ash collected in Pullman Washington (250 miles from the mountain), although lower in fallout density, consisted of nearly 75% of particles within that size range.

Discussions with engine suppliers, service personnel and fleet operators produced several recommendations on revising maintenance schedules and modifying operating practices during periods of ash fallout. They also pointed out potential hazards of inadequate air and oil filtration. These include

- Clogged air filters will restrict the flow of air to the engine and cause a loss of power;
- Contamination of the oil can cause inadequate lubrication, clogged oil lines, and increased engine heat;
- Excessive wear to the piston rings, cylinder walls and valve seats can be caused by ash-laden air;
- Excessive wear to bearings and seals can be caused by lubrication with dirty oil.

These hazards can be minimized. Some special precautions and maintenance procedures recommended by industry specialists include the following.

I. Revise the engine maintenance schedule.

A. Air filters.

Install one if the engine is not presently so equipped. Air filters must be correctly sized to meet the engine's requirements for air. Your local equipment dealer can help in selecting the proper filter for your engine. (Check Coast Guard regulations before adding anything -- particularly to a gasoline engine.)

Clean or replace the air filter only when you notice a decrease in engine power. Over-maintenance is discouraged; a partially dirty paper-type air filter will trap particles as small as 10 microns, compared to 20 microns for a new filter; over-maintenance will also expose the engine to ash contamination more often than necessary.

Follow manufacturer's recommendation when servicing air filters. A general one is to use a low pressure air hose blowing from the inside out. Wipe seals and the inside of the filter cannister with a damp cloth to remove any settled dust.

Check the filter element for any damage. Check for rips or tears in the paper with the aid of a light. When replacing the filter be sure it is seated properly and that gaskets seal tightly.

B. Oil system.

Change the oil and filter more often when operating in dusty environments.

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* 1 micron = 10^{-6} meters

Servicemen recommend reducing the time between changes to 1/2 to 1/3 the normal interval, depending on conditions.

Wipe ash away from dip stick, oil plugs, and the oil filter cannister before removing or installing any of them.

Laboratory oil analyses help determine the type and amount of wear occurring inside an engine. (See box for more information.) Equipment manufacturers recommend increasing the frequency of such tests when operating under dusty conditions. Marine tugs operating out of Portland under extreme ash conditions have had oil analyses done as often as once per day.

C. Other maintenance.

All bearings and joints not included in the oil system need to be greased more often than normal. This will flush out ash from the inside.

Clean ash from starters and alternators with a low pressure air hose or a vacuum. Ash wetted with spray water or condensation will settle into the windings and brushes.

II. Follow Special Protection Practices.

Adoption of some basic protection practices could help reduce the amount of ash reaching the engine.

- Several layers of gauze over engine room vents will aid in filtering air.
- As much as possible, close hatches, portholes and any other unfiltered openings to the engine room to reduce the amount of ash entering.
- Reduce the engine R.P.M.'s (and thus air intake) if possible.
- Washing the deck down frequently will trap dust and keep it from blowing below.
- While the engine is not in operation, cover air intakes to keep dust from settling in. (But don't forget to remove them all before restarting.)

Conclusion

Operating marine engines under dusty situations is a very unusual occurrence and requires an alteration of the normal routine in order to protect the engine from damage.

The volcanic ash from Mt. St. Helens is composed of very small, very abrasive particles which will clog filters, dirty the oil and increase wear throughout the engine. To minimize the effects of the ash on a marine engine, implement a revised maintenance schedule and reduce the engine's exposure to the ash by adoption of some special protection practices.

OIL ANALYSIS

Laboratory analysis of oil can be of great value in assessing engine wear. Modern procedures can accurately measure levels of foreign solids and liquids and chemical changes of the oil due to high temperatures or contaminants. In some fleet operations, oil analysis is part of a regular maintenance schedule to provide a complete history of engine wear patterns. A one-time analysis can assist a boat owner in determining engine damage due to contact with volcanic ash. Cost is commonly between $10 and $15 per sample.

The type of analysis will vary between laboratories, but all will test for the presence of "wear metals" (iron, lead, copper, aluminum, silicon and chromium). The type and concentration of wear metals in the oil will indicate the location and amount of wear which has occurred. For example, engine oil which has been contaminated by ash would show a high concentration of silicon, a major component of ash. If any wear has occurred to the piston rings, cylinder walls or valve seats the concentration of iron and chromium would also be high. Other tests include measurement of the concentrations of fuel, water and antifreeze, and measurement of the viscosity, color and oxidation. The laboratory will provide an interpretation of the results.

To obtain a fully representative sample, run the engine for awhile before collection. A sample can be collected either by drawing oil with a tube from the dip stick entrance, or during an oil change. If a sample is taken during an oil change, allow the oil to drain for a short time before collecting. This is so the grit which has accumulated by the drain plug does not become part of the sample. Four to six fluid ounces are needed for analysis.

Included with every oil sample should be information on hours of engine operation since the last oil change; size, age, and type of engine; name and type of oil.

Authors: Scott Robinson, Engineering Assistant
Edward Kolbe, Associate Professor
Department of Agricultural Engineering
Marine Science Center
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