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RESEARCH PROJECT TITLE

Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment

SPONSORS

Iowa Highway Research Board
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Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment

Tech transfer summary

Testing shows that corrosion in the field due to ice control chemicals cannot be predicted by laboratory studies. Methods of avoiding or limiting corrosion in the field are presented and discussed.

OBJECTIVES

The purpose of this study was to determine how corrosion occurs on maintenance trucks, to find methods that would minimize corrosion mechanisms, and to suggest a mode of analysis to determine the optimal combination of approaches for a given maintenance situation.

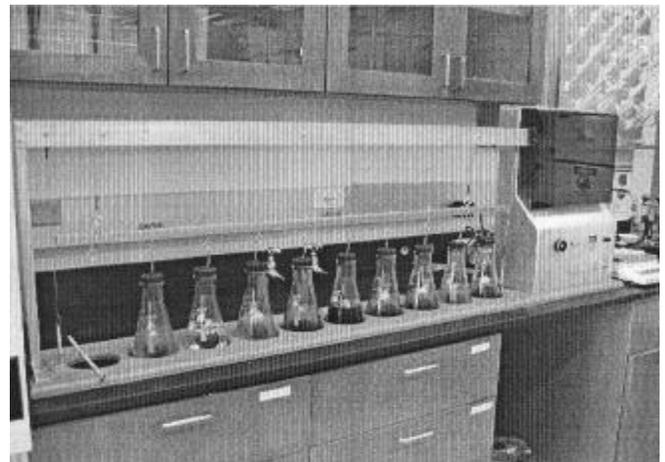


Figure 1: Corrosion Testing Apparatus

PROBLEM STATEMENT

Corrosion of winter maintenance equipment is becoming of greater concern because of the increased use of liquid solutions of ice control chemicals, as opposed to their application in solid form. Methods to minimize corrosion may include coatings, additives, cleansing techniques, and may also include doing nothing, and accepting a reduced equipment lifetime as a valid trade off with the enhanced benefits of using liquid ice control chemicals. Some

combination of these methods may also be optimal. Whatever solutions are selected, they must be relatively cheap and durable. The latter point is critical because of the environment in which maintenance trucks operate, in which scrapes, scratches and dents are facts of life.

RESEARCH DESCRIPTION

The research included three major parts: a literature review, laboratory experiments (see Figure 1), and the development of suggested approaches to minimize corrosion.

The literature review covered three areas:

1. General ways in which corrosion occurs.
2. The corrosion specification developed by the Pacific Northwest Snowfighters.
3. Reports that are specific to corrosion in winter maintenance environments.

The laboratory experiments exposed additional uncertainty about the field effects of corrosive chemicals on metals, by examining how concentration of chemical impacted the corrosion rates (Figure 2). In addition to being new data that had not been collected previously this information also highlights how difficult it is to predict what will happen in the field on the basis of laboratory or specification testing. The degree to which chemicals will become diluted in the field is simply not known to any degree of accuracy, and thus it may be that the expense of specification tests can only be justified in very limited circumstances.

In terms of approaches to minimize corrosion there are four primary ways in which the impact of corrosion on winter maintenance equipment can be reduced. These are as follows:

1. Add some sort of inhibitor to the ice control chemicals being used.
2. Provide a mechanism to wash vehicles thoroughly and often after use, so as to remove corrosive chemicals from contact with corrodible components.
3. Ensure that equipment is designed and maintained in such a way as to minimize opportunities for corrosion.

4. Coat all exposed metal parts so as to prevent corrosive liquids from coming into contact with metal surfaces.

Obviously each of these approaches have benefits and drawbacks, and these were considered in developing the final recommendations.

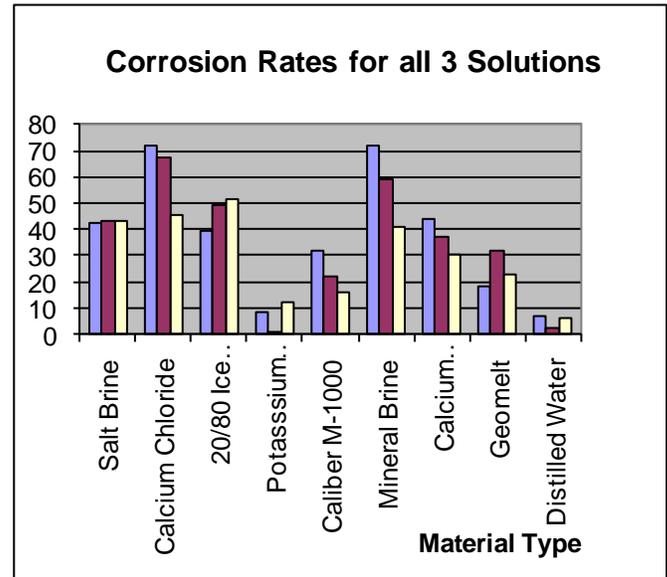


Figure 2: Corrosion Rates for Three Different Concentrations (1.5, 3, and 6%)

KEY FINDINGS

Given uncertainties on the performance in the field of corrosion inhibitors, it is recommended that ice control chemicals not be selected on the basis of their potential to reduce corrosion due to inhibitors.

A detailed field test should be conducted to determine the benefits and costs of different types of vehicle washing systems.

A working group should be formed to identify simple design changes in trucks that either avoid the potential for corrosion or make subsequent maintenance against corrosion simple.

Field trials of various coating systems should be conducted over a period of several winters.