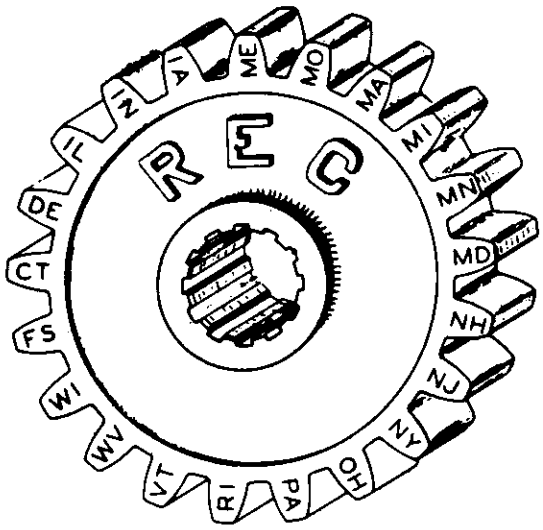

Roscommon Equipment Center

PROJECT NO. 5

RAPID WATER EVALUATION

Sept. 1981

NORTHEAST FOREST FIRE SUPERVISORS

RAPID WATER EVALUATION
ROSCOMMON EQUIPMENT CENTER
PROJECT NO. 5

CONTENTS

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Discussion

The evaluation of UCAR® Rapid Water was one of the eight projects approved when the REC program was initiated. Rapid Water is a liquid polymer friction reducing chemical. Polymers are non-toxic. opaque, white, liquids that form long chain molecules in water. The long chain molecules reduce turbulence in a flowing stream of water, thus reducing friction loss.

The project objective was to determine the advantages and disadvantages of using Rapid Water in standard water pumping systems. If determined advantageous, the next step was to be the development of hardware that would efficiently meter Rapid Water into fire streams. As an initial step, a review of existing work was made by Northeastern Area - CFFM.

In 1971, the Macon Fire Laboratory conducted some simple laboratory tests and reached two conclusions:

1. Rapid Water is not compatible with ammonium phosphate (fire retardant) solutions. 1/

2. The product is sensitive to shear as it passes through the pump and is mixed with water. Excessive shear destroys the long polymer chains and the property of Rapid Water to minimize line friction.

A memorandum report by A. V. Shoemaker (San Dimas Equipment Development Center) covered a field demonstration of the Rapid Water system in Orange County, California, on January 26, 1972. Shoemaker concluded that while dramatic performance results were obtained with the UCAR® Rapid Water product, the practical application for wildfire use was limited significantly by the type and cost ($3,300.00) of the injection system. The difficulty of retrofitting a non-uniform tanker fleet with injection systems was another disadvantage. The system was felt to be best suited for large tankers when working at stationary pumping assigments. 2/

An article by Truman Clough, in 1973, reported on feasibility trials carried out by the New York City Fire Department. They found that Rapid Water increased water flow significantly for a given pumping pressure, reduced nozzle reaction force, and greatly reduced friction loss in fire hose. 3/ However, their study and the equipment used therein was for structural fire fighting rather than wildland. The New York study also revealed some safety problems of men and equipment skidding and slipping on surfaces wet with water and the additive.

In 1973 and 1974 at the Forest Fire Experiment Station, Steve Such conducted some tests on stability, resistance to freezing, and other properties of Rapid Water. The tests, though very limited and informal, did show the Rapid Water additive to have a relatively short life expectancy (about 1-2 years). In storage, particularly with varing temperature conditions, the material had a tendency to turn spongy over a period of months, especially if air is allowed to enter the container.

In July of 1974, the Lawrence Livermore Laboratory in California conducted some friction loss studies in cooperation with the Hexcel Corporation using polyethylene oxide injected into the pumping system by means of a cartridge. Friction was reduced by an average of 44 percent. 4/ The cartridge is now distributed under the trademark of Hydropak by Western Fire Equipment Company.

The San Dimas Equipment Development Center evaluated and tested four polymer induction systems, including the UCAR^{R} Rapid Water system, in 1976 and published a Project Record, "Chemicals and Support Equipment to Reduce Friction in Hose Lays" reporting the results. Briefly, the report concludes Hexel Hydropak^{R} and Nalco Polymer will, in effect, allow the length of hose lays to be doubled while retaining identical waterflow and pressure characteristics. 5/

Conclusions

The Rapid Water system definitely reduces friction loss in hose lays. However, some problems do exist. The Rapid Water System used by the New York City Fire Department and California Division of Forestry was designed for flows from 150 to 800 gpm. From a practical standpoint, low flow nozzles are usually used for combating wildfires. Most fire department practice is usually associated with large volume pumpers dependent upon a hydrant system for the water requirements. Of necessity, forestry tankers carry the water required to the fireline in tank sizes ranging up to 300, 500, 750 or even 1000 gallons and the water is judiciously used through small diameter hose lines and nozzle tips. Turbulence, resulting in friction, is not too noticeable in the low flow areas used by forestry agencies. If a large water supply is available and pumped from a stationary tanker the Rapid Water system has merit.

The Hydropak^{R} system is cheaper, more easily installed and practical to use for wildfire wherever a requirement exists to increase water flow and pressure through a given hose lay, or wherever extra lengths of hose are needed when water flow and pressure are initially adequate.

Due to the limited practical application of Rapid Water and other polymer agents for wildland fire use REC did not attempt to develop hardware for metering polymers into fire streams.

This is the final report on REC Project No. 5 and the project is closed.

References

1/ Personal correspondence from R. A. Johansen of 9/2/71

2/ UCAR Liquid Rapid Water Product and Injection System, memorandum by A. V. Shoemaker, USDA, Forest Service, Equipment Development Center, San Dimas, California, 1972

3/ Research on Friction Reducing Agents by Truman C. Clouth, Fire Technology, Vol. 9, No. 1 (February 1973)

4/ Friction Loss Studies Using A 0.0127-M Fire Hose by R. G. Purlington, Fire Technology, Vol. 11, No. 3 (August 1975)

5/ Chemicals and Support Equipment to Reduce Friction in Hose Lays, by Jim Tour, USDA, Forest Service, Equipment Development Center, San Dimas, California, October 1976

Bibliography

(1) Better Fire Fighting with UCAR Rapid Water System, Union Carbide Corporation, 1973

(2) Hydropak - The Economical, Efficient Rapid Water System, Western Fire Equipment Company, 1975

(3) Rapid Water Additive for Fire Fighting, Union Carbide Corporation, 1970

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