FINAL REPORT

ALASKA RAILROAD CORPORATION INTEGRATED VEGETATION MANAGEMENT RESEARCH PROJECT

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FOREWORD

This project initially focused on an investigation of herbicide persistence and migration in Alaska. The scope was later broadened to include alternative methods of vegetation control.

Completion of this research investigation required the efforts of numerous individuals. Four students completed Master of Science theses on subjects associated with this project, and as required for their graduate degrees in the Environmental Quality Engineering and Science Program, Department of Civil Engineering, University of Alaska Fairbanks. The four students were Ms. Jill S. Chouinard, Mr. Darren F. Mulkey, Mr. Adam H. Owen and Ms. Tracey L. Preston.

The report that follows is in large part from the theses prepared for the respective students' University of Alaska thesis requirements. Those students are recognized and acknowledged for their efforts without which this project would not have been completed. The report reflects their efforts and those of others spanning more than two years of study.

An Executive Summary is included with this report to provide the reader with an overview of the project and its findings.

Timothy Tilsworth and Lawrence A. Johnson
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ACKNOWLEDGEMENTS

This research project was conducted under the direction of Tim Tilsworth and Larry Johnson. Other investigators from the University of Alaska Fairbanks included Jim Durst, Jill Chouinard, Darren Mulkey, Adam Owen and Tracey Preston.

A large number of organizations and individuals assisted the investigators, for which we are very grateful. We acknowledge them for their assistance. However, we note that such acknowledgement does not necessarily imply endorsement of the study or its findings. Several other University employees participated and assisted with the project They included:

Ms. Erin Bashaw - Technician
Mr. Al Batten - Museum
Mr. Bruce Baxter - Technician
Dr. F.Lawrence Bennett - Engineering Management
Ms. Robin Brown - Technician
Dr. R. F. Carlson - Water Resources
Ms. Bobbi Chouinard - Report Preparation
Dr. Jeffery Conn - Pesticides
Mr. Cash Fay - Technician
Mr. Huan Luong - Chemistry and GC
Ms. Cynthia Owen - Report Preparation
Ms. Annie Pham - Technician
Dr. Pham X. Quang - Statistics
Ms. Wendy Redpath - Report Preparation
Dr. Richard Stolzberg - Chemistry
Dr. Les Viereck - Ecology
Ms. Keli Yerian - Technician
Mr. Y. Zheng - Technician

We are grateful to the above individuals for their help and we also wish to acknowledge assistance given us by the UAF Department of Chemistry and the Institute of Northern Engineering for funding and logistical support. In particular we wish to recognize Charlotte (Hok) Barker for assistance with organization and editing of the report. Special mention is made of Dr. Stolzberg for his help with chemistry, gas chromatography, quality assurance/quality control (QAQC) and laboratory safety.

Additionally, we recognize the efforts of Dr. Quang for his guidance with statistics and project design.

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Mr. Dale Brackon - Security
Mr. Ralph Chiperno - Roadmaster
Ms. Debby Davis - Secretary
Mr. Walter Earl - Logistics
Mr. Mike Fretwell - Surveying
Ms. Vivian Hamilton - Communications
Ms. Phyllis Johnson - Legal
Ms. Steve Love - Roadmaster
Ms. Donna Rulien - Finance
Ms. Juanita Stewart - Secretary
Ms. Cheryl Sautel - Secretary
Mr. Keith White - Roadmaster

ARRC VEGETATION ADVISORY COMMITTEE - ARRC established a Vegetation Advisory Committee shortly after initiation of this research project. This group was a valuable asset to the research team. They showed keen interest, asked difficult questions and offered sound advice.

Dr. Sue Bishop, Anchorage
Mr. Paul Bratton, Talkeetna
Ms. Sue Libenson, Anchorage
Ms. Becky Long, Talkeetna
Mr. Randy McGovern, Fairbanks
Ms. Dorothea Rupprecht, Birchwood
Ms. June Weinstock, Fairbanks

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for suggesting the use of the ARRC Vegetation Advisory Committee. In retrospect, that was a great suggestion and a wise decision on the part of ARRC.

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION - ADEC personnel assisted throughout the duration of this project including design, monitoring, public hearings, and permit provisions.

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Mr. Douglas Donegan, Juneau
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Finally, we make special mention of all the railroad companies that participated in our national survey and of the proprietary companies that furnished vital information.

Our sincere thanks are extended to those who helped make this project a successful effort. Without their help, we would not have been able to complete it. Our deep appreciation is extended. Thanks.

Tim Tilsworth and Larry Johnson

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EXECUTIVE SUMMARY

**NOTE: This executive summary has been prepared for the purpose of providing the reader a summary of the major findings of this study. It is not intended to be a stand-alone document. Therefore, the reader is cautioned to interpret information in the context in which it was intended.

This project consisted of field testing to determine persistence and migration of herbicides on the Alaska Railroad Corporation (ARRC) right-of-way, literature reviews of vegetation control methods used by railroads, a survey of operating railroads in the U.S. and Canada, cost analyses of vegetation control methods used by railroads in general and the Alaska Railroad in particular, laboratory testing under controlled conditions, and an evaluation of vegetation control methods along the ARRC right-of-way.

The herbicide portion of the project was designed to address the persistence and migration of two herbicides in the field. This was accomplished through laboratory determination of residual levels of the chemicals in soil applications. Analyses were done by taking soil samples and performing pesticide extraction and cleanup procedures on the soils so that the extracts could be analyzed by gas chromatography.

Concentrations of the herbicides were determined at four depths in the soil: surface (0 ft), 1 ft, 2 ft, and 3 ft. Soil samples were taken at intervals of approximately 0, 7, 49, and 365 days after initial application of the herbicides.

Persistence was evaluated by analysis of the parent compound through time, which was then compared to the original application concentration. Migration was tracked through analysis of samples at progressive depths through time and soil outside of the application zone.