

# Fact Sheet

## CAPABILITIES FOR COLD-UNIQUE SOIL RESPIRATION RESEARCH

### PROBLEM

In field situations, soil microbial activity varies with temperature and moisture availability. Using  $Q_{10}$  values developed from pure, soil-free systems at room temperatures to predict long-term microbial kinetics may not be appropriate for low-temperature and freeze-thaw conditions found in cold regions. Many soil incubation studies are hindered by the inability to maintain relatively constant soil moisture and to accurately cycle the temperature through freeze-thaw processes in a controlled manner.

### SOLUTION

Biotreatment is an attractive option for treating contaminated soils in remote, cold regions where alternatives are costly and limited. CRREL has assembled a soil respirometer to investigate the effects of cold-unique phenomena on soil microbial processes. The respirometer is based on a commercially available respirometer that measures microbial activity by sampling the headspace above a respiring soil. Both  $CO_2$  and  $O_2$  are measured by in-line sensors. CRREL's soil respirometer system has 40 individual incubation chambers; each chamber has a condensing line to reduce soil moisture losses during long-term incubations. During incubation studies, vessels reside in controlled temperature baths. With this system, incubation temperatures can be controlled and varied from  $-20^{\circ}C$  to  $+30^{\circ}C$ . CRREL researchers have developed a series of macro instructions to work with commercially available spreadsheet applications to collect, organize, and plot the data in varied formats.

### RESULTS

Early testing of the respirometer for moisture loss at low temperatures indicates that the system is capable of keeping soil moisture loss under 3% during a four-week incubation. CRREL currently is using the system to develop temperature and soil moisture potential response surfaces to provide guidance for field bioremediation rates.

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