Lichen Radionuclide Baseline Research

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Introduction: Nuclear accidents leading to the release of radioactivity into the atmosphere may have adverse effects on the environment due to atmospheric fallout. Within Alaska, such an occurrence would effect many communities and villages that maintain a subsistence lifestyle.

Lichen has a high absorbance capacity for radionuclides, which varies depending on the species of lichen (Hanson 1968). As a major source of food for caribou during the winter months, radionuclides contained in the lichen transfer to the caribou and concentrate within their tissue. As a subsistence food, many communities and villages depend on caribou meat for nutrition and other subsistence uses. Consumption of caribou concentrates radionuclides in human tissue. Since humans are primarily at the top of the food chain, the concentrated radionuclides remain within their tissue until it completes the cycle of its decaying process.

Objectives:

- Establish composition and spatial distribution of natural and anthropogenic radionuclides in Alaska.
- Assess known and potential lichen indicator species.
- Derive correlation between baseline lichen data and radiological data gathered by NEWNET autonomous stations.
- Derive correlation between current baseline lichen data and previous radionuclide data in artic Alaska to estimate potential bioaccumulation effects in caribou

Sampling Methodology – Sampling guidelines/methods adopted from the International Technology Corporation Standard Operating Procedure for both surface soil sampling and vegetation sampling (1993). Coding of samples is based on a pre-existing coding system used by the Alaska Department of Environmental Conservation (ADEC). Samples were logged using the appropriate coding along with wet weight, date of retrieval, and Global Position System (GPS) location. For long term storage, samples were refrigerated until dried. Weights were determined at each step as the samples were prepared for Gamma Ray Spectrometer analysis.

Lichen Sampling Procedure:

- Choose sample area based on lichen abundance.
- Separate lichen from other natural materials, store in sealed, tared plastic bags.
- Sample area – 1/4-meter (smaller, if lichen abundance is low).
- Samples also archived for later identification.
- Drying time – 24-hours at 100°C.
- Samples ground to fine particles.
- Ash for 24-hours at 450°C and store in tared plastic bags.

[Fig. 1]: Sampling area at Moose Pass containing *Cadina stellaris.*

[Fig. 2]: Unwanted plant material and debris is separated from the lichen samples.

[Fig. 3]: Lichen abundance at Eagle Summit vs. Moose Pass

Region	Site Name	Species
Barrow	BEO	Thamnolia subuliformis*
Steese Highway	Eagle Summit	Cornicularia divergens*
White Mountain	Wickersham Dome	Cladina stellaris*
Alaska Highway	Donnelly Dome Lake	Stereocaulon tomentosum*
Seward Highway	Moose Pass	Cladina stellaris*
Seward Highway	Turnagain Pass	Cladina stellaris*
Denali Highway	Cantwell	Stereocaulon tomentosum
Denali Highway	Fish Creek, Denali Highway	Stereocaulon tomentosum
Denali Highway	Seattle Creek	Cladina stellaris*

* Indicates one of several types of lichen collected from site.
** Species identification tentative.

[Fig.4]: Left: Various species of lichen at the different sampling sites.

Soil Sampling Procedure:

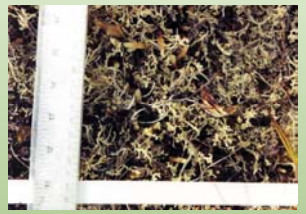
- Extract soil sample plug with metal corer, 5x10-cm.
- Split 8-10-cm plugs into 1-5-cm and 6-10-cm pieces.
- Take soil sample replicates from center of each plot and 1-2 additional samples outside each plot per sampling site.
- Drying time – 24-hours at 100°C.
- Sift samples to extract and discard rocks/grains exceeding 2-millimeters in size.
- Highly organic samples, ash for 24-hours at 450°C and store in tared plastic bags.

[Fig.5]: Soil sampling using a metal corer at Moose Pass along the Seward Highway.

[Fig.6]: Soil sample collected at Moose Pass along the Seward Highway.

[Fig. 9]: *Stereocaulon tomentosum* collected at the Cantwell sampling site along the Denali Highway.

[Fig. 8]: *Cladina mitis* or yellow reindeer lichen collected at Turnagain pass along the Seward Highway.



[Fig. 7]: *Dactylina arctica,* yellow-brown and finger like, collected at the Eagle Summit along the Steese Highway.

Analysis:

Collection and preparation of lichen and soil samples is considered as phase 1 of this project. All samples will be analyzed for radionuclides by gamma ray spectroscopy in phase 2 of the project during Spring 2002. A new gamma ray spectrometer with a deep well detector is currently being installed by the International Arctic Research Center (IARC). Samples will be sent to an outside laboratory as a means of data quality control.

References:

1, Vitt, D., et al, Mosses Lichens and Ferns of Northwest North America, Lone Pine Publishing, 1988.

2, Hanson, W., Fallout Radionuclides in Northern Alaskan Ecosystems, 1968.

3, International Technology Corporation Standard Operating Procedure for both surface soil sampling, 1993.

4, International Technology Corporation Standard Operating Procedure for vegetation sampling, 1993.

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