

INITIAL RESPONSE LETTER FOR SDSTA LETTER OF INTENT

1. Title of proposal

Low Radioactivity Measurement Laboratory (LRML)

2. List of participants

NORM Group USA

Massachusetts Institute of Technology (MIT)

Department of Earth Atmospheric Planetary Sciences (EAPS)

Boston College, Department of Geology

NORM Group Canada

Others under negotiation

3. A brief description

Low Radioactivity Measurement Laboratory (LRML) is useful for studies in Earth and Environmental Sciences; for example determining very low abundances of U and Th in natural [1] and manufactured materials [2], trace element analysis for studies in nanotechnology [3, 4], and providing age constraints for young sediments by determining abundances of radio nuclides, for example, ^{137}Cs created by nuclear weapons testing [5, 6]. Also demand for LRML capabilities are expected to increase in the fields of material selection for power reactors and fusion reactors [7, 8]. LRML has synergy with low background counting laboratories set up underground for particle astrophysics studies.

State of the art LRML facilities have been established in Germany at the Max Plank Institute to design and develop Low Background Counting Science; also in Italy at Gran Sasso, a separate laboratory is dedicated to the development of new techniques and methodology for Low Radioactivity Measurements [9].

Naturally Occurring Radioactivity Materials (NORM) groups around the world have pioneered the development of techniques for the measurement and quantification of NORM, and for the materials selection demands in various fields of research, industry and defense. The Homestake mine through SDSTA provides a unique opportunity to construct a LRML facility in the USA in an environment of very low natural radioactivity. The shallow and deep depths and low radon levels of Homestake mine automatically improve the sensitivity of radio-analytical techniques making them the next generation cutting edge analytical tools to the applied and fundamental science investigations. A SDSTA LRML is proposed in the spirit of taking this opportunity to setup a laboratory to meet these demands on a long term basis.

The Department of Earth, Atmospheric and Planetary Sciences (EAPS) at Massachusetts Institute of Technology (MIT) established a radioactivity measurements laboratory in 1970 and operated it continuously with several upgrades over the last 35 years. The opportunity is now available to extend the capabilities of this laboratory by setting up LRML under SDSTA. Geology groups at Boston College and MIT are actively engaged in training students starting at the undergraduate level in the techniques of radioactivity

measurement and in applications to geology. The students at these and other institutions will benefit from training at the proposed LRML to meet the long term manpower needs of NSF DUSEL and other proposals in the USA. LRML is useful in training young geochemists to address important problems in geology and environmental sciences.

The following Research and Development program is proposed to develop the above needs anticipated in the near future.

1. Preparation of sub-ppm to possible ppt level next generation analytical standards and reference materials for low radioactivity measurements and geochemical analytical techniques. (Note: ppm – parts per million; ppt - parts per trillion).
2. Radiometric measurements for establishing LRML by assaying the materials and the surroundings of the location for natural radioactivity.
3. Development of courses for geochemical studies taking advantage of the deep underground geological formations of the Homestake mine using the ultra low radioactivity measurement laboratory capabilities.
4. Specialized Instrumentation for future high temperature geochemical studies using the LRML advantages.

In saying all this in these proposals it is anticipated that supersensitive analytical techniques are needed to make new discoveries.

4.A Space requirements

30' x 30' room plus 15' x 15 room, or 3 rooms 15' x 15 minimum 10' ceiling height for lifting devices.

4.B Technical issues

Specific issues:

1. Surface finish of rooms to inhibit radon ingress.
2. Low radioactivity rock in hanging wall and foot wall of the location.

Unusual issues:

1. Neutron shielding from rock neutrons may require engineering considerations prior to finishing the rooms for occupancy.
2. Rapid access from surface for handling short lived radio-activities.

5. Estimate of when access is required to underground facility

1. Pre-engineering studies involve immediate access for site selection from the point of view of 4.B above.
2. It is advantageous to students to participate at this stage from the training point of view to establish and operate LRML.

6. Any other requirements or questions:

A preliminary study of the effects of cosmic rays on shielded radiation detectors at representative depths would be required to optimize and confirm the design calculations for LRML.

Would SDSTA participate in this study and provide the necessary engineering support?

Is there any funding available for this engineering study from SDSTA?

Would any of the institutions associated with SDSTA be interested in participating in LRML proposal?

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