

Implementing Arrangement #1

Title: Scoping Study on Arsenic Toxicity in Groundwater, West Bengal, India (hereinafter referred to as the "Project")

Section 1.0 Authority:

This is an Implementing Arrangement (hereinafter referred to as "Annex") to the Memorandum of Understanding ("MOU") signed at Ottawa on April 1st, 2003, between the Ministry of Mines, Government of the Republic of India (hereinafter referred to as "MOM"), and the Department of Natural Resources (represented by the Earth Sciences Sector), Government of Canada, (hereinafter referred to as "NRCan"), hereinafter jointly referred to as the "Parties". This Annex is developed in accordance with Article Two of the MOU.

Section 2.0 Project Coordination:

For NRCan:

Responsible Program Manager: Dr. Andrew Rencz
Metals in the Environment Program (MITE)
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For MOM:

Responsible Senior Manager: Dr. S. Sengupta
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Section 3.0 Background:

Both Parties have expressed a desire to strengthen their knowledge and experience in understanding the toxicity of Arsenic (As) in groundwater of West Bengal, India in reducing the risk of exposure in potable water. Through this Project, the Parties will collect and analyze groundwater samples in selected, but representative and strategic sample locations. Results of the analysis will be used to develop a model addressing the source and mechanisms controlling the release of As. Information gathered will be combined with data in a Geographic Information System (GIS) to extrapolate the results over priority areas in West Bengal. Finally, a strategy to manage the risk associated with As in the area will be developed.

Section 4.0 Work Objectives:

The Parties shall assign personnel to activities under the Project in accordance with applicable laws, regulations, and policies of their respective countries. Specific objectives of the Project are as follows:

- i: to mutually undertake a field testing study to develop and test procedures for acquiring and analyzing samples and to test certain scientific hypotheses relevant to release of As into groundwaters.
- ii: to mutually prepare a detailed scientific proposal that incorporates current knowledge on arsenic from other studies, relevant geoscience knowledge at GSI, and addresses research needs
- iii: to mutually identify further potential collaboration with funding organizations, working organizations, community based organizations for implementing mitigation strategies.

The proposal (4ii above) will outline Phase#2 (technical feasibility and pilot implementation) and will be built based on the results of the Project. The goal is to develop this proposal for the mitigation of As toxicity through potential contributions from international development institutions. It is expected to provide appropriate geoscience knowledge to regulators in the State of West Bengal that will reduce the risk of As exposure in potable water.

A draft work plan for the Project is attached as "Appendix A" to this Annex.

Section 5.0 Financial Arrangements:

- Unless otherwise indicated in this Annex or agreed to in writing, both Parties (as well as those other Canadian parties identified in "Appendix A") will be responsible for their own expenses and costs incurred as a result of this Project.
- MOM will pay all costs relating to local sample collection and analysis in India (including accommodation and local transportation expenses for NRCan personnel), excluding per-diem.
- Each sending Party shall continue to pay the salary of each visiting scientist for the duration of the visit.
- Medical expenses will be the responsibility of each Party or their personnel.
- Where appropriate, each Party shall provide research facilities and assistance (for example, related to customs) for visiting scientists.

Section 6.0 Intellectual Property:

The Parties shall retain ownership of their existing Intellectual Property that they bring to the Project. Intellectual Property arising out of the Project or resulting from activities conducted under this Annex shall be jointly owned by the Parties.

For the purposes of this Project, Intellectual Property refers to all rights in any information including, without limitation, data, techniques, methods, processes, know-how, inventions, designs, formulae, photographs, drawings, plans, specifications, reports, studies, technical and procedural manuals and computer programs, and all patents, copyrights, trademarks, and industrial designs arising therefrom.

Section 7.0 Publication/Communications:

Publications and public communications related to the Project shall be made in a spirit of collaboration, with consultation and participation by both Parties. All publications and public communications relating to the Project shall acknowledge the contribution by the Parties.

Section 8.0 Title to Property:

Any property or equipment of whatever nature or kind furnished by any Party in connection with work under this Project is and will remain the property of the Party furnishing such property or equipment.

Section 9.0 Indemnification and Liability:

- Each Party shall indemnify and save harmless each other and their Ministers, officers, employees and agents from and against all claims, demands, losses, costs including lawyers fees, damages, actions, suits or proceedings, that are in any manner based upon, arising out of, or attributable to any wilful or negligent acts or omissions of their employees and agents relating to activities conducted under this Annex.
- The products/services provided by the Parties are provided on an "as is" basis and neither Party makes any guarantees, representations or warranties respecting these products/services, either expressed or implied, arising by law or otherwise, including but not limited to, effectiveness, completeness, accuracy, or fitness for a particular purpose.
- Neither Party shall be liable in any way for loss of profits or contracts, or any other consequential loss of any kind relating to the Project.

Section 10.0 Dispute Resolution:

Any disputes regarding the interpretation or implementation of this Annex will be resolved only by consultation among the Parties and will not be referred to a national tribunal or other third party for settlement.

Section 11.0 Duration and Termination:

- This Annex will remain in effect until September 1st, 2005. It may be amended at any time with the mutual written consent of the Parties and may be terminated immediately upon the written consent of both Parties or by either Party upon ninety (90) days written notice to the other Party.
- Each Party shall immediately upon early termination, return the other Party's papers, materials, or other property held for the purpose of carrying out the Project.

Section 12.0 Responsible Authorities and Effective Date:

This Annex becomes effective upon the signing below by both designated responsible authorities representing the MOM and NRCan.

Signed in Montreal this 5th day of April, 2005.

Representing NRCan:

Representing MOM:

Irwin Itzkovitch
Assistant Deputy Minister
Earth Sciences Sector
Department of Natural Resources
Canada

C.D. Arha
Secretary
Ministry of Mines
India

Appendix A:

PROPOSED WORK PLAN FOR THE SCOPING STUDY ON ARSENIC TOXICITY IN GROUNDWATER

1. Technical Background

A. Geoscience Issues

1. Understanding the biotic and abiotic process leading to fixation and release of arsenic on particulate matter.
2. Understanding the affect of variation in chemical attributes of aquifer sediments and groundwater in a stratigraphic column on the fixation and speciation of arsenic:

"... whether chemical variation in a stratigraphic column induces a variation in the type of bacteria present at different depths of the column. If so, whether that influences the processes of arsenic fixation and release".

3. Small areas with high-As in groundwater are surrounded by large tracts of groundwater with permissible limits of As. The parties are interested in knowing what actually causes the formation of such stand-alone hot spots.

B. Risk Management Issues

1. Identify spatial extent of problem by developing a geospatial database.
2. Attempt to link geochemical process types with stratigraphic type sections and extend the model over the entire affected region.
3. Develop risk management strategies based geochemical processes.

2. Project Activities (conducted jointly by the Parties):

A. Field Test Case

Objective: To develop and test procedures for acquiring and analyzing samples and to test certain scientific hypotheses relevant to release of Arsenic into groundwater.

Method: Fieldwork for the test case will be conducted during a visit to India from November 21 to December 5, 2004. Discussions to derive preliminary results will also be held during the visit.

Specific tasks to be accomplished through the field test case will include:

- i. Discussion of proposed fieldwork.
- ii. Visit study area to appreciate area-specific geologic and social issues.
(The Geological Survey of India, GSI, will arrange for transportation to field)
- iii. Undertake field trips to gather water and sediment samples.
(Drilling apparatus and sediment sampling will be handled by GSI whereas water sampling will be responsibility of the Geological Survey of Canada, GSC)

- iv. Initiate geochemical analyses of samples.
(Samples will be split for separate analyses in the labs of the GSC, and where possible in GSI).
- v. Initiate development of database. Database to include LANDSAT data, surficial geology (including 3D data), geochemistry, land use and others to be determined at the meeting.
- vi. Discuss successes/limitations of fieldwork.
- vii. Discuss field work results
- viii. Discuss the important scientific issues.
- ix. Discuss remediation possibilities.
- x. Draft report of field test results.

B: Proposal Development

Objective: To develop a proposal covering the technical feasibility and pilot implementation (Phase 2) for discussion at the India-Canada geosciences working group.

Method: Discussions will be conducted during the field-testing with the aim of developing a proposal for a Phase 2 (the technical feasibility and pilot implementation phase) for use in attracting potential funding from international development agencies with the support of the Governments of India and Canada. The trip proposed for November 2004 will constitute the major activity of the year during which discussions will be held with GSI, universities, NGOs and other stakeholders to build a team.

The specific task to be accomplished is a draft proposal for the technical feasibility and pilot implementation (Phase 2) to be presented at the India-Canada Geoscience working group, tentatively scheduled for March 2005. Approval by both Parties to proceed to Phase 2 will be contingent upon the mutual agreement of the:

- a) results from Phase 1;
- b) proposal for Phase 2; and
- c) availability of funds/resources.

C: Development of Further Collaboration

Objective: To develop further collaboration with funding organizations, service providers, etc.

Methods: In cooperation with the International Division, Earth Sciences Sector, NRCan and Technical Coordination Division, MOM and other stakeholders, carry out preliminary consultations with potential funding organizations for the proposed Phase 2 (technical feasibility and pilot implementation).

Develop contacts with other scientific organizations that will enhance our capacity to prepare a successful proposal and conclude the objectives of the research.

Solicit input from service providers in Canada and in India who could develop business opportunities through this Project.



3. Project Schedule/Activities or Deliverables:

The Project commences on signing of the Annex and is scheduled to end on September 1, 2005. The following Table shows specific deliverables from this Project together with the expected date of delivery.

Deliverable or Activity	Schedule or date of delivery
Formal announcement (in Kolkata, West Bengal, India) of the project initiation	November 23, 2004
Reaffirm requirements and expectations concerning the mitigation of Arsenic toxicity in West Bengal through discussions with partners and stakeholders (Universities, industry, NGO's, international development institutions)	November 23, 2004
Field work in West Bengal, India	November 21 – December 5, 2004
Briefing the remaining stakeholders on the consensus/ outcome of the As toxicity mitigation discussions in Kolkata. The stakeholders in particular include senior officials in India and in Canada as well as those in International Development Institutions	November – December 2004
Report of activities from field work	February 28, 2005
Report of results from field study	March 31, 2005
Progress report on technical feasibility and implementation proposal for the India-Canada Geosciences Working Group	March / April 2005 (second meeting of the India-Canada Geosciences Working Group)
Final report	September 1, 2005

4. Project Team

A team composed of personnel from Canada and India will undertake the Project. The following Table shows the names of the members together with an estimate of allocated days to the Project.

Canada's Estimated Personnel Expenses		India's Estimated Personnel Expenses	
Name of Participant	Days	Name of Participant	Days
Dr. Andy Rencz, NRCan / ESS	40	Dr. S. Sengupta, GSI	20
Dr. G. Hall, NRCan / ESS	40	Dr. T. Pal, GSI	40
Dr. A. Desbarats, NRCan / ESS	22	Sri P.K. Mukherjee, GSI	80
Ms. S. Simpson, NRCan / ESS	22	Sri S. Shome, GSI	10
Dr. P. Chagarlamudi, NRCan / ESS	30	Sri P.K. Mondal, GSI	20
Prof. Roger Becki, University of British Columbia, Canada	20	Sri S. Chattopadhyay, GSI	20
		One officer from MoM	10
Total personnel days	174		200