Final report

INTERCALIBRATION OF ANALYTICAL PROCEDURES FOR ANALYTES, INCLUDED INTO HARMONIZED PROGRAM OF HYDROCHEMICAL MONITORING FOR SELENGA RIVER BASIN Phase II. (MONGOLIA)"

Tender: RFQ_EMO_2014-069

"Intercalibration of analytical procedures for analytes, included into harmonized program of hydro chemical monitoring for Selenga river basin"

Executor: Central Laboratory of Environment and Metrology /CLEM/, Mongolia

The purpose of the work is inter-laboratory comparable testing of surface water quality analysis methods which are used in Russia and Mongolia on water bodies of the Selenga River basin with the purpose of their compatibility.

The service will accomplish the following tasks:

- to send Mongolian specialists to Russia for training study of methodological issues of surface water analysis and measure quality control with the purpose of this training was a learning to determine anion and cation especially in water samples using the modern and sophisticated Ion Chromatography, to develop quality of analytical method and measurement for surface water.
- to carry out an intercalibration of developed harmonized program of hydrochemical monitoring under supervision of the leading Russian organization;
- to determine necessary elements which require intercalibration after consulting with Russian side, then determine Mongolian laboratories which will take part in this work;
- to conduct an analysis of control samples received from approved laboratory and hold a discussion of intercalibration results;
- to develop recommendations and cost enhancements to existing monitoring regime based on intercalibration results;

In order to supply service described in the quotation were chosen following staff as required according to the Terms of Reference: Badarch Lkhagvasuren, Director of Central Laboratory of Environment and Metrology and Engineers Yadamsuren Erdenebayar, Bold Altantuya, Gerelbadrah Oyunsuren,

Central Laboratory of Environmental and Metrology (CLEM) had been delivered "Abacus" ion chromatography equipment which made in Germany and sponsored by the project of Baikal lake in February 2014. Then "Abacus" company's operator Ribakova Elena Veniaminovno and two operators came from Moscow Russia, gave technical 5 day training and installed the equipment.

With the sponsorship of Baikal lake project, we practiced for how to replacing column of cations and anions, determination of cations and anions and calculating by using ICS 1600 Abacus ion chromatography equipment at the Baikal Institute of Rational nature management in Ulan-Ud in order to prepare personnel work at ion chromatography equipment.

1. **Internship of the specialists to** the Federal State-Budget Academic Institution "Baikal Institute of Nature Management" for the Siberian Branch of the Russian Academic of Sciensec, in Ulan-Ude, Russia

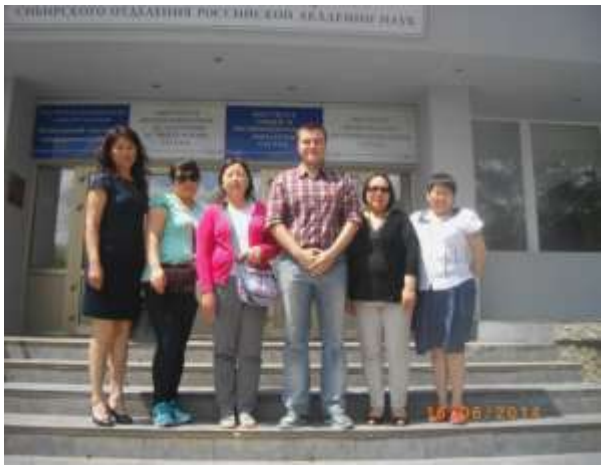
The main purpose of the organization and carrying out of an internship of the specialists from the Central Laboratory of Environment and Metrology (CLEM) of Mongolia (4 persons) on the methodology issues of this training was a learning to determine anion and cation especially in water samples using the modern and sophisticated Ion Chromatography, to improve quality of analytical method and measurements for surface water which was developed by the Laboratory of Natural Systems Chemistry to the Federal State-Budget Academic Institution "Baikal Institute of Nature Management" for the Siberian Branch of the Russian Academic of Sciences.

Participants:

Ms.Erdenebayar, Engineer, Central Laboratory of Environment and Metrology (Ulaanbaatar, Mongolia)
Ms.Altantuya, Engineer, Central Laboratory of Environment and Metrology (Ulaanbaatar, Mongolia)
Ms.Oyunsuren, Engineer, Central Laboratory of Environment and Metrology (Ulaanbaatar, Mongolia)
Ms.Ayagul, Engineer, Laboratory of Environment in the Selenga (Suhbaatar, Mongolia)

Duration and place: from 16 through 20 of June 2014, Federal State-Budget Academic Institution "Baikal Institute of Nature Management" for the Siberian Branch of the Russian Academic of Sciensec, Ulan-Ude, Russia.

During the training, Introduction about Institute and their processes, theoritical and practical exercise leant as followed based on agenda (See Attachment 1)



The Laboratory of Natural Systems Chemistry of Federal State-Budget Academic Institution "Baikal Institute of Nature Management" for the Siberian Branch of the Russian Academic of Sciences (BINM SB RAS & BSU) was founded in 2005. Main research fields Laboratory of Natural Systems Chemistry (BINM SB RAS & BSU): formation and transformation of Baikal hydrobionts lipids in dependence of ecological and biological factors; study of water objects in the Baikal natural territory; chemical composition of plants as indicator of the state of Baikal region ecosystems;

Main objectives of the training program are as follows:

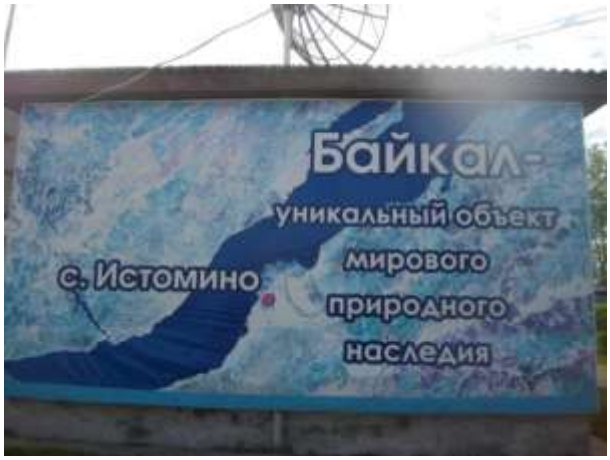
- to improve the are worked inskills work in the Ion Chromatography of Abacus ICS-1600, «DIONEX»
- to improve knowledge of the trainee in measurement of changes of anion and cation column
- to improve quality of measurement in changes of suppressor
- to improve the quality of analysis anion and cation in the surface water

When we were worked "with DIONEX-1600" Ion Chromatography especially trained in changes of anion and cation column and suppressor.

We trained not only determination of anion and cation, calculation, and interpretation of results but also attended transboundary water joint research result seminar at "Istomino" Center of Siberian branch of Russian Academy of Science with specialists of Mongolian and Russian Specialized Inspection Organization.

International Ecolojical-Educational Center "ISTOMINO" was founded in 2001in Istomino village of Kabansk district of the Republic of Buryatia. The main goals of the center are to provide a scientific and technical-material platform for the academic research of the Baikal Lake ecosystem and the Selenga River delta as well as to host diverse activities aimed at the implementation of the programs of ecological education.

During the seminar, we are decided to obtain comparison measurement of Baikal Lake water anion and cation analyses between the Institute of Natural Resource Management, Ulan-Ude, State Specialized Inspection Organization of Mongolia and Russian Branch and CLEM. This comparison measurement water analyses have been processing at CLEM and we sent the results to the Institute of Natural Resource Management, Ulan Ude. The analysis results of comparison measurement of water sample of the Baikal Lake (was taking 20 June 2014) are shown in **Table 3.**



During the study programs, we were introduced to the Laboratory of Natural Systems Chemistry and had some lectures and labs (see Table 1 and Attachment 1). Purpose of this training was a learning to determine anion and cation especially in water samples using this modern and sophisticated Ion Chromatography, to develop quality of analytical method and measurement for surface water.

This training was successful and efficient at high level. Skill of engineers of CLEM had been improved how to analyze at ion chromatography ICS 1600 and calculate the results.

Table 1. The training program on the "Methodology issues of the surface water analysis and the Ion Chromatography of Abacus ICS-1600, «DIONEX»"

No	Title	Person in charge	Date
1	Opening speech, Introduction of the laboratory of Natural Systems Chemistry (BINM SB RAS & BSU)	Kudelya S.V Radnayava L.D Bazarsadueva S.V	16.06.2014
2	Introduction of the analytical methods of "DIONEX-1600" Ion Chromatography"	Bazarsadueva S.V	16.06.2014
3	Introduction of the "DIONEX-1600" Ion Chromatography"	Bazarsadueva S.V	16.06.2014
4	Determination anion and cation especially in water samples using this modern and sophisticated Ion Chromatography	Bazarsadueva S.V	16.06.2014
5	To train in changes of anion and cation column	Bazarsadueva S.V	16.06.2014
6	To train in changes of suppressor	Bazarsadueva S.V	17.06.2014
7	The trained in changes of anion and cation column and suppressor	Bazarsadueva S.V	17.06.2014
8	Determination of anion and cation, calculation, and interpretation of results	Bazarsadueva S.V	18.06.2014
9	Excursion in the Ulan-Ude and Introduction in the Center of Hydrology and Meteorology of Buryatia	Radnayava L.D Bazarsadueva S.V Urbazaeva S.D	19.06.2014
10	To determine anion and cation especially in water samples using the modern and sophisticated Ion Chromatography	Bazarsadueva.S.V	19.06.2014
11	Attended transboundary water joint research result seminar at Istomino (BINM SB RAS & BSU)	Radnayava L.D	20.06.2014
12	Decide Comparison Measurement of Baikal Lake water anion and cation analyses between the Laboratory of Natural Systems Chemistry (BINM SB RAS & BSU) and CLEM	Radnayava L.D Bazarsadueva S.V	20.06.2014

2. The inter-laboratory comparative tests (ILCT) of the Harmonized Water Quality Monitoring Program in the Selenga River basin

In order to provide the system of quality control of the analytical measurements and increase the reliability of results in the water pollution monitoring laboratories of Russia and Mongolia the approaches towards formation and implementation of quality control systems should be similar.

The proposed system of information quality guarantees and control is provided due to:

-correct selection of priority indicators of water composition entitled to testing;
-selection of a representative water sample;
-adherence to specifications of sample preparation and analysis specified by measurement methodologies, executed according to national standard or in accordance with other regulatory documents;
-use of certified measurement procedure (MP) of the composition of water;
-internal measurement quality control, including sampling selection quality, operative control of the analysis procedure and analysis results stability control (assessment of the total aggregate of the analysis results during a controlled period);
-participation in the inter-laboratory comparative testing of measurement procedure (external measurement quality control).

The control of compatibility of analysis results obtained by the Russian and Mongolian laboratories should be carried out by:

-organizing of joint water sampling and their analysis by methods used by each side followed by a comparison of obtained results with due regard to measurement errors;

-carrying out of a special experiment- dissemination of control samples prepared in Russia by the Hydrochemical Institute for the external control of measurements.

Carrying out of control samples' analysis and submission of the results to the coordinator Federal State Budgetary Institution "State Hydrochemical Institute" for the processing of data obtained should be done. Further processing of the analysis results of the control samples of the inter-laboratory comparative tests obtained in the laboratories of Russia and Mongolia and then submit to the provider.

In June, 2014, within the framework of the Baikal Lake project which was entitled the "Water quality monitoring plan of Selenge River Basin", Water Chemistry Institute of Rostov-on-Don, RUSSSIA were sent international quality control water samples for ammonium-nitrogen, nitrite-nitrogen, phosphorous, hardness, calcium, anion and trace metals determination to CLEM. In September, 14, 2014, to end analysis and in November, 2014, data results sent to Water Chemistry Institute of Rostov-on-Don, RUSSSIA. We determined ammonium-nitrogen, nitrite-nitrogen, phosphorus, hardness, calcium, magnesium and anion trace metals.

CLEM will introduce new methods in further even though did not reach the goal that set to test the method of water quality monitoring after the training of Water Chemical Institute in Rostov in 2013 due to the financial hold in the necessary standard solution and reagent.

CLEM booked a sensitive lamp that determine heavy metals (Cd, Cu, Pb) in Atomic Absorbing Spectrophotometric of Varian 110, Austria cooperating with "Medimpecs international" LLC within the scope of small projects that aimed to improve measuring quality and water quality monitoring-analyzing laboratory in 2014. Trace metal analyses will be done when we have a new lamp for atomic absorption spectrophotometer of Varian 110, Austria.

The analysis results of the control samples for the inter-laboratory comparative tests ammonium-nitrogen, nitrite-nitrogen, phosphorous, hardness, calcium, magnesium, anion for the inter-laboratory comparative tests of CLEM and Laboratory of Environment in the Selenga are shown in **Table 2 and 4.**

Table.2 Determination of Phosphate, Nitrite, Chloride, Sulphate, Fluoride, Nitrate, Ammonium, Hardness, Calcium, Magnesium

Take 5 ml of sample using a volumetric pipette and transfer to the volumetric flask from pure water. Add pure water up to the marked line of the flask to 500 ml.

Central Laboratory of Environment and Metrology (CLEM), Ulaanbaatar

Parameters	Number of sample	Number of analytical methods	Data, mg/l
Phosphate, mg/l	PN-4	Spectrophotometric method with ammonium molybdate	0.010
	PN-8	Spectrophotometric method with ammonium molybdate	0.023
Nitrite, mg/l	PN-4	Spectrophotometric method with reagent Griss	0.009
	PN-8	Spectrophotometric method with reagent Griss	0.025
Chloride, mg/l	A-1	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	4.15
	A-3	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	4.21
	A-6	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	9.44
	A-9	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	9.39
	A-13	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	20.82
	A-14	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	20.20

Sulphate, mg/l	A-1	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	4.30
	A-3	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	4.33
	A-6	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	9.40
	A-9	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	9.34
	A-13	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	20.55
	A-14	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	19.89
Fluoride, mg/l	A-1	Photocolorimetric method determination of fluoride ion content	ND
	A-3	Photocolorimetric method determination of fluoride ion content	ND
	A-6	Photocolorimetric method determination of fluoride ion content	ND
	A-9	Photocolorimetric method determination of fluoride ion content	ND
	A-13	Photocolorimetric method determination of fluoride ion content	ND
	A-14	Photocolorimetric method determination of fluoride ion content	ND
Nitrate, mgN/l	A-1	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	0.22
	A-3	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	0.30
	A-6	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	0.38
	A-9	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	0.29
	A-13	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	0.63
	A-14	Ion Chromatography of Abacus, ICS-1600, «DIONEX»	0.62

Ammonium, mgN/l	NH_4-3	Spectrophotometric method with reagent Nessler	0.014
	NH_4-9	Spectrophotometric method with reagent Nessler	0.021
	NH_4-11	Spectrophotometric method with reagent Nessler	0.090
Hardnest, mg-eq/l	H^0-1	Complexometric method	0.82
	H^0-9	Complexometric method	1.69
	H^0-13	Complexometric method	3.42
	H^0-14	Complexometric method	3.42
Calcium, mg/l	H^0-1	Titrimetric method (Trilon B, complexion III)	11.6
	H^0-9	Titrimetric method (Trilon B, complexion III)	13.8
	H^0-13	Titrimetric method (Trilon B, complexion III)	48.7
	H^0-14	Titrimetric method (Trilon B, complexion III)	48.7
Magnesium, mg/l	H^0-1	Calculation metod	2.9
	H^0-9	Calculation metod	6.1
	H^0-13	Calculation metod	12.0
	H^0-14	Calculation metod	12.0

Chemist engineer B. Almantuya
G.Oyunsuren

Director of CLEM B.Lkhavgasuren

Table.3 The results water analysis of the Baikal Lake, was taking 20 June 2014 (comparison measurement of Baikal Lake)

Central Laboratory of Environment and Metrology (CLEM), Ulaanbaatar

Parameters / Sample Site	Water Quality Standart, MNS4586-98	Baikal Lake-Istomino
Obs & Date		20 june
Calcium, mg/l		96.00
Magnesium, mg/l		8.21
Sodium, mg/l		5.96
Potassium, mg/l		1.50
Sulphate, mg/l	100	10.62
Chloride, mg/l	300	1.29
Ammonium, mgN/l	0.5	ND
Nitrate, mgN/l	9.0	ND

Chemist engineer G.Oyunsuren
Ts.Miiduv

Director of CLEM B.Lkhavgasuren

Table.4 Determination of Phosphate, Nitrite, Ammonium, Hardness, Calcium, Magnesium

Take 5 ml of sample using a volumetric pipette and transfer to the volumetric flask from pure water. Add pure water up to the marked line of the flask to 500 ml.

Laboratory of Environment in Selenga aimag, Suhbaatar

Parameters	Number of sample	Number of analytical methods	Data, mg/l
Phosphate, mg/l	PN-1	Spectrophotometric method with ammonium molybdate	0.011
	PN-6	Spectrophotometric method with ammonium molybdate	0.027
Nitrite, mgN/l	PN-1	Spectrophotometric method with reagent Griss	0.015
	PN-6	Spectrophotometric method with reagent Griss	0.040
Ammonium, mgN/l	NH_4-1	Spectrophotometric method with reagent Nessler	0.04
	NH_4-8	Spectrophotometric method with reagent Nessler	0.07
	NH_4-14	Spectrophotometric method with reagent Nessler	0.14
Hardnest, mg-eq/l	H^0-2	Complexometric method	0.82
	H^0-6	Complexometric method	1.65
Calcium, mg/l	H^0-2	Titrimetric method (Trilon B, complexion III)	12.82
	H^0-6	Titrimetric method (Trilon B, complexion III)	25.65
Magnesium, mg/l	H^0-2	Calculation metod	2.19
	H^0-6	Calculation metod	4.56

Chemist engineer D.Oyunchimeg
M.Ayagul

Summary

One purpose of the monitoring, through the evaluation of analytical results, analytical equipment and its operating condition, to recognize the analytical precision and accuracy of the measurements, give to an opportunity to improve the quality of the analysis on water quality monitoring, improve reliability of analytical data through the assessment of suitable analytical methods and techniques

In CLEM, for water chemical analysis, laboratories are using spectrophotometers, pH meters, conductivity meters, Ion Chromatography of Abacus, ICS-1600, «DIONEX», Ion Chromatography of IONUS, AAS (flame atomization), X-Ray fluorescence and some field testing equipments.

In 2014 in the CLEM booked a sensitive lamp that determine heavy metals (Cd, Cu, Pb) in Atomic Absorbing Spectrophotometric of Varian 110, Austria cooperating with "Medimpecs international" LLC within the scope of small projects that aimed to improve measuring quality and water quality monitoring-analyzing laboratory. CLEM is unable to do analyze that determine the heavy metals according to monitoring sample that came from Water Chemical Institute in Rostov, Russia due to defect in the AAS even though installation process made in 20th October.

CLEM will introduce new methods in further even though did not reach the goal that set to test the method of water quality monitoring after the training of Water Chemical Institute in Rostov in 2013 due to the financial hold in the necessary standard solution and reagent.

To get verified information: about if those laboratories have a laboratory certificate, what standards, methods and calibrations they use, and those methods are appropriate for today's conditions or not; on internal and external QA/QC is very difficult.

Attachment 1

СОГЛАСОВАНО
и.о. директора БИП СО РАН, д.г.н.
Гармаев Е.Ж. _____
«__» _____ 2014 г.

ПРОГРАММА
семинара обучения специалистов работе
на ионном хроматографе ICS 1600

Семинар обучения проводится в соответствии с проектом **GPSO/Lake Baikal/069/29Apr2014_CLEM** для монгольских специалистов:
- Эрдэнэбаяр Ядамсурен, старший инженер Центральной лаборатории по изучению окружающей среды и метрологии (г. Улан-Батор);
- Алтантуяа Болд, инженер Центральной лаборатории по изучению окружающей среды и метрологии (г. Улан-Батор);
- Оюнсурен Гэрэлбадрах, инженер Центральной лаборатории по изучению окружающей среды и метрологии (г. Улан-Батор);
- Аягул Минеп, инженер лаборатории по изучению окружающей среды и метрологии (г. Сухэ-Батор).

Сроки проведения семинаров: с 16 по 20 июня 2014 г.

Место проведения: г. Улан-Удэ, Федеральное государственное бюджетное учреждение науки Байкальский институт природопользования Сибирского отделения Российской академии наук.

Инженер по работе на ионном хроматографе ICS 1600 – к.б.н., инженер лаборатории химии природных систем БИП СО РАН Базарсадуева С.В.

Дата проведения	Время проведения	Наименование мероприятия	Ответственный исполнитель
16.06.2014	$9^{00} - 12^{30}$	• установка предколонки и колонки CG12A-5mm; • приготовление растворов стандартных образцов; • смена фильтров предколонки и колонки CG12A-5mm.	Базарсадуева С.В.
	$12^{00} - 12^{30}$	Встреча с руководителем проекта ПРООН/ГЭФ	Куделя С.В.
	$12^{30} - 13^{30}$	Обеденный перерыв	
	$13^{30} - 17^{00}$	• запуск системы для анализа катионов;	Базарсадуева С.В.

		• запуск последовательности калибровки, анализ стандартных образцов; • работа в ПО Chromeleon 7.	
17.06.2014	$9^{00} - 12^{30}$	• Смена катионной системы на анионную; • запуск системы для анализа анионов; • приготовление растворов стандартных образцов.	Базарсадуева С.В.
	$12^{30} - 13^{30}$	Обеденный перерыв	
	$13^{30} - 14^{30}$	• Экскурсия по лабораториям БИП СО РАН, знакомство с приборами и методами анализа.	Базарсадуева С.В. Урбазаева С.Д.
	$13^{30} - 17^{00}$	• запуск последовательности калибровки, анализ стандартных образцов; • работа в ПО Chromeleon 7.	Базарсадуева С.В.
18.06.2014	$9^{00} - 12^{30}$	• обработка навыков по работе на ионном хроматографе ICS 1600, смена колонок, анализ реальных проб воды.	Базарсадуева С.В.
	$12^{30} - 13^{30}$	Обеденный перерыв	
	$13^{30} - 17^{00}$	• Поездка в Бурятский центр по гидрометеорологии и мониторингу окружающей среды • Знакомство с приборами для анализа окружающей среды	Раднаева Л.Д.
19.06.2014	$9^{00} - 12^{30}$	• обработка навыков по работе на ионном хроматографе ICS 1600, смена колонок, анализ реальных проб воды.	Базарсадуева С.В.

	$12^{30} - 13^{30}$	Обеденный перерыв	
	$13^{30} - 17^{00}$	Поездка в с. Истомино Кабанского района р. Бурятия	Раднаева Л.Д. Базарсадуева С.В.
20.06.2014	$9^{00} - 12^{30}$	Участие в итоговом семинаре по совместной программе санитарно-эпидемиологического мониторинга качества и безопасности трансграничных водных объектов на территории Бурятии и Селенгинского района Монголии с международными научными экспертами проекта ПРООН/ГЭФ «Комплексное управление природными ресурсами трансграничной экосистемы бассейна озера Байкал» (с. Истомино Кабанского района р. Бурятия)	
	$12^{30} - 13^{30}$	Обеденный перерыв	
	$13^{30} - 17^{00}$	Итоговый семинар с международными научными экспертами проекта ПРООН/ГЭФ «Комплексное управление природными ресурсами трансграничной экосистемы бассейна озера Байкал» (с. Истомино Кабанского района р. Бурятия)	Раднаева Л.Д.
21.06.2014	07^{30}	Отъезд монгольских специалистов	