

Project ISTC - K-1240p

“Post-containment Management and Monitoring of Mercury
Pollution in Site of Former PO “Khimprom” and Assessment
of Environmental Risk Posed by Contamination of
Groundwater and Adjacent Water Bodies of the Northern
Industrial Area of Pavlodar”

Quarterly technical report

on the work performed from 1 April 2009 - to 30 June 2009

Quarter 15

Non-profit JSC “Almaty Institute of Power Engineering and
Telecommunication”, BG Chair of Environmental Technology

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Project manager

Ilyushchenko M.A.
PhD (Chemistry)



10.06.2010

Signature / Data

1. Summary of Technical Progress

1.1. Current Technical Status

Task Subtask	Start (quarter)	End (quarter)	Status / Comments
1.1.	1	17	Suspension of the work.
1.2.	4	8	Completed.
1.3.	1	15	Completed / Map of topsoil residual mercury contamination at the industrial site of the former chlor-alkali production has been produced.
2.1.	1	2	Completed
2.2.	3	4	Completed
2.3.	5	6	Completed
2.4.	7	12	Completed
2.5.	10	12	Completed.
2.6.	8	8	Replaced with other works in 14-16 quarters.
2.7.	8	8	Replaced with other works in 14-16 quarters.
2.8.	9	10	Replaced with other works in 14-16 quarters.
2.9.	9	10	Completed
3.1.	1	17	Suspension of the work
3.2.	4	6	Completed
3.3.	8	8	Replaced with other works in 14-16 quarters.
3.4.	8	8	Completed
3.5.	14	15	Completed/Hydro-dynamic model of oil products spread in groundwater has been produced.
3.6.	15	15	Completed/ Risks posed by oil products spread together with groundwater for inhabitants of Pavlodarskoe village have been assessed.
4.1.	1	2	Completed
4.2.	2	10	Completed
4.3.	3	11	Completed
4.4.	4	8	Completed
4.5.	4	9	Completed
4.6.	14	16	Implementing/The results of study of biota mercury contamination in the wastewater storage pond Balkyldak were discussed at the special session of 9 th International conference "Mercury as a Global Pollutant" in Guiyang, China, June, 7-12, 2009.
5.1.	1	17	Suspension in the work.
5.2.	1	16	Implementing /The results of post-demercurization monitoring were discussed at the special ISTC Session in the framework of 9th International Conference "Mercury as a Global Pollutant" (Chine, Guiyang, 7-12 June, 2009).

1.1. Tasks of the work plan

Task 1: Study of the movement of mercury in the groundwater rise in depressed area in saturated and unsaturated zones and its accumulation in the shallow ponds and vegetation. Development of management strategy to contain the risk to population in the vicinity and livestock.

Subtask 1.3: To carry out 3-year monitoring program (sampling and analysis), including the monitoring of soils, surface and ground water, aquatic biota, milk, and grazing grass in the close vicinity of groundwater contamination. To measure the hydrogeological parameters (water levels in boreholes, pH, temperature, redox potential) simultaneously with groundwater sampling.

- **State / Situation at the beginning of the current quarter**

The results of analyses of soil samples taken in 2008 were brought to “Summary Table 03.2008”. 10% of the samples contained mercury over 1 g/kg.

- **Fulfilled work**

The results of soil samples collection in 2008 and chemical and analytical works checked and discussed. Computer map of topsoil (0-10 cm) mercury contamination at the industrial site of the former chlor-alkali production was produced on the basis of the data of “Summary Table 03.2008” on 240 sampling points within the GIS of the Northern industrial area of Pavlodar city using software ArcGIS, module Spatial Analyst (Annex 1). The map shows practically the same level of soil contamination which had existed before the remediation works were done, that proves assumption that the contractor has not fulfilled this component of the project of demercurization.

- **Results by the end of the current quarter**

Computer map of topsoil (0-10 cm) mercury contamination at the industrial site of the former chlor-alkali production has been produced. Soils of the industrial site of the former chlor-alkali production still retain high level of risks for the personnel working at JSC “Kaustik” especially in summer time and as a source of groundwater feeding with mercury.

- **Personnel Commitments**

Name	Category	Work days
Kaustik		
Kosyashnikova Ol'ga Mikhailovna	1	3
BMP		
Balpanov Darkhan Serikovich	2	3
Prikhodko Tatyana Vladimirovna	1	3
Zhulikova Xeniya Sergeevna	2	1
Mukanov Kassym Kassenovich	2	1
Abeldenov Sailau Kassenovich	2	1
AIPET		
Uskov Grigoriy Aleksandrovich	2	11
Stepanov Vladimir Aleksandrovich	3	19
Mukhamejanov Khamit Valiakhmetovich	2	40
Kamberov Rustam Irkenovich	2	30

Task 3. Study of the spread of groundwater plume contaminated with oil products from the territory of Pavlodar Oil Refinery; development of model and assessment of environmental risk posed by oil-products contamination of groundwater in the Northern industrial area of Pavlodar: Subtask 3.5: To draw up the forecasts for the spread of oil products with groundwater using the hydrogeological model in the Northern industrial area of Pavlodar.

▪ **State / Situation at the beginning of the current quarter**

With the help of the hydro-dynamic model epignosis and prognosis tasks of the groundwater table surface fluctuation have been solved.

▪ **Fulfilled work**

Large-scale hydro-dynamic model of the area of groundwater pollution with oil products has been created based on gathered archive data with the help of GMS 6.0 software, which simulates groundwater flow movement under effect of natural and technogenic factors.

On the model the change of hydro-geological conditions for thirty-year period has been predicted with the help of MODFLOW module. Then using ModPath module the trajectory of movement of oil products dissolved in groundwater has been calculated.

▪ **Results by the end of the current quarter**

With the help of MODEFLOW module the change of hydro-geological conditions for thirty-year period has been predicted. Thereafter using ModPath module the trajectory of movement of oil products dissolved in groundwater has been calculated.

▪ **Personnel Commitments**

Name	Category	Work days
IHH		
Panichkin Vladimir Yurievich	2	15
Miroshnichenko Oxana Leonidovna	2	19
AIPET		
Kamberov Rustam Irkenovich	2	5

Task 3. Study of the spread of groundwater plume contaminated with oil products from the territory of Pavlodar Oil Refinery; development of model and assessment of environmental risk posed by oil-products contamination of groundwater in the Northern industrial area of Pavlodar: Subtask 3.6: To assess the risks posed by groundwater contamination with oil products for the population of Northern outskirts of Pavlodar and for river Irtysh floodplain

▪ **State / Situation at the beginning of the current quarter**

Large-scale hydro-dynamic model of the area of groundwater pollution with oil products has been produced simulating groundwater flow movement under effect of natural and technogenic factors. The trajectory of movement of oil products dissolved in groundwater have been calculated.

▪ **Fulfilled work**

Since scheduled field and laboratory researches on detailed mapping of existing aureole of groundwater pollution with oil products, determination of migration parameters of oil products, real velocity of the pollution spread were not managed the created model reproduced only the trajectory of the most probable spread of oil products dissolved in water without taken processes of sorption, biodegradation and so on into account.

The trajectory calculated using ModPath module goes from north-west part of Pavlodar Oil Refinery towards the Irtysh River in fact through the centre of Pavlodarskoe village. The results of the

modeling proved high probability of oil products ingress into waster supply wells of Pavlodarskoe village what means high potential risks for its inhabitant health.

For having more detailed prognosis some additional field and laboratory investigations on mapping of the aureole of groundwater pollution with oil products and determination of the actual velocity of the pollution spread are required. It is necessary to determine the composition of oil derivatives entering the groundwater and their properties, functional dependences between permeability, saturation and pressure. In order to obtain reliable results the model shall take the filtration of a three-component fluid (water, air and oil products) into account that is why the functions should be obtained for every of the component.

- **Results by the end of the current quarter**

The trajectory of the plume of groundwater pollution with oil products calculated using ModPath module goes in fact through the very middle of Pavlodarskoe village. The results of modeling prove high probability of oil products ingress into the water supply wells of Pavlodarskoe village and consequently high potential risks for the human health.

- **Personnel Commitments**

Name	Category	Work days
IHH		
Panichkin Vladimir Yurievich	2	10
Miroshnichenko Oxana Leonidovna	2	10
AIPET		
Kamberov Rustam Irkenovich	2	5

Task 4: Assessment of possibility to contain the risk posed by mercury pollution of lake Balkyldak including the fish within it:

Subtask 4.6: To identify the pathways of Hg bioaccumulation and to develop the possible solutions to break these pathways.

- **State / Situation at the beginning of the current quarter**

Manuscript and expanded abstracts of the manuscript: M. Ilyushchenko, P. Randall,R, T. Tanton, A.Ubas'kin, G.A. Uskov "Mercury Contamination of a Wastewater Storage Pond of Chlor-Alkali Production in Pavlodar and Problems of its Remediation" were prepared for 9th International Conference "Mercury as a Global Pollutant" (Chine, Guiyang, 7-12 June, 2009).

- **Fulfilled work**

Presentation M. Ilyushchenko, P. Randall,R, T. Tanton , A.Ubas'kin, G.A. Uskov "Mercury Contamination of a Wastewater Storage Pond of Chlor-Alkali Production in Pavlodar and Problems of its Remediation" was done and discussed at the special session of 9th International Conference "Mercury as a Global Pollutant" (Chine, Guiyang, 7-12 June, 2009). Levels of contamination of the water body biota and prognoses of their evolution were discussed with experts.

- **Results by the end of the current quarter**

At the special session of 9th International Conference "Mercury as a Global Pollutant" (Chine, Guiyang, 7-12 June, 2009) the platform presentation M. Ilyushchenko, P. Randall,R, T. Tanton , A.Ubas'kin, G.A. Uskov "Mercury Contamination of a Wastewater Storage Pond of Chlor-Alkali Production in Pavlodar and Problems of its Remediation" was done and discussed.

- **Personnel Commitments**

Name	Category	Work days
Kaustik		
Merenkova Lyudmila Borisovna	1	24

Solov'eva Nadezhda Vassilievna	1	16
PSU		
Ubaskin Alexander Vasilievich	4	15
Kalieva Aida Akhmetbekovna	2	5
AIPET		
Ilyushchenko Mikhail Alexeevich	1	5
Yakovleva Lyudmila Vassilievna	2	5

Task 5: To draw up and discuss with local stakeholders the recommendations for the 2nd stage of demercurization and other remediation activities in the area of the former PO “Khimprom” (Northern industrial area of Pavlodar), including the recommendation for abolishment or further safe use of the wastewater storage pond – lake Balkyldak:

Subtask 5.2: To hold the workshops, press-conferences and presentation in order to discuss the interim results.

▪ **State / Situation at the beginning of the current quarter**

For the 9th International Conference on Mercury as a Global Pollutant (Guiyang, China June 7-12, 2009) for presentations including one poster presentation were prepared as follows:

1. V.Yu.Panichkin, O.L.Miroshnichenko, M.A.Ilyushchenko, P.M.Randall and T.W.Tanton. “Evaluation of demercurization efficiency of chlor-alkali production in Pavlodar City, Kazakhstan”
2. M.A.Ilyushchenko, L.V.Yakovleva. “Problems of demercurization of industrial objects within the former USSR”
3. O.L.Miroshnichenko, V.Yu.Panichkin, M.A.Ilyushchenko, P.Randall, T.W.Tanton. “Mathematical modeling of groundwater mercury pollution, post-demercuration monitoring and evaluation of clean-up efficiency (case of Northern industrial area of Pavlodar City, Kazakhstan)”
4. M. Ilyushchenko, P. Randall, R. T. Tanton, A.Ubas'kin, G.A. Uskov. “Mercury Contamination of a Wastewater Storage Pond of Chlor-Alkali Production in Pavlodar and Problems of its Remediation”.

▪ **Fulfilled work**

At the 9th International Conference on Mercury as a Global Pollutant (Guiyang, China June 7-12, 2009) special session of ISTC was arranged in which 9 specialists on mercury contamination from Russia and Kazakhstan took part. On the results of ISTC K-1240p project 6 presentations (2 platform presentations and 3 poster ones, on request of the conference Steering Committee the presentation of M.A.Ilyushchenko, L.V.Yakovleva. “Problems of demercurization of industrial objects within the former USSR” was done twice in different sections of the conference); in total 5 specialists-participants of ISTC K-1240p project did 7 presentations (one additional presentation was done on a case of mercury pollution in Kiev City and one more presentation – on mercury contamination in the town of Usolie-Sibirskoe). Possibilities to use the experience of remediation works in Kazakhstan were discussed with UNEP experts for preparation of UNEP report on problems of storage of surplus mercury in Asia. The workshop held in Asia Institute of Technology, Bangkok, Thailand on the 15th June, 2009 was devoted to this subject, where M.A.Ilyushchenko and L.V.Yakovleva were involved. On the results of the workshop M.A.Ilyushchenko concluded a contract with Asia Regional Centre of UNEP on rendering consulting service.

Manuscript and abstract were prepared for International Symposium on Contaminated Soils and Sediments arranged within the framework of an exhibition RemTech 2009, Ferrara 23-24 September 2009: M.A.Ilyushchenko, V.Yu.Panichkin, P.Randall, T.W.Tanton, S.A.Abdrashitova, O.L.Miroshnichenko, L.V.Yakovleva “Influence of efficiency of chlor-alkali production cleanup from mercury on groundwater status in Pavlodar City, Kazakhstan”.

▪ **Results by the end of the current quarter**

ISTC special session was arranged at 9th International Conference on Mercury as a Global Pollutant (Guiyang, China June 7-12, 2009) where 5 presentations (2 platform presentations and 3 poster ones) were done on the results of ISTC K-1240p project.

The manuscript and abstract were prepared for International Symposium on Contaminated Soils and Sediments arranged within the framework of an exhibition RemTech 2009, Ferrara 23-24 September 2009: M.A.Ilyushchenko, V.Yu.Panichkin, P.Randall, T.W.Tanton, S.A.Abdrashitova, O.L.Miroshnichenko, L.V.Yakovleva "Influence of efficiency of chlor-alkali production cleanup from mercury on groundwater status in Pavlodar City, Kazakhstan".

▪ Personnel Commitments

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	9
Yakovleva Lyudmila Vassilievna	2	9
Kamberov Rustam Irkenovich	2	15
Mukhamejanov Khamit Valiakhmetovich	2	15
IHH		
Panichkin Vladimir Yurievich	2	5
Miroshnichenko Oxana Leonidovna	2	10
PSU		
Ubaskin Alexander Vasilievich	2	5
Kaustik		
Akhmetov Arthur Darazhatovich	1	18
Karimov Sharapat Sattarovich	1	2

Task 0.: Project Management

▪ Fulfilled work

The Report for Quarter XV was prepared.

▪ Personnel Commitments

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	5
Yakovleva Lyudmila Vassilievna	2	5
Ibraeva Alma Abylkasymovna	3	15

2. Summary of Personnel Commitments

	Number of persons	Total days	Total grants (US\$)
Category I	7	84.5	2280
Category II	11	219.5	6674
Category III	2	34	775
Category IV	1	20	400
Total:	21	358	10129

Change in the project personnel

Name	Previous			Newly appointed			Comments
	Category	Daily rate	Work days	Category	Daily rate	Work days	
no							

3. Preparation of reports and publications

The Report for Quarter XV has been prepared

4 papers have been published, as follows:

1. M.Ilyushchenko, L.V.Yakovleva. Problems of demercurization of industrial objects within the former USSR. ISTC Science Workshop at the International Conference on Mercury as a Global Pollutant. ICMGP 2009 (7- 12 June 2009) Guizhou's Great Hall of the People Guiyang, China. The International Science and Technology Center, 2009, P.5-8.
2. V.Yu.Panichkin, O.L.Miroshnichenko, M.A.Ilyushchenko, P.M.Randall, T.W.Tanton. Evaluation of demercurization efficiency of chlor-alkali production in Pavlodar City, Kazakhstan. ISTC Science Workshop at the International Conference on Mercury as a Global Pollutant. ICMGP 2009 (7- 12 June 2009) Guizhou's Great Hall of the People Guiyang, China. The International Science and Technology Center, 2009, P.23-27.
3. V.Yu.Panichkin, O.L.Miroshnichenko, M.A.Ilyushchenko, T.W.Tanton, P.M.Randall. Mathematical modeling of groundwater mercury pollution (case of Northern industrial area of Pavlodar City, Kazakhstan). ISTC Science Workshop at the International Conference on Mercury as a Global Pollutant. ICMGP 2009 (7- 12 June 2009) Guizhou's Great Hall of the People Guiyang, China. The International Science and Technology Center, 2009, P.28-34.
4. M.A.Ilyushchenko, P.M.Randall, T.W.Tanton, A.V.Ubaskin, G.A.Uskov. Mercury Risk Assessment from a Wastewater Storage Pond in Pavlodar City, Northern Kazakhstan. ISTC Science Workshop at the International Conference on Mercury as a Global Pollutant. ICMGP 2009 (7- 12 June 2009) Guizhou's Great Hall of the People Guiyang, China. The International Science and Technology Center, 2009, 35-37.

The abstracts are published on flash-card: Abstracts of 9th International Conference on Mercury as a Global Pollutant. ICMGP 2009 (7- 12 June 2009), Guiyang, China.

4. Significant Travel and Meetings

4.1. Travel and meetings inside CIS

no

4.2. Travel and meetings outside CIS

Participants of ISTC K-12450p project:

1. Panichkin Vladimir Yurievich
2. Miroshnichenko Oxana Leonidovna
3. Ilyushchenko Mikhail Alexeevich
4. Yakovleva Lyudmila Vasilievna
5. Ubaskin Alexander Vasilievich

were sent to Guiyang, China for participation in 9th International Conference on Mercury as a Global Pollutant. ICMGP 2009 (7- 12 June 2009). At that M.A. Ilyushchenko, A.V. Ubaskin and O.L. Miroshnichenko were funded from the budget of ISTC K-1240p project, L.V. Yakovleva – from the budget of ISTC K-1477 project, and V.Yu. Panichkin – from the resources of ISTC, allocated for arrangement of the special session at the conference.

Besides Ilyushchenko Mikhail Alexeevich and Yakovleva Lyudmila Vasilievna participated in UNEP Workshop on problems of surplus mercury storage in Asia held at Asia Institute of Technology in Bangkok, Thailand on the 15th June, 2010. The trip was funded through UNEP.

5. Cooperation with foreign collaborators

- Exchange of scientific materials (information, computer programs and data, samples)

Paul Randall, K-1240p project coordinator visited Kazakhstan on the 10-15 May, 2009. During the visit K-1240p project Work Plan implementation was discussed, as well as the results obtained, publications on materials of the project, and possibilities of further cooperation.

6. Procurement

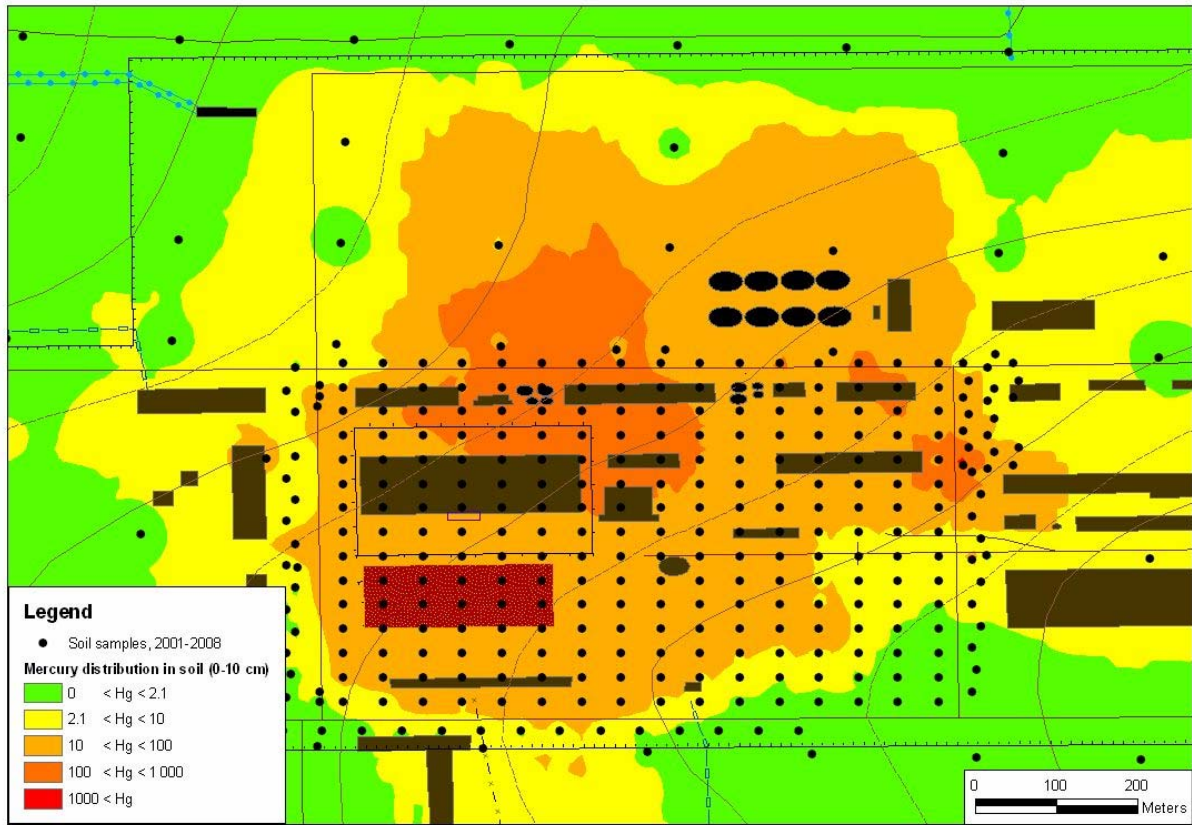
Number in accordance with Work Plan	Name	Status
	no	

7. Questions, suggestions

(Including plans for the next quarter(s), if initial Work Plan has been changed significantly).

no

A N N E X



Map of topsoil (0-10 cm layer) mercury contamination at the industrial site of the former chlor-alkali production of Pavloar Chemical Plant, produced on the results of soil sampling of 2008.