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 July 2007 - to 30 September 2007

Quarter 8

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

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26.12.2007

Signature / Data

1. Summary of Technical Progress

1.1. Current Technical Status

Task Subtask	Start (quarter)	End (quarter)	Status / Comments
1.1.	1	4	Has postponed till 9-10 quarter as a result of replacement of Participant Institution PCP by Participant Institution Kaustik in the project.
1.2.	4	8	Completed/Justified and suggested the plan of soil sampling with a view to produce a new map of soils mercury contamination of the Northern industrial area of Pavlodar.
1.3.	1	12	Implementing /Fall groundwater sampling and their analysis for mercury content have been fulfilled; samples of gramma grass have been taken; groundwater tables have been measured in observation boreholes. New variant of the map of soil mercury contamination with detailed areas along the sewer pipe network was produced.
2.1.	1	2	Completed
2.2.	3	4	Completed
2.3.	5	6	Completed
2.4.	7	12	Stoppage in work in 8th quarter
2.4.(new variant)	8	11	Implementing/analysis of features of hydro-geological conditions of the area being investigated as well as results of modeling has been conducted with a view to find areas with high potential of mercury there to get to zone of aeration.
2.5.	10	12	
2.6.	8	8	Has postponed till 11-12 quarters as a result of replacement of Participant Institution PCP by Participant Institution Kaustik in the project.
2.6.(new variant)	11	12	
2.7.	8	8	Has postponed till 11-12 quarters as a result of replacement of Participant Institution PCP by Participant Institution Kaustik in the project.
2.8.	9	10	Has postponed till 11-12 quarters as a result of replacement of Participant Institution PCP by Participant Institution Kaustik in the project.
2.9.	9	10	Completed/on request of Participant Institution IHH to speed up the work the results of which are necessary for computer simulation.
3.1.(new variant)	8	8	Completed/Sampling plan has been produced.
3.2.(new variant)	9	11	
3.3. (new variant)	9	11	
3.4. (new variant)	10	12	
3.5. (new variant)	12	12	
4.1.	1	2	Completed

4.2.	2	10	Completed/Bottom sediment samples have been taken along the shore line where thicket of reeds occurs.
4.3.	3	11	Stoppage of work in 8th quarter.
4.4.	4	8	Implementing/wastewater storage pond Balkyldak biota sampling has been conducted
4.5.	4	9	Implementing/Chemical and analytical works are being conducted with samples of bottom sediments, taken in both 6 and 8 quarter
4.6.	10	12	
5.1.	1	12	Stoppage of work in 8 quarter
5.2.	1	12	Implementing /conducting ecological bicycle run around the wastewater storage pond Balkyldak as well as student conference in PSU.

1.2. 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 1.2: To revise the Program of Post-containment Monitoring by expanding the study of pollution of groundwater and biota, and by adding the tests of grazing grass and milk.

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

The research conducted in 1-7 quarters of the project have shown that the risk posed by soil mercury contamination due to the mercury evaporation at the industrial area of the former chlor-alkali production still remains inadmissibly high, measurements on topsoil clean up conducted during demercurization works of 2002-2004 within this territory are not sufficient and soil mercury contamination of the rest territory of the Northern industrial area is poorly investigated. All this has necessitated the regional authority of Pavlodar to ask managers of ISTC K-1240p project to make some change in tasks of the Work Plan in 8th quarter with a view to expand the research program of soil mercury contamination.

- **Fulfilled work**

Field works conducted in fall of 2007 on investigation of groundwater contamination (see below fulfillment of subtask 1.3) suggest significant decrease in high mercury concentration in the groundwater within quite unpolluted area to the west of the cut-off wall around the former electrolysis factory (the building 31) and very little decrease in the same high mercury concentration to the north of this cut-off wall. The northern area differs from the west one with higher level of mercury contamination of topsoil outside the perimeter of antifiltration barrier. These results suggest both continued recharge of the plum of groundwater contamination with dissolved mercury compounds due to filtration of atmospheric precipitation through the contaminated soil and persistent high risk of mercury contamination spread not only through atmosphere but also with groundwater. .

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

Persistent high level of soils mercury contamination makes more critical the work not on expansion of the Program of groundwater and biota monitoring but on creation of new map of soil mercury contamination at the Northern industrial area of Pavlodar. This map should on the one hand reveal changes happened within the area of the former chlor-alkali production as a result of fulfilled clean up works accompanied with significant dislocation of soils and on the other hand give more detailed in comparison with previous map of 2002 description of spots of possible contamination caused by mercury containing sewage leaking from sewer system, losses from transportation of mercury contaminated materials as well as rise of mercury contaminated ground water up to the ground surface.

In order to produce the new map of soil mercury contamination AIPET has developed Sampling Plan (2007) implying sampling from three soil layers (0-10, 10-20, 20-50 cm) on a regular grid with different size. The Sampling Plan has been divided into three sections (see Annexes 1-3): the section 1 – industrial area of the former chlor-alkali production (240 sampling points), the section 2 – area of the industrial site #1 (545 sampling points) and the section 3 – the area around the industrial site #1 including the territory between the industrial site #1 and the wastewater storage pond Balkydak (367 sampling points), in total – 1152 sampling points or 3456 samples taken. In the sampling Plan of 2007 at the sections 2 and 3 old sampling points investigated when producing the map of soil mercury contamination in 2002 have been taken into account so that the number of the new sampling points has been reduced by 1/3. The new Sampling Plan has been delivered to the Participant Institution JSC Kaustik for both implementing the field works within the frameworks of ISTC K-1240 (the task 3 new reduction of the task 3 of the Work Plan) and preparing Phase II of the Demercurization Program at the cost of some other sources of funding.

- **Personnel Commitments**

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	10
Yakovleva Lyudmila Vassilievna	2	5
Kamberov Rustam Irkenovich	2	5
Kuzmenko Larissa Vitalievna	1	18
IHH		
Panichkin Vladimir Yurievich	2	10

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 map of soil mercury contamination as of 2002 has been supplemented with new data.

- **Fulfilled work**

Field works on investigation of groundwater mercury contamination have been conducted: together with scientists from Oxford University, (United Kingdom) Dr. Donald Parcelli and post-graduate student Arani Kajenthira and with the partner Paul Randall groundwater samples has been taken from 81 observation boreholes (in total 101 observation boreholes were investigated including two wells where the samples were taken from twice and 18 wells where it was impossible to take the groundwater samples from). During groundwater sampling also the water temperatures and pH were measured.

Groundwater tables have been measured in 154 observation boreholes.

Four integrated samples of gramma grass have been selected within pasture for livestock belonging to inhabitants of Pavlodarskoe village in places of mercury contaminated groundwater rise to the ground surface.

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

The results of groundwater table measurements have been delivered to the Participant Institution IHH; the results of groundwater analyses for mercury content have been compiled to Summary Table. Gramma grass samples have been delivered to AIPET laboratory to be analyzed.

- **Personnel Commitments**

Name	Category	Work days
AIPET	1	40
Ilyushchenko Mikhail Alexeevich	2	40
Uskov Grigoriy Aleksandrovich	2	40
Yakovleva Lyudmila Vassilievna	2	40
Zyryanova Natal'ya Alexandrovna	2	20
Kamberov Rustam Irkenovich	2	24
Muhkamejanov Khamit Waliachmetovich	3	40
Stepanov Vladimir Alexandrovich	1	5
Kuzmenko Larissa Vitalievna	1	10
Sharov Boris Alexandrovich	1	10
Primbetova Galina Iskanderovna	1	10
Kiseleva Raisa Alexandrovna	1	10
Shevchenko Natalia Nikolaevna	1	10
Aksenova Tatyana Vladimirovna	1	40

Task 2: Assessment of possibility for mercury-polluted groundwater flow to change its direction; study of interaction of contaminated groundwater with bearing strata and underlying aquifers: Subtask 2.4 (new variant): To assess the risk of mercury accumulation in topsoil as a result of going contaminated groundwater up to the ground surface followed by their evaporation

- **Fulfilled work**

Based on initial hydro-geological information being contained in the data base the detailed hydro-geological cross sections have been constructed using software GMS 6.0 within the area of the plum of groundwater mercury contamination spread. 13 cross sections have been constructed one of which – along the plum, four of them are delineating the plum, eight – across the direction of the plum of groundwater mercury contamination spread.

On the basis of analysis of hydro-geological conditions at the area of predictable plum of groundwater mercury contamination conducted according to both the facts and the results of simulation the area zoning has been made taking into account depths of groundwater tables, mercury concentrations in the groundwater and lithological character of the bearing strata. For that soil spots of so called "windows" which do not contain clay layers have been indicated. Maps of mercury concentrations in groundwater for different points of time have been produced. The zones with depths of groundwater tables higher than the critical groundwater table of 2.4 m from where groundwater evaporation starts have been indicated.

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

Based on the results of the area zoning zones where mercury contaminated groundwater can go up to low bound of aeration zone have been found.

- **Personnel Commitments**

Name	Category	Work days
IHH		
Panichkin Vladimir Yurievich	2	30
Miroshnichenko Oxana Leonidovna	2	40
Trushel' Lyudmila Yurievna	2	16
Zakharova Nonna Maximovna	2	14

Task 2: Assessment of possibility for mercury-polluted groundwater flow to change its direction; study of interaction of contaminated groundwater with bearing strata and underlying aquifers:
Subtask 2.9: To conduct laboratory study of adsorption equilibrium in the system bearing strata – solution of Hg (II) nitrate and Hg (II) chloride; to perform the leaching tests for adsorbed mercury.

- **Fulfilled work**

Solutions of mercury (II) chloride of different concentration were added to preliminary averaged in AIPET Lab soil samples not containing mercury and taken when drilling observation boreholes in 2002. The mixtures were shacked automatically for 6 hours in isothermal conditions at 15^{o}C and natural pH. After attaining equilibrium the solutions were filtered through membrane filters and analyzed for total mercury. Using the obtained results Freundlich adsorption isotherms were constructed and adsorption coefficients were calculated.

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

Averaged coefficients of Freundlich adsorption isotherms have been delivered to IHH to use them for simulation of hydro-geological processes of the mercury contamination spread.

- **Personnel Commitments**

Name	Category	Work days
IHH		
Uskov Grigoriy Aleksandrovich	2	15
Yakovleva Lyudmila Vassilievna	2	5
Zyryanova Natal'ya Alexandrovna	2	5

Task 3 (new variant): Creation of a map of soils mercury contamination in Northern industrial area of Pavlodar with a view to develop a feasibility study of their clean up:
Subtask 3.1. (new variant): To draw a sampling plan of the soils from the layers 0-10, 10-20, 20-50 deep according to a regular grid for the industrial area #1 of the former PO "Khimprom", Pavlodar and in the vicinity. The regular grid should be more detailed in heavily contaminated places in compliance with the map of soils mercury contamination as of 2001 as well as with the results of the soils monitoring conducted on the Task 1.

- **Fulfilled work**

The new variant of the Task 3 "Creation of a map of soils mercury contamination in Northern industrial area of Pavlodar with a view to develop a feasibility study of their clean up" has been come to an agreement with the Partner and Participant Institutions Kaustik and BMP

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

Sampling Plan has been worked out (the table with sampling points and their coordinates and three maps with the sampling points – see Annexes 1-3) for production of new map of soil mercury contamination at the area of the former PO "Khimprom" and in the vicinity and has been delivered to Participant Institution Kaustik. The personnel of Kaustik have been trained in use of GPS to coordinate

the sampling points, techniques of soil sampling, storage and preparation of the samples for chemical analytical analysis.

- **Personnel Commitments**

Name	Category	Work days
BMP		
Kamberov Rustam Irkenovich	2	10
Balpanov Darkhan Serikovich	2	5
Volkov Oleg Efimovich	2	16
Kravchenko Yelena Vladimirovna	1	16
Smirnova Svetlana Yurievna	1	16
Prikhodko Tatyana Vladimirovna	1	16
Kolysheva Olga Ivanovna	1	8
Kirplyuk Eduard Valentinovich	1	12
Starodubova Valentina Fedorovna	1	11
Zhulikova Xeniya Sergeevna	2	8
Mukanov Kassym Kassenovich	2	8
Abeldenov Sailau Kassenovich	2	9

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Task 4: Assessment of possibility to contain the risk posed by mercury pollution of lake Balkyldak including the fish within it:
Subtask 4.2: To sample the bottom sediments from lake Balkyldak by regular grid using the different types of samplers and augers.

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

In March 2007 additionally 159 samples of bottom sediments of the wastewater storage pond Balkyldak were taken on 94 sampling points (over 80% of total scheduled scope of activity). Bathymetric measurements and ones of thickness of sediment deposits were taken. The frozen samples were delivered to the analytical lab in Almaty.

- **Fulfilled work**

In September 2007 additionally 35 samples of bottom sediments of the wastewater storage pond Balkyldak were taken on 35 sampling points (100% of total scheduled scope of activity) located along shore line in reed thicket and measurements of sediment deposits thickness were taken. The frozen samples were delivered to the analytical lab in Almaty.

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

The final variant of the vector bathymetric map of the wastewater storage pond Balkyldak and thickness of its bottom sediments has been produced.

- **Personnel Commitments**

Name	Category	Work days
AIPET		
Stepanov Vladimir Alexandrovich	3	5
PSU		
Malkov Igor Viktorovich	1	5
Kuzmin Valery Sergeevich	1	10
Pastukh Viktor Petrovich	1	3
Bazarbekov Kairbai Urazambekovich	2	10
Kalieva Aida Akhmetbekovna	2	10

Task 4: Assessment of possibility to contain the risk posed by mercury pollution of lake Balkyldak including the fish within it:
Subtask 4.4: To take the samples of biota from the lake Balkyldak and to describe the existing food chains.

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

In IV quarter of the project sampling of fish, mollusks, benthos and plankton were conducted in the wastewater storage pond Balkyldak as well as fish in a control pond.

- **Fulfilled work**

In VIII quarter of the project 8 expeditions to the wastewater storage pond Balkyldak were conducted where samples of plankton – 9, benthos – 8, fish – 60 were taken for chemical analysis as well as 3 mass measurements of fish were carried out. From the catchments area of Balkyldak 3 samples of benthos were taken. From the water area of the control pond Krivoe 30 samples of fish and 3 samples of benthos were taken for chemical analysis and mass measurement of fish was carried out for morphologic analysis.

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

The frozen samples were delivered to AIPET for chemical analysis. Biological analysis of the aquatic life was conducted. Plankton, benthos and fish species were determined. Characteristics of ecotypes were determined in the aquatic life sampling points within both the wastewater storage pond Balkyldak and the Krivoe pond ecosystems.

- **Personnel Commitments**

Name	Category	Work days
PSU		
Malkov Igor Viktorovich	1	4
Kuzmin Valery Sergeevich	1	10
Pastukh Viktor Petrovich	1	3
Bazarbekov Kairbai Urazambekovich	2	10
Kalieva Aida Akhmetbekovna	2	10

Task 4: Assessment of possibility to contain the risk posed by mercury pollution of lake Balkyldak including the fish within it:
Subtask 4.5: To conduct chemical analysis (including the determination of total mercury content) and morphological studies of the taken samples of biota

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

In March and September 2007 194 samples of bottom sediments of the wastewater storage pond Balkyldak were taken on 129 sampling points (100% of total scheduled scope of activity).

- **Fulfilled work**

Chemical analytical woks on determination of total mercury content in the bottom sediment samples are being implemented.

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

The data on total mercury content in the bottom sediments are being recorded in “Final table 08.2007” in order to produce a vector map of the pollution.

- **Personnel Commitments**

Name	Category	Work days

AIPET	1	10
Sharov Boris Alexandrovich	1	10
Primbetova Galina Iskanderovna	1	10
Kiseleva Raisa Alexandrovna	1	10
Shevchenko Natalia Nikolaevna	1	10
Aksenova Tatyana Vladimirovna	1	10

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**

International workshop "Environmental Mercury Pollution: Mercury Emissions, Remediation and Health Effects" was held in Astana, Kazakhstan

- **Fulfilled work**

On the 21st of August, 2007 PSU, public fund "Partnership Center" and Tourism division of Pavlodar oblast Department of Physical Training and Sports held bicycle race around the wastewater storage pond Balkyldak within the framework of "Eco-tourist 2007" Program. Pupils of the secondary school no. 40 located in Pavlodarskoe village as well as PSU students participated in the bicycle race. During the cycle race where 10 cyclists - pupils of the secondary school no. 40 of Pavlodarskoe village were accompanied by a car of motorway police and a bus with medical staff and support group (the escort of 15 people) halts were made near some places of regular environment observations. During such halts PSU students talked to the bicycle race participants about history of the natural Lake Balkyldak and its transformation into a wastewater storage pond, its present technical status, influence on the environment and showed techniques of environmental research, methods of sampling and so on. The results of the bicycle race were summed up at the workshop "Eco-tourist 2007" in the secondary school no.40 on the 15th of September, 2007.

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

In Pavlodar within the framework of "Eco-tourist 2007" Program the bicycle race around the wastewater storage pond Balkyldak for pupils of Pavlodarskoe village has been held with a view to popularize the results of research on ISTC K-1240 project.

- **Personnel Commitments**

Name	Category	Work days
PSU		
Malkov Igor Viktorovich	1	2
Kuzmin Valery Sergeevich	1	5
Pastukh Viktor Petrovich	1	5
Kalieva Aida Akhmetbekovna	2	8

Task 0.: Project Management

- **Fulfilled work**

The Report for Quarter VIII has been prepared; changes in the tasks 2 and 3 of ISTC K-1240p Work Plan have been made; new Participant Institution JSC "Kaustik", Pavlodar has been introduced to the project; personnel of the participants BMP and AIPET have been changed.

- **Personnel Commitments**

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	14
Yakovleva Lyudmila Vassilievna	2	5
Kamberov Rustam Irkenovich	2	20
Ibraeva Alma Abylkasymovna	3	15

2. Summary of Personnel Commitments

	Number of persons	Total days	Total grants (US$)
Category I	16	327	8765
Category II	16	424	12502
Category III	2	60	975
Category IV			
Total:	34	811	22242

Change in the project personnel

Name	Previous			Newly appointed			Comments
	Category	Daily rate	Work days	Category	Daily rate	Work days	
Mikhailenko Natalya Aleksandrovna	2	30	357	2	30	205	Left AIPET
Ilyushchenko Mikhail Alexeevich	1	35	333	1	35	462	Due to Grants after Mikhailenko N.A.
Stepanov Vladimir Aleksandrovich	3	15	324	3	15	327	Due to Grants after Mikhailenko N.A.
Kuzmenko Larissa Vitalievna	1	30	462	1	30	385	Transferred from PCP to AIPET team
Amanov Serzhan Bakhytuly	1	35	62	1	35	30	Left BMP
Galieva Yelena Vladimirovna	1	25	115		25	33	Removed from the project due to reorganization of BMP lab and by decision of BMP administration
Lobacheva Tatyana Ivanovna	2	25	70	2	25	15	Removed from the project
Zolotova Nadezhda Vladimirovna	2	30	32	2	30	10	Removed from the project
Lyashenko Galina Nikolaevna	2	25	30	2	25	20	Removed from the project
Volkov Oleg Efimovich	-	-	-	2	35	80	Appointed as a submanager of the project instead of Amanov S.B.
Kolysheva Olga Ivanovna	1	30	100	1	30	62	due to reorganization of BMP lab and by decision of BMP administration

Kirplyuk Eduard Valentinovich	1	25	90	1	20	78	due to reorganization of BMP lab and by decision of BMP administration
Kravchenko Yelena Vladimirovna	-	-	-	1	30	80	According to decision of BMP administration
Smirnova Svetlana Yurievna	-	-	-	1	20	80	According to decision of BMP administration
Prikhodko Tatyana Vladimirovna	-	-	-	1	20	80	According to decision of BMP administration
Starodubova Valentina Fedorovna	-	-	-	1	15	59	According to decision of BMP administration
Zhulikova Xeniya Sergeevna	-	-	-	2	20	40	According to decision of BMP administration
Mukanov Kassym Kassenovich	-	-	-	2	25	40	According to decision of BMP administration
Abeldenov Sailau Kassenovich	-	-	-	2	25	45.5	According to decision of BMP administration
Balpanov Darkhan Serikovich	-	-	-	2	30	28	According to decision of BMP administration

3. Preparation of reports and publications

1. The Report for Quarter VIII has been prepared
2.
3.

4. Significant Travel and Meetings

4.1. Travel and meetings inside CIS

1. Almaty-Pavlodar-Almaty (carrying out scheduled field works)
   40 days
   Ilyushchenko Mikhail Alexeevich
   Muhkamejanov Khamit Waliachmetovich
   Yakovleva Lyudmila Vassilievna
   Uskov Grigoriy Aleksandrovich
   Zyryanova Natalya Aleksandrovna
   Stepanov Vladimir Aleksandrovich

4.2. Travel and meetings outside CIS

1. no

5. Cooperation with foreign collaborators

During visit of Paul Randal a representative of the Partner to Kazakhstan in September of 2007 it was:

- Correction of the tasks 2 and 3 of Work Plan of ISTC K-1240 project was discussed.
- The draft of an article on simulation of groundwater mercury contamination in Pavlodar was discussed with a view to be submitted for publication in US Groundwater Journal.
- Joint groundwater sampling in Northern industrial area of Pavlodar was conducted.

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).

A N N E X E S

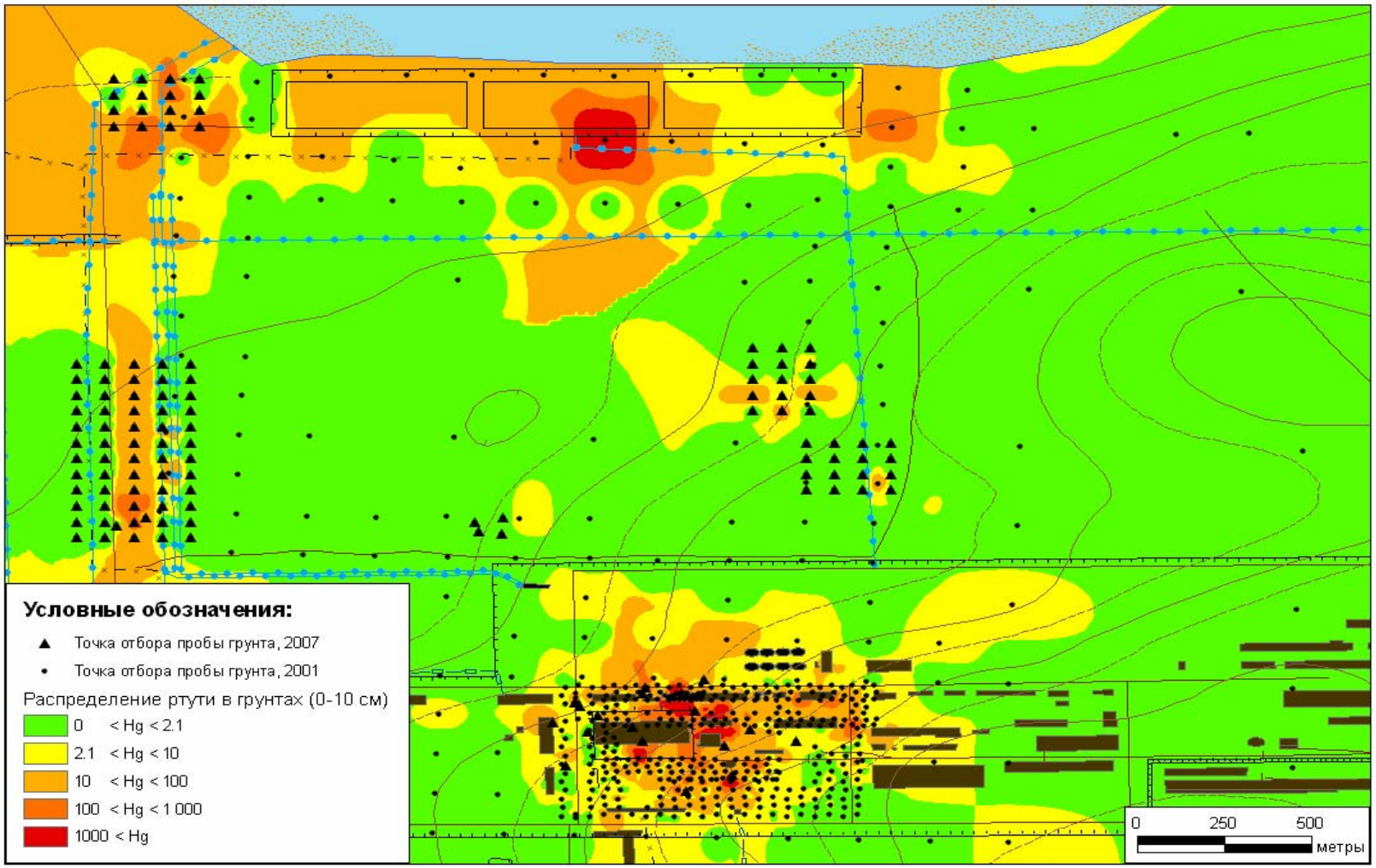

Fig. 1. Map of topsoil mercury contamination (layer 0-10 cm) of the Industrial area of Pavlodar as of 2002 supplemented with the data of 2007 on 107 sampling points

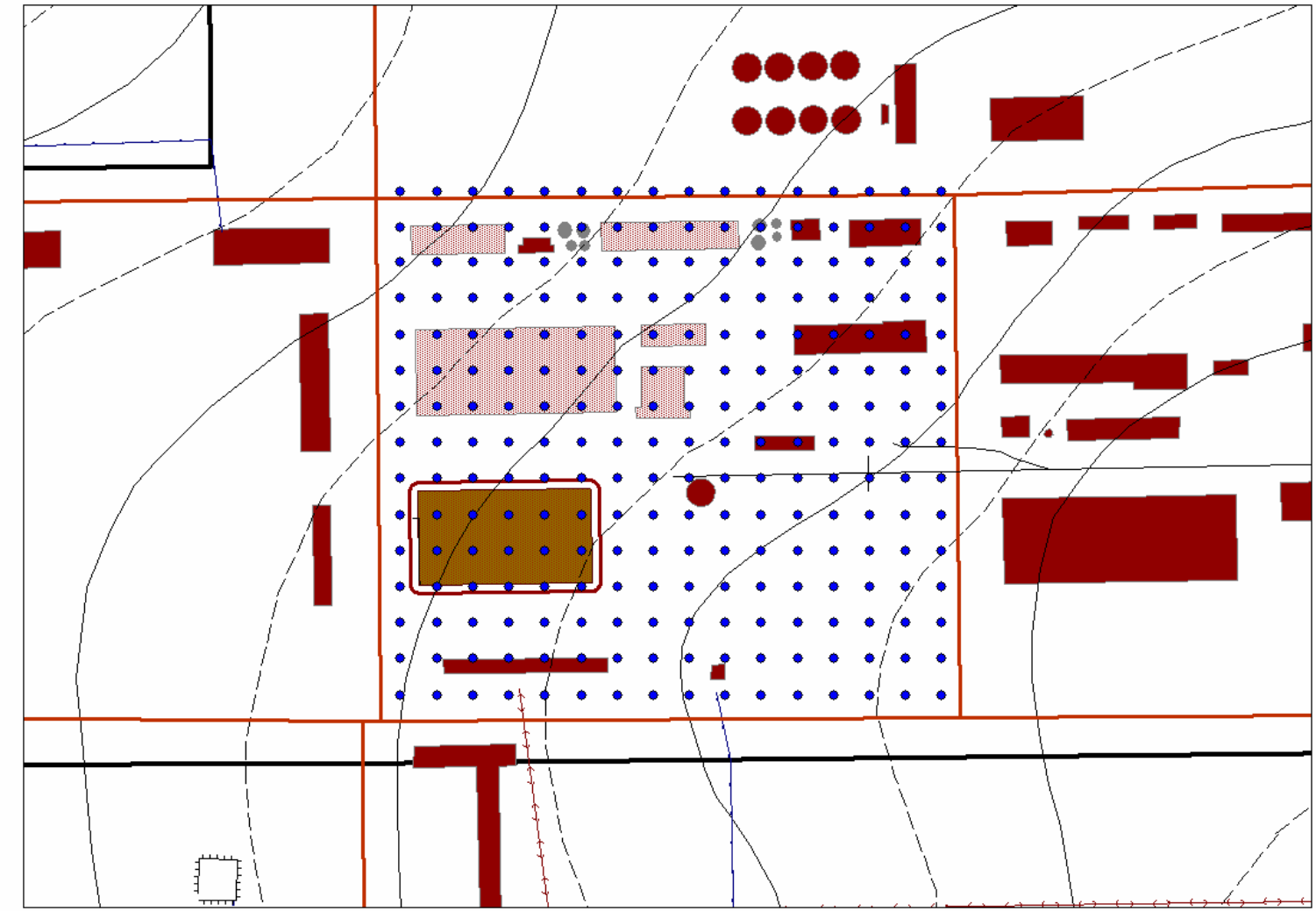

Fig. 2. Plan of Soil Sampling from layers 0-10, 10-20, 20-50 cm within the area of the former chlor-alkali production, PCP

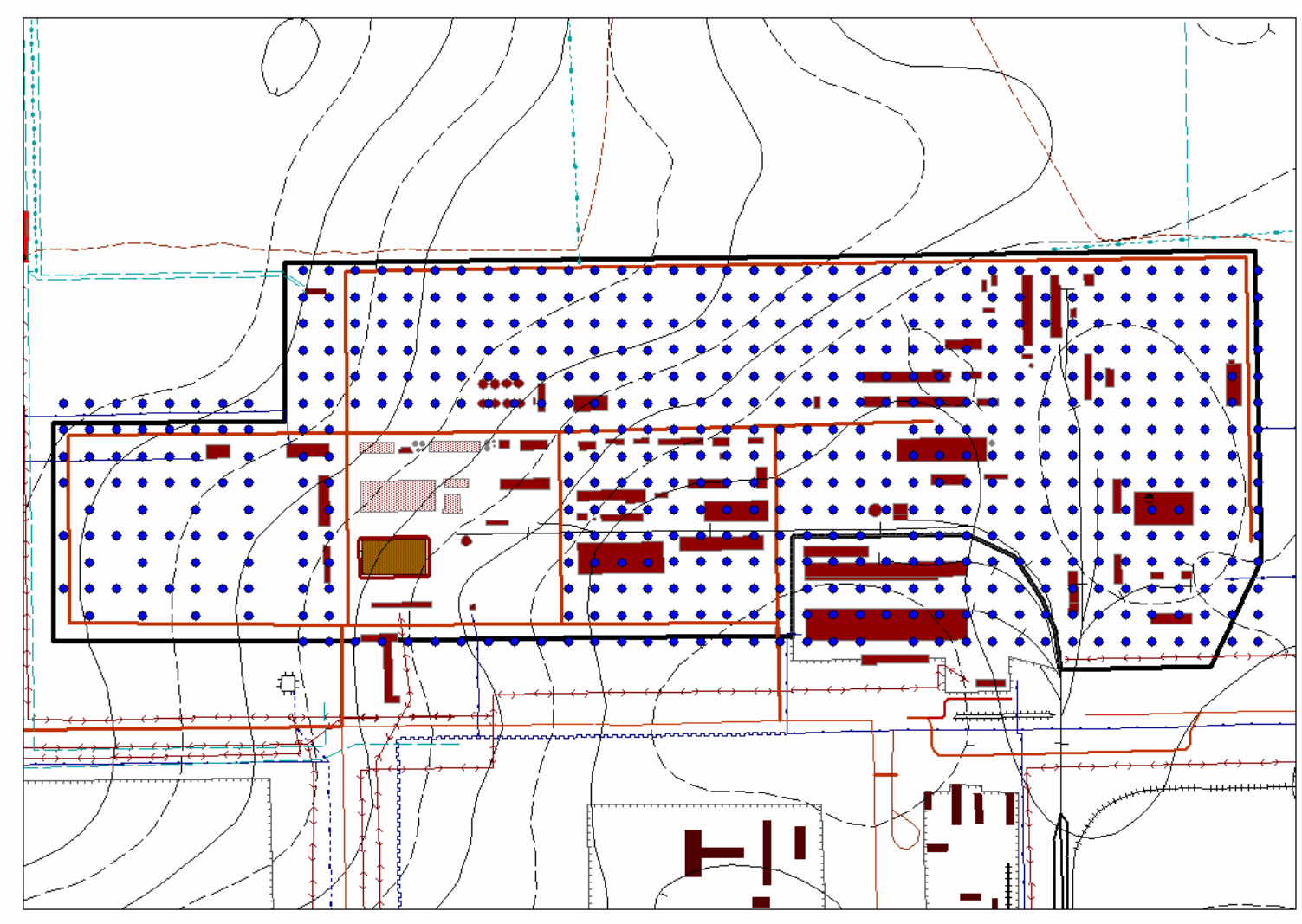

Fig. 3. Plan of Soil Sampling from the layers 0-10, 10-20, 20-50 cm within the Industrial Site #1, PCP

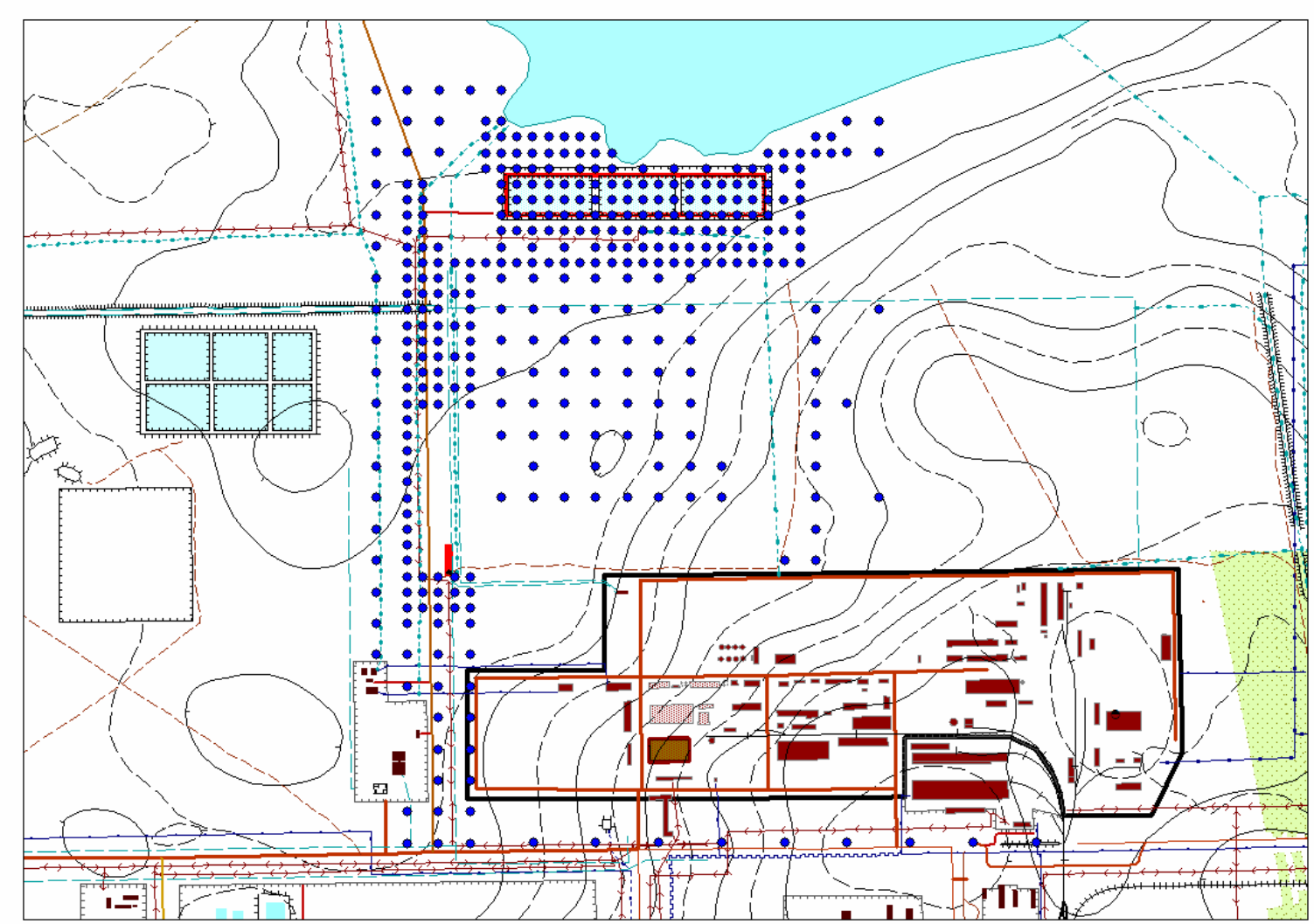

Fig. 4. Plan of Soil Sampling from the layers 0-10, 10-20, 20-50 cm at the area around former chlor-alkali production, PCP