

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 2007 - to 30 June 2007

Quarter 7

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

Address: 126, Baytursynov Str., Almaty, 050013, Kazakhstan

Project manager

Ilyushchenko M.A.
PhD (Chemistry)



20.07.2007

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 not fulfilled because of bankruptcy of the partner PCP
1.2.	4	8	Implementing/Suggestion on the Monitoring Program expansion by including investigation of areas of groundwater rise, soils at the industrial site #1 and along the sewer pipe network as well as investigation of methyl mercury was justified.
1.3.	1	12	Implementing /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	Implementing/Study of three-dimension transport of mercury by groundwater flow taking into consideration character of lithographic structure.
2.5.	10	12	
2.6.	8	8	
2.7.	8	8	
2.8.	9	10	
2.9.	9	10	
3.1.	1	2	Did not fulfilled because of PCP Participant Institution bankruptcy.
3.2.	4	6	Negotiations with Pavlodar Oil Refinery, Pavlodar Oblast Territorial Department of Environmental Protection and Kaustik were conducted about getting an access to the observation boreholes network for monitoring of oil products monitoring. It was refused to provide an access to the boreholes and recommended not to do monitoring of oil products in Pavlodarskoe village. In connection with preparation of the second phase of demercurization works in Pavlodar it was suggested to expand the scope of activity on mercury monitoring within ISTC K-1240 project.
3.3.	8	8	
3.4.	8	8	
3.5.	9	11	
3.6.	11	12	
4.1.	1	2	Completed
4.2.	2	10	Work interruption in VII Quarter
4.3.	3	11	Work interruption in VII Quarter
4.4.	4	8	Work interruption in VII Quarter
4.5.	4	9	Implementing/Chemical and analytical works are being conducted with samples of bottom sediments, taken in VI Quarter
4.6.	10	12	
5.1.	1	12	Implementing
5.2.	1	12	Implementing /28 May-1 June 2007 in the cities of Pavlodatr, Ekibastuz, Astana International Workshop

			“Environmental Mercury Pollution: Mercury Emissions, Remediation and Health Effects” was held.
--	--	--	--

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**

Change of the Work Plan of ISTC K-1240p project is suggested which generally lies in broadening of tasks on mercury monitoring due to reduction of tasks on oil products monitoring.

- **Fulfilled work**

Processing of the data of field studies of the first year of monitoring as well as simulation of mercury contamination spread by groundwater flow including its vertical movement up to ground surface was carried out. It is shown that mercury contaminated groundwater rise and its evaporation and also losses of mercury contaminated effluent from the sewage system on the Northern industrial site of Pavlodar results in topsoil pollution at pastures of Pavlodarskoe village beyond the main source of contamination. Also it is possible mercury contamination of groundwater and seasonal surface waters in this area.

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

Suggested change of the Work Plan of ISTC K-1240 (described in the Annual Report for the first year of the project) and the Program of Post-containment Monitoring was justified which generally lay in broadening the tasks of mercury monitoring due to construction of tasks on oil products monitoring. The justification is revealing the high probability of risk of mercury contamination to the pastures of Pavlodarskoe village located beyond the mail source of pollution. It is necessary to produce detailed map of soil mercury contamination not only within the industrial site #1 (see the report for Quarter V) but also along the sewage system and at the territory of mercury contaminated groundwater spread (with layer soil sampling down to seasonal daturence surface of the groundwater). It is also necessary to found mercury contamination level in gramma grass. Within the same area it is important to determine mercury concentration (including methyl mercury one) in shallow groundwater as well as seasonal surface waters in ditches and small natural depressions. The project Work Plan correction is suggested to be done in Quarter VIII.

- **Personnel Commitments**

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	4
Yakovleva Lyudmila Vassilievna	2	6
Kamberov Rustam Irkenovich	2	10
IHH		
Panichkin Vladimir Yurievich	2	4
PCP		
Akhmetov Arthur Darazhatovich	1	17
Kuzmenko Larissa Vitalievna	1	18

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**

During summer and fall (2006) field works the material characterizing mercury content in groundwater and near-earth atmosphere was collected and soil samples were taken. Chemical and analytical works were conducted with soil samples taken on the regular grid from the territory located to the north from the industrial site #1.

▪ **Fulfilled work**

111 topsoil (0-10 cm) samples have been analyzed taken on the regular grid on 5 spots located between the industrial site #1 and the wastewater storage pond Balkyldak in places with high probability of the topsoil contamination due to rise of groundwater and/or flows from the sewage system. The results obtained were put on the vector map of soil mercury pollution which was produced in 2002 (see Annex 1).

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

The renewed map proves existence of small hotspots of soil mercury contamination caused by mercury contaminated groundwater rise as well as losses of mercury containing effluents from the sewage system. These hotspots pose great danger for local population because they are located within the pasture for communal livestock of Pavlodarskoe village. It is necessary to produce detailed map of the mercury pollution of this area, to investigate vertical distribution of mercury in the soil layer (in order to find the source of contamination) and to find level of mercury contamination of gramma grass.

▪ **Personnel Commitments**

Name	Category	Work days
AIPET		
Uskov Grigoriy Aleksandrovich	2	30
Yakovleva Lyudmila Vassilievna	2	6
Zyryanova Natal'ya Alexandrovna	2	20
Kamberov Rustam Irkenovich	2	10
Stepanov Vladimir Alexandrovich	3	12
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 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: To make detailed forecasts for mercury pollution spread taking into account the parameters of adsorption/desorption equilibrium.

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

Inverse nonstationary task has been solved. Change in hydro-geological conditions since 1970 till 2001 was represented on the model. Coefficients elastic and gravitational water loss of bearing strata were found, groundwater recharge caused by losses of technical water from engineering services was defined more exactly.

- **Fulfilled work**

Using the renewed model three-dimensional mercury transport by groundwater flow was studied. The model is detailed in representation of character of lithologic structure of the area where mass transfer process occurs. It also takes into account the process of mercury sorption by bearing strata. An assumption was made that equilibrium between liquid and solid phases is attained instantly, that is why Henry's linear isotherm is used to describe the process (a model of inverse equilibrium sorption).

Values of Henry's constant were used (distribution coefficient) ranged from 0.01 to 0.04 dm³/mg for clay materials and from 0.00001 dm³/mg for differently grained sand to 0.0015 dm³/mg for clay and dust sands. It conforms very well with laboratory and Literature data.

Within the simulated area water bearing strata were represented by sands interlaced with clay and loam. Based on the results of simulation it was found that mercury transport goes not only across sands between clay interlayers but also vertically upward through so called "windows" in places of clay layers pinching out. In fact mercury can not penetrate through clay interlayers themselves even if they are not thick but it is just adsorbed on their surface.

Mercury transport upward gives prerequisites for its accumulation in zone of aeration followed by its getting to ground surface, groundwater and vegetation. This result of the simulation, however, requires experimental demonstration.

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

The result has been obtained showing high risk of formation of new hotspots of mercury contamination of soil at the territory between the industrial site #1 and the wastewater storage pond Balkyldak.

- **Personnel Commitments**

Name	Category	Work days
IHH		
Panichkin Vladimir Yurievich	2	36
Miroshnichenko Oxana Leonidovna	2	40
Trushel' Lyudmila Yurievna	2	16
Zakharova Nonna Maximovna	2	14

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 3.2. Basing on the hydrogeological model of Northern industrial area of Pavlodar to estimate the most likely direction of the plume of oil products with groundwater.

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

Verbal refusal to provide an access to observation boreholes network of Pavlodar Oil Refinery (POR) has been received from its administration.

- **Fulfilled work**

Negotiations with POR, Pavlodar Oblast Territorial Department of Environmental Protection and JSC "Kaustik" have been conducted about getting an access to the observation boreholes network for monitoring of oil products. It was refused to provide an access to the boreholes and recommended not to conduct monitoring of oil products in Pavlodarskoe village. During the meeting of Mr. S. Amanov, BMP sub-manager, Mr. A. Akhmetov, JSC "Kaustik" sub-manager and Mr. M. Valentine, Curator of the project possibility to conduct monitoring of oil products using network of observation boreholes within the industrial site #1 of the former PO "Khimprom" as well as surface waters of the

wastewater storage pond Balkyldak has been discussed. Analytical methods have been discussed and chosen.

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

BMP and JSC “Kaustik” have made joint suggestion to conduct monitoring of oil products in groundwater and surface waters at the area to the north from the industrial site #1 of Pavlodar Chemical Plant.

- **Personnel Commitments**

Name	Category	Work days
BMP		
Kolysheva Olga Ivanovna	1	15.00
Galieva Elena Vladimirovna	1	15.00
Lobacheva Tatiana Ivanovna	1	15.00
Zolotova Nadezhda Vladimirovna	1	10.00
Lyashenko Galina Nikolaevna	1	10.00
Amanov Serzhan Bakhytovich	1	30.00

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.

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

In March 2007 159 samples of bottom sediments of the wastewater storage pond Balkyldak were taken on 94 sampling points (a little more than 80% of total scheduled scope of activity).

- **Fulfilled work**

Chemical analytical works 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		
Uskov Grigoriy Aleksandrovich	2	10
Yakovleva Lyudmila Vassilievna	2	4
Zyryanova Natal'ya Alexandrovna	2	15
Stepanov Vladimir Alexandrovich	3	15
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
PSU		
Malkov Igor Viktorovich	1	11
Kuzmin Valery Sergeevich	1	25
Pastukh Viktor Petrovich	1	25

Bazarbekov Kairbai Urazambekovich	2	6
Kalieva Aida Akhmetbekovna	2	28

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 5.1: To discuss the work program and obtained results with Pavlodar regional department of environmental protection and with the managers of Pavlodar Chemical Plant.

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

As a result of discussion with administration of POR, JSC “Kaustik” and Pavlodar Oblast Territorial Department of Environmental Protection about possibility to investigate observation boreholes of POR it was recommended to broaden scope of activity on mercury monitoring within ISTC K-1240p project and not to conduct monitoring of oil products.

- **Fulfilled work**

It was suggested to discuss necessity to conduct oil products monitoring in groundwater of the Northern industrial area of Pavlodar. Administration of POR justifies their refusal to provide an access to observation boreholes network by the fact that their Laboratory of environmental protection being under the control of Pavlodar Oblast Territorial Department of Environmental Protection is already conducting such monitoring and do not have any grounds for concern. It was strongly recommended to ISTC K-1240p project not to conduct an investigation of water in the water supply wells of Pavlodarskoe village for presence of oil products there because it can spread groundless panic among the local population and mass media. At the same time recognizing validity of high risk to the environment and community of Pavlodarskoe village from mercury pollution it was suggested to ISTC K-1240p project to prepare materials for designing and justification to conduct the second phase of demercurization in the Northern industrial area of Pavlodar. These works could be connected with both remediation/clean-up of soils within the industrial site #1 or to the north from it and reduction of potential risks from mercury contaminated bottom sediments of the wastewater storage pond Balkyldak. Pavlodar Oblast Territorial Department of Environmental Protection and Ministry of Environmental Protection could apply to the government of the Republic of Kazakhstan with suggestion to finance such works from the budget of the Republic of Kazakhstan.

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

It was recommended to ISTC K-1240p project to broaden mercury monitoring and not to conduct monitoring of oil products.

- **Personnel Commitments**

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	6
Muhkamejanov Khamit Waliachmetovich	2	6
PCP		
Akhmetov Arthur Darazhatovich	1	19
Kuzmenko Larissa Vitalievna	1	20

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

Dates and place of holding International Workshop on mercury danger funded by ISTC have been determined. The Workshop is planned to hold in Astana City, Kazakhstan on the 28th of May – 1st of June, 2007 under support of Global Partnership Program of Canada government. Application Form for its holding has been prepared and the subjects were determined.

▪ Fulfilled work

International Scientific Workshop “Environmental Mercury Pollution: Mercury Emissions, Remediation and Health Effects” was held in Astana City, Kazakhstan, on the 28th of May – 1st of June, 2007 under support of Global Partnership Program of Canada government, Ministry of Environmental Protection of the Republic of Kazakhstan and ISTC. One of the goals of the Workshop was assessment of efficiency of engineering solutions and exchange of an experience in remediation of areas contaminated with mercury (cases of demercurization projects in Pavlodar and Temirtau). The International Workshop has brought together 42 participants from Kazakhstan, Russia, Canada, USA and United Kingdom. In total it was made 25 presentations including 8 ones related to the mercury contamination in Pavlodar. There were results obtained on K-1240p project in 4 presentations. Within the framework of the Workshop the special technical tour was arranged and conducted during which its participants visited the site of mercury contamination at Northern industrial area of Pavlodar and met with specialists from Pavlodar Oblast Territorial Department of Environmental Protection. Specialists from Ministry of Environmental Protection of the Republic of Kazakhstan, Ministry of Industry and Trade of the Republic of Kazakhstan and Water Resources Committee of the Ministry of Agriculture of the Republic of Kazakhstan took part in the Workshop. The Workshop activity was being highlighted by the republican TV.

▪ Results by the end of the current quarter

International Scientific Workshop “Environmental Mercury Pollution: Mercury Emissions, Remediation and Health Effects” was held in Astana City, Kazakhstan

▪ Personnel Commitments

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	10
Yakovleva Lyudmila Vassilievna	2	4
Kamberov Rustam Irkenovich	2	20

Task 0.: Project Management

▪ Fulfilled work

The Report for Quarter VII was prepared as well as possibility of correction in VIII quarter of ISTC K-1240p Work Plan and budget was discussed.

▪ Personnel Commitments

Name	Category	Work days
AIPET		
Ilyushchenko Mikhail Alexeevich	1	8
Yakovleva Lyudmila Vassilievna	2	14

Kamberov Rustam Irkenovich	2	14
Ibraeva Alma Abylkasymovna	3	15

2. Summary of Personnel Commitments

	Number of persons	Total days	Total grants (US\$)
Category I	17	358	10100
Category II	11	313	9252
Category III	2	42	705
Category IV			
Total:	30	671	20057

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 VII has been prepared
- 2 articles have been published:
 - S.M.Ullrich, M.A.Ilyushchenko, I.M.Kamberov, T.W.Tanton. Mercury contamination in the vicinity of a derelict chlor-alkali plant. Part I: Sediment and water contamination of Lake Balkyldak and the River Irtysh. The Science of the Total Environment, V. 381, 2007, P. 1-16
 - S.M.Ullrich, M.A.Ilyushchenko, T.W.Tanton, G.A.Uskov. Mercury contamination in the vicinity of a derelict chlor-alkali plant. Part II: Contamination of the aquatic and terrestrial food chain and potential risks to the local population. The Science of the Total Environment, V. 381, 2007, P. 290-306
- Website <http://Hg-Kazakhstan.narod.ru> has been renewed: the section with materials on International Scientific Workshop "Environmental Mercury Pollution: Mercury Emissions, Remediation and Health Effects", Astana, Kazakhstan (May 28- June 1, 2007) has been included.

4. Significant Travel and Meetings

4.1. Travel and meetings inside CIS

- Almaty-Pavlodar-Ekibastuz-Astana-Almaty (not from the budget of K-1240p)
5 days
Ilyushchenko Mikhail Alexeevich
Kamberov Rustam Irkenovich
Yakovleva Lyudmila Vassilievna
Panichkin Vladimir Yurievich
Miroshnichenko Oxana Leonidovna
- Pavlodar- Ekibastuz-Astana-Pavlodar (not from the budget of K-1240p)
5 days
Akhmetov Arthur Darazhatovich
International Scientific Workshop "Environmental Mercury Pollution: Mercury Emissions, Remediation and Health Effects" has been held in Pavlodar, Ekibastuz, Astana. In particular the progress of demercurization and post-demercurization monitoring in Pavlodar was discussed

there, meeting with V.A. Bednenko, Head of Pavlodar Oblast Territorial Department of Environmental Protection was conducted and area of demercurization works and monitoring at the Northern industrial area of Pavlodar was visited. 4 presentations were devoted to the results of K-1240p project.

4.2. Travel and meetings outside CIS

1. no

5. Cooperation with foreign collaborators

- Exchange of scientific materials (information, computer programs and data, samples)
- no

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).

There are suggestions for Quarter VIII:

1. To agree with Partners and Participant Institutions of ISTC K-1240p project the following changes in plans of subsequent works on the project:

- for BML and JSC “Kaustik” to determine the area and time of surface water and groundwater sampling for monitoring of oil products (because of a ban of the local authority these works can be conducted only at the territory to the north from the industrial site #1 of Pavlodar Chemical Plant);
- for BML to determine time and sequence of analytical works on analysis of oil products in the samples taken;
- for JSC “Kaustik” to determine area, sequence and time of soil samples collection for their analysis for mercury content and also sequence and time of the chemical and analytical works with collected soil samples;
- for IHH to determine character of works on simulation of hydro-geological conditions and development of prognosis scenarios for groundwater mercury contamination instead of works planed earlier on simulation of hydro-geological conditions at the area of Pavlodar Oil Refinery;
- to conduct reallocation of the rest of budget of the former Participant Institution PCP (left the project due to its bankruptcy) among new Participant Institution JSC “Kaustik” and AIPET (to transfer the part of PCP project budget to AIPET to replenish Travel expense item as well as to purchase analytical equipment for methyl mercury determination).
- to draw up the budget of JSC “Kaustik” so that funds planed to purchase analytical equipment for PCP for oil products analysis and to conduct drilling works at the area of Pavlodar Oil Refinery would be

used for purchase of necessary general labware increasing resources of the laboratory in mercury monitoring;

- to do other necessary changes in K-1240 project documentation as for instance in lists of Participant Institutions' teams.

2. To create conditions to conduct the scheduled field works on groundwater mercury monitoring and bottom sediment sampling from points inaccessible earlier within the wastewater storage pond Balkyldak in Pavlodar in the second half of September, 2007.

3. To do analysis of fulfilled and scheduled works as well as funds spent on the project and to make a suggestion for discussion and approval of the Partners to extend K-1240 project due to late involving of two key Participant Institutions - BMP and JSC "Kaustik" to the research work.

ANNEX

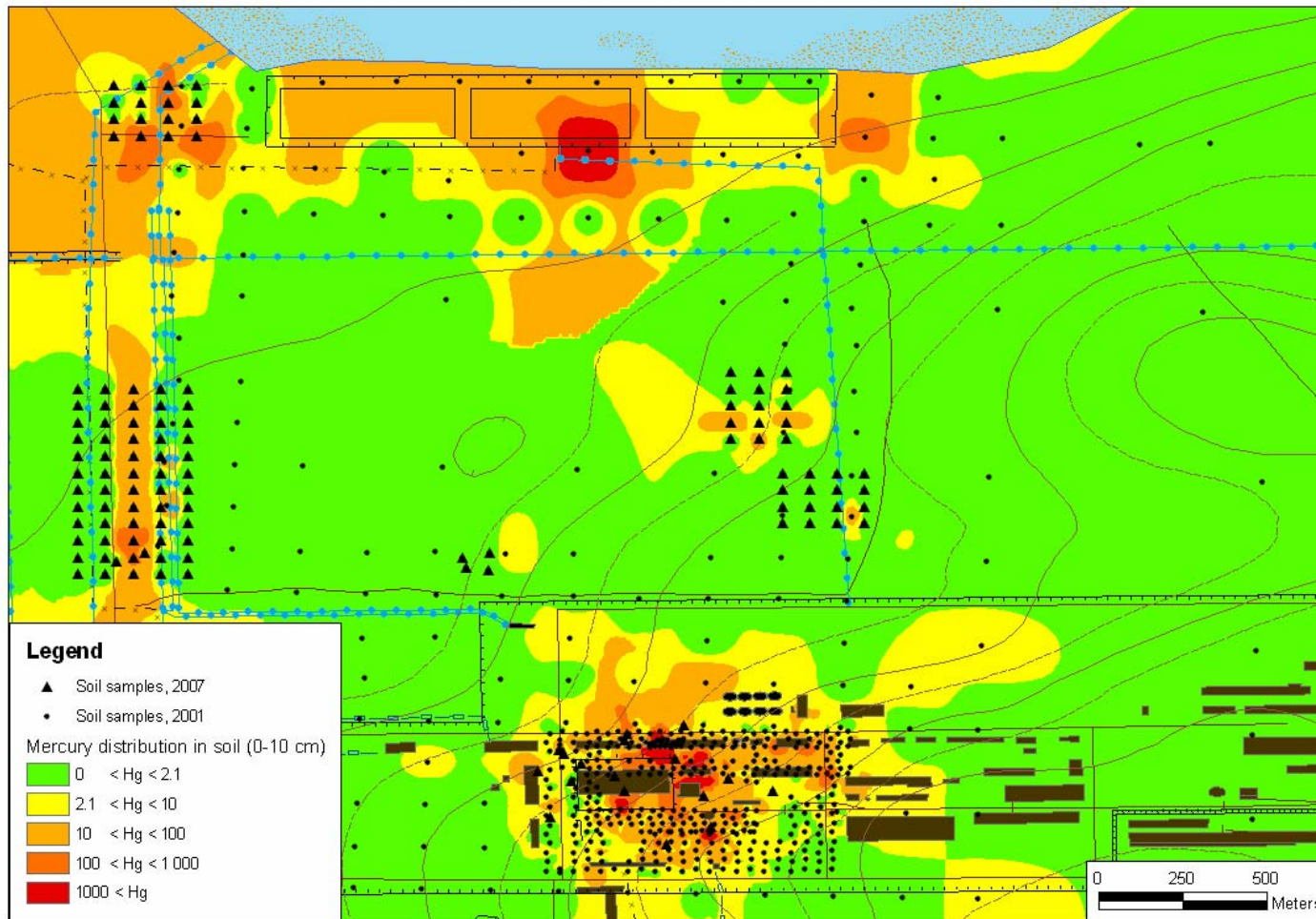


Fig.1 Map of topsoil (0-10 cm layer) contamination of the Northern industrial area of Pavlodar, augmented with data of 2007 on 107 sampling points