TECHNICAL REPORT

regarding

Soil and Water Quality Contamination Investigation

at

Pulau Burung Sanitary Landfill Site & Its Vicinity,

Seberang Perai Selatan,

Pulau Pinang

PREPARED BY:

State Director

Department of Environment Pulau Pinang

Tingkat 5, Wisma Peladang

Jalan Kampung Gajah

12200 Butterworth, Pulau Pinang

PREPARED AT THE REQUEST OF:

Department of Environment (Headquarters)

Date: 30th December 2008

CONTENTS

APPENDICES

1. SUMMARY OF CONCLUSIONS

This should list the main facts derived from the evidence dealt with in the report and the conclusions/opinions arrived at, and the answers to questions posed by the complainants

Our (Department of Environment Pulau Pinang) experts opinion support the explanation that the issue of migration of the contaminants from landfill site that caused the death of fishes (within the fishing breading areas, rivers and marine ecosystem in the sampling areas) and mangrove was not likely true. However, we support the Y.B. Ahli Parliamen Pulau Burung directives so that the Idaman Bersih Sdn. Bhd. to:

(a) carry out maintenance of bund along perimeter drain of the landfill to minimize the risk of seepage;
(b) remove the overflow pipes that jutting out off the Pulau Burung dumping ground; and
(c) replant the mangrove at the vicinity of the landfill site; to demonstrate their social and corporate responsibility to the stakeholders.

2. INSTRUCTIONS

(This section must give the substance of all instructions received by the expert, whether written or oral.)

The Department of Environment Pulau Pinang was instructed to conduct an investigation on potential soil contamination at surrounding Pulau Burung Sanitary Landfill site, located at Seberang Prai Selatan, Pulau Pinang. The letter of instruction from the Department of Environment Headquarters dated **2nd July 2008** was referred.

3. ISSUES

(The issues to be addressed and the questions to be answered must be clearly set out.)

Y.B. Ahli Parlimen Nibong Tebal raised an issue of the Pulau Burung Sanitary Landfill Site was not properly managed in accordance to standard approved practice. Consequently, several problems arises such as pollution of nearby watercourses, death of mangrove within certain portion of the areas nearby the surrounding the landfill site and fishing areas nearby being likely to be affected due to migration of the contaminants of the landfill site. This issue was raised to the Minister

of Ministry of Mineral Resources and Environment on the last third quarter of parliamentary meeting session dated August 2008. This issue was raised again during a special meeting with the Y.B. Ahli Parlimen Nibong Tebal dated 5th. December, 2008. Three issues raised by the Y.B Ahli Parliamen Pulau Burung were:

(a) Maintenance of bund along perimeter drain of the landfill to minimize the risk of seepage;

(b) Removal of the overflow pipes that jutting out off the Pulau Burung dumping ground; and

(c) Replanting of the mangrove at the landfill site.

[*BRIEF*] CURRICULUM VITAE

Identity of any other person who has assisted with the preparation of the report and whether the expert accepts responsibility. If considered necessary, a more detailed curriculum vitae can be attached as an appendix.

The investigation teams comprises of two groups: the site investigation team conducting soil and water sampling; and the other group involved in the data analysis and report preparation. The list of the investigation teams are shown below

(a) Data Analysis & Report Preparation Team:

Pengarah Dr Ahamd Kamarulnajuib Che Ibrahim

PPKK Mohd Jafri Mohd Noor

PK June Bong

(b) Sampling & Investigation Team:

PPKK Azhar Zainal Abiddin

PPK Mohd Fatah

PPK Hasbulah Hamzah

JTK Mohd Sharin Mahmood

JT Mohd Sharin

JT Md Shah Rizal

4. DOCUMENTATION

A full list must be provided of all documents and other submitted material on which the report is based.

In assisting this investigation, information was referred to an EIA, Written Permission and Monitoring reports submitted by the Idaman Bersih Sdn. Bhd. (No. 24, Jln Seri Aman1, Pusat Perniagaan Seri Aman, 14200 Sungai Bakap, Seberang Perai Selatan, Pulau Pinang).

5. CHRONOLOGY

The chronology must deal only with factual items of the evidence. It may be appropriate to include a very brief outline of details of the

antecedent history of the case that could bear on the matter under consideration. Fuller details should be included as appendices.

(a) !st August 2001, Pulau Burung Sanitary Landfill was awarded a contract by the Majlis Perbandaran Seberang Prai (MPSP), to be responsible to manage solid waste generated, limited within the state of Penang.

(b) 30th May 2008, Idaman Bersih Sdn. Bhd. was given Written Permission under Regulation 4 of the Environmental Quality (Sewage and Industrial Effluent) 1979 to set up effluent treatment plant to treat leachate.

(c) On Mac, April, May, June and Juay 2008, Idaman Bersih Sdn. Bhd. submitted Air and Water Quality reports to the Department of Environment Pulau Pinang.

(d) On August 2008, Y.B. Ahli Parlimen Nibong Tebal raised an issue of the Pulau Burung Sanitary Landfill Site was not properly managed in accordance to standard approved practice.

(e) On August 2008 a follow up soil and water sampling & investigation were conducted by the Department of Environment Pulau Pinang to verified the issue raised.

(f) On 5th. December, 2008, a special meeting at the landfill site and office of Idaman Bersih Sdn. Bhd were held and chaired by the Y.B. Ahli Parlimen Nibong Tebal.

(g) On 28th December,2008, the Department of Environment Pulau Pinang received results of the soil and water samples analysis from the Chemistry Department Pulau Pinang for further interpretation by the Department of Environment Pulau Pinang.

6. TECHNICAL BACKGROUND

(In cases where technical aspects of the issues are out with the general knowledge or experience of those who will have to deal with the report an explanation of the technical issues in this section may be necessary.. The details should be clearly presented in paragraphs of reasonable length. All technical terms and jargon should be clearly defined or explained, either within this Section or by cross-reference to an appendix. The details of any tests or experiments conducted should be set out, with relevant details of any person who conducted the test or experiment on behalf of the expert.

Regardless of whether a technical explanation is required, the expert should set out at this section the facts he has established in his enquiries, taking care to separate fact from opinion.)

In examining of the facts in issue (the contamination issue), an investigation was conducted at the landfill site and its vicinity by the Department of Environmental Pulau Pinang. Detailed site investigation

were carried which involved collection of metals contamination data on the landfill and its surrounding site, nearby rivers, coastal marine water and sediments. The data was important to be converted into rational interpretation to establish evidence on the relationship of the migration of the metals from landfill to its surrounding areas including mangrove areas, fishing (fish breeding areas) and river ecosystems. The data could be converted into rational interpretation by using multivariate statistics and geostatistics (spatial variability). Strict observance of the sampling requirements was carried out on the soil and water quality of nearby watercourses and coastal marine water. The samples were taken to the Chemistry Department Penang for details analysis of metals concentration for the soil and water quality. A portion of the soil and water samples were also collected for in-situ analysis and metals concentration determination at the DOE Penang office by using enforcement in-situ measurement toolkits. This task was carried out by the Department of Environment Pulau Pinang investigation team. A total of twenty sample stations were selected and investigated.

The investigated site is located at Pulau Burung within longitude and latitude of 100.38 ^{o} and 5.19 ^{o} at Sungai Bakap, Seberang Prai Selatan, Pulau Pinang. The sketch location of Pulau Burung is shown in **Appendix 1**. The conceptual site model of the investigated site to identify the potential source, pathway, and receptor of the contaminant is shown in **Appendix 2.**

The soil samples were collected by grab sampling techniques. The soil was kept in plastic bottles of capacity 500 mL. All the soil samples were sent to the Chemistry Department for metals analysis by using ICP-MS Method. All samples bottles have been labelled according to the sampling protocol of the Department of Environment. The Chain of the Custody Forms was entrusted to PPK Fatah for filling up and transferred of the samples to the laboratory of Chemistry Department Pulau Pinang. The soil sampling strategy conducted in this investigation was based on kriging (Spatial Sampling Techniques) as shown in **Appendix 1**. **Appendix 3** shows photographs of the sampling activities.

In-situ measurements for pH were conducted for all the sampling stations. The results of pH measurements indicated that the whole investigated site was in alkaline state with a range of 8.32 to 9.38. Appendix 4 shows the results of the pH measurements.

The detail results of the in–Situ measurement for the metals are shown in **Appendix 5.**

The results of the Chemistry Department analysis for the metals and the analysis conducted by the Department of Environment Pulau Pinang were analysed and interpreted by using the Principle Component Analysis (PCA) of the Multivariate Statistical Method,

Semivariogram and the contour plot analysis running on the SURFER version 6 of the Geostatistical Method.

The PCA was used to help summarise and facilitating the interpretation of the complex data to two or three components that could described contaminants (metal concentrations of the soil and water quality samples) that co varies (co-occur) at the sampling sites and the landfill site. **Appendix 10** shows the PCA plots for the data set.

The semivariogram quantify the degree of spatial dependence of the metals concentration and confirmed whether the metals of the sampling sites came from the same source (the landfill site). In other words, it demonstrates the gradient of contaminants.

Analysis of Department of Chemistry Data

The Principal component analysis demonstrated that the complex data could be reduced to 5 principal components as demonstrated by its Scree Plot (considering eigenvalues more than 1). However, after analyzing the associated components loading of more than 0.5, it could be reduced to only one component (PC 2). In this case, it was observed the only metals that probably with high covariance loadings were narrow down to copper (Cu) and Arsenic (Ar).

The same data set used in PCA was plotted in a semivariogram and it was found that there was no gradient. The reason for this observation was that the metals concentration data was not linearly fitted in the semivariogram. This finding rule out that there is strong believes that the copper and arsenic found at sampling sites not likely to originate from the landfill site.

Appendix 9 shows the final plotting of the contour plots. The contour plot shows that the dense pattern of directions for the Cu and Ar were found towards the landfill sites rather than away from the source (the landfill site). This patterns also show the dispersion of contaminants was found could not occurred outside the landfill site.

The present of copper (Cu) and arsenic (Ar) were further analyzed by carried out descriptive statistics analysis and comparison of the results with Third Schedule of the Environmental Quality (Sewage and Industrial Effluent) Regulations 1979. It was found that the mean concentration of copper (Cu) and arsenic (Ar) were very low 0.077 mg/L and 0.005 mg/L respectively. Indeed, the mean values of Cu and Ar were far below the Standards stipulated under the Third Schedule. (Standard B for Cu 1.0 mg/L and Ar 0.1 mg/L). All sampling locations demonstrated that the values of Cu concentration were very low than 0.2 mg/L. Similarly, for Ar , all sampling locations demonstrated the values very low than 0.007 mg/L including within the landfill site with

an exception at the fish breeding areas the highest value detected was 0.014 mg/L.

OPINION

In this section the expert should present his opinion clearly and unambiguously. If appropriate the sequence of events in the chronological evidence can usefully be adopted. Suitable reference should be made to any appendices attached to the report.

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The reasons given for opinions expressed by the expert should be explicit. Suitable reference should be made to any literature or other matter on which the expert has relied.)

Our (Department of Environment Pulau Pinang) experts opinion that there was no contamination occurred outside the landfill site. Although Cu and Ar were detected slightly significant within sampling areas, the level of contamination was found not arise from the landfill site. and its risk still probably low and below the Third Schedule of the Environmental Quality (Sewage and Industrial Effluent) Regulations 1979.

Therefore it is inconclusive to tell that the contaminant within vicinity of the landfill site (including the mangrove areas, rivers and coastal marine areas) could be related to the landfill site. Our opinion support the explanation that the issue of migration of the contaminants from landfill site that caused the death of fishes (within the fishing breading areas, rivers and marine ecosystem in the sampling areas) and mangrove was not likely true.

However, we support the Y.B. Ahli Parliamen Pulau Burung directives so that the Idaman Bersih Sdn. Bhd. to:

(a) carry out maintenance of bund along perimeter drain of the landfill to minimize the risk of seepage;
(b) remove the overflow pipes that jutting out off the Pulau Burung dumping ground; and
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7. REFERENCES

This should consist of a numbered list of all items of technical literature relied on and of any other material to which reference is made. If the references are extensive they may be listed as a separate appendix.

1. Robert D. Morrison and Brian L. Murphy, Environmental Forensic, “Contaminant Forensic Guide”, ELSEVIER, Academic Press, U.K. , 2006.
2. Brian L. Murphy and Robert D. Morrison, Second Edition, “Introduction to Environmental Forensic”, ELSEVIER, Academic Press, U.K. 2007.
3. Stephen M. Mudge, Method in Environmental Forensic, CRC Press, 2009.
4. Law of Malaysia, Environmental Quality Act 1974 (ACT 127) & Subsidary Legislation, 2008

1.

STATEMENT OF TRUTH

I confirm that insofar as the facts stated in my report are within my own knowledge I have made clear which they are and I believe them to be true, and the opinions I have expressed represent my true and complete professional opinion.

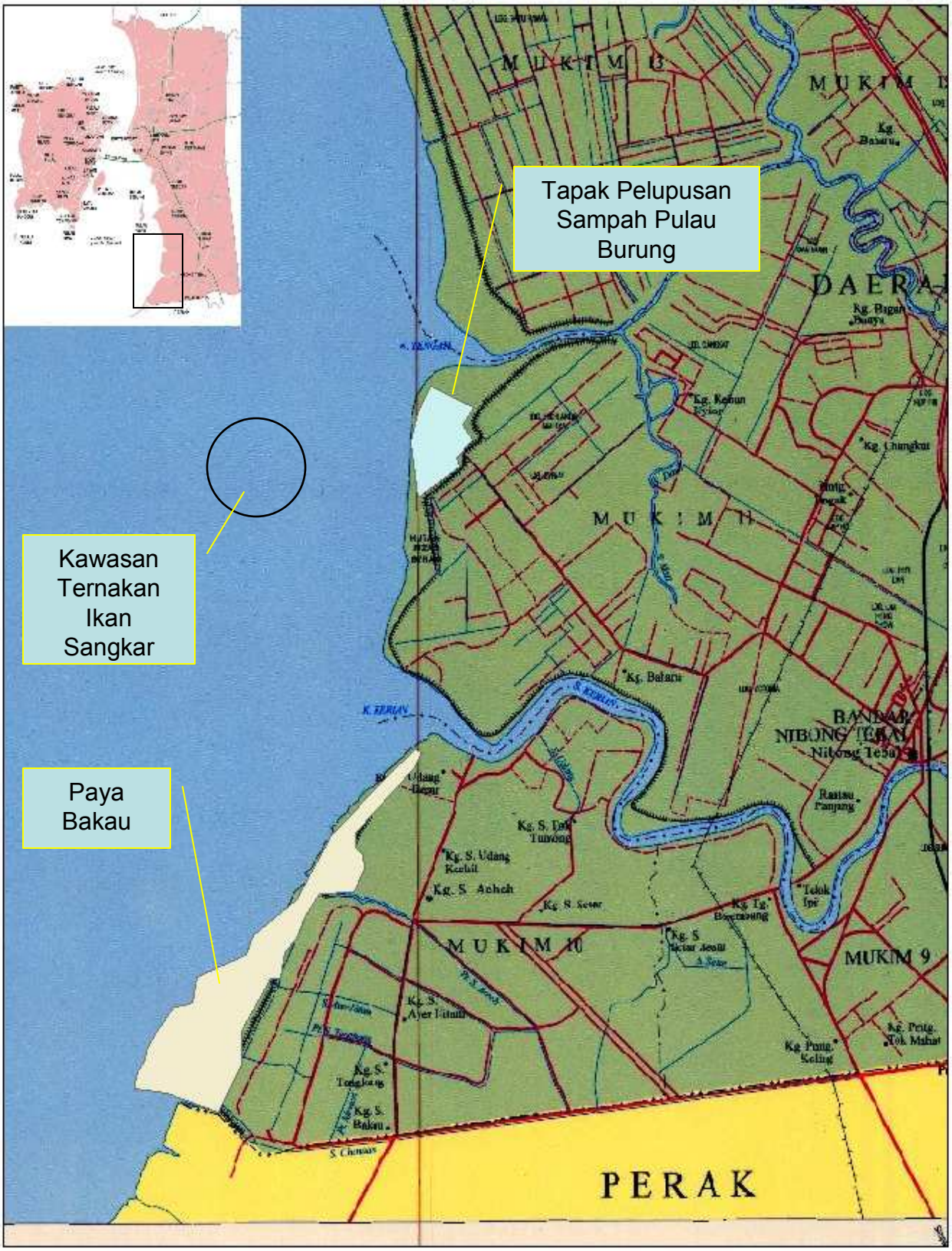
Signature: _____ Date: _____

APPENDICES

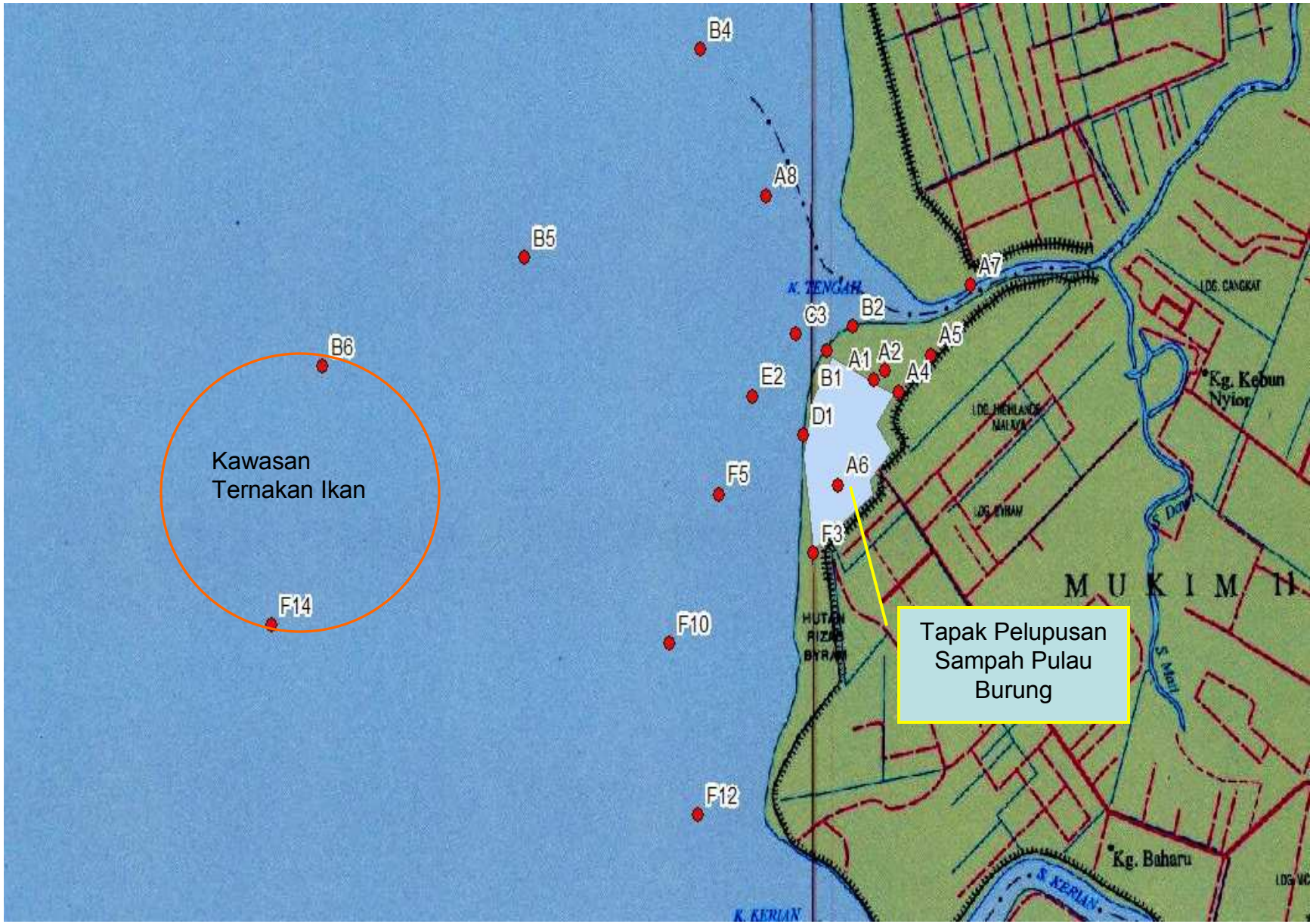
Where the report covers extensive and detailed facts, chronology, medical and other records it is preferable to include this information in appendices to the main report.

APPENDICES

Pulau Pinang: Kawasan Tapak Pelupusan Sampah Pulau Burung



Pulau Pinang: Lokasi Stesen Pemantauan di Tapak Pelupusan Pulau Burung dan merin

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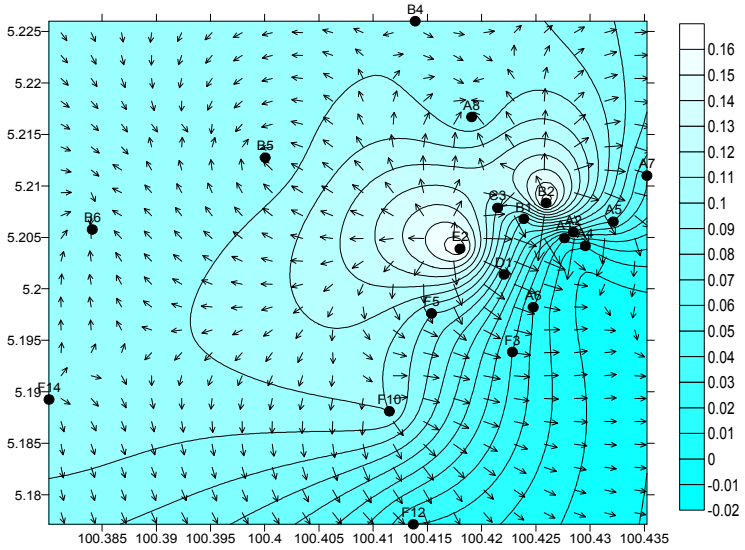

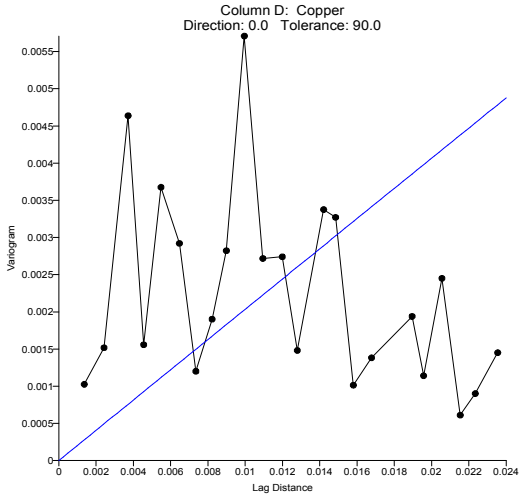

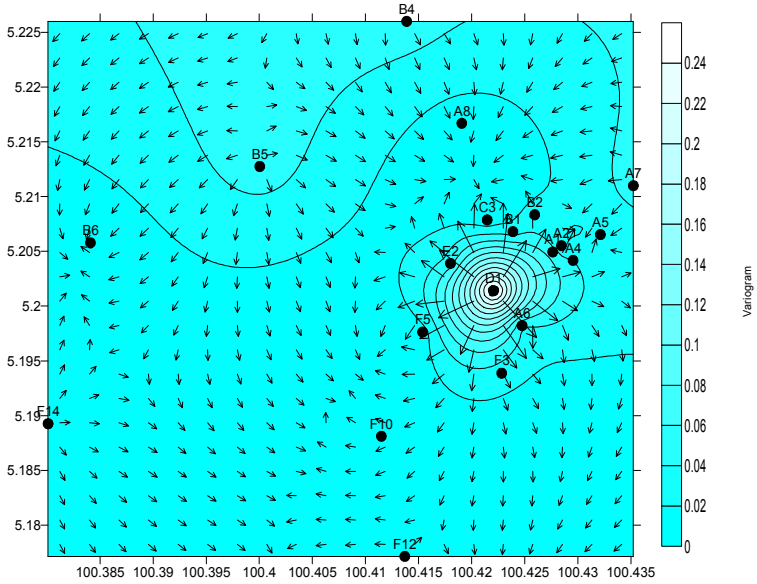

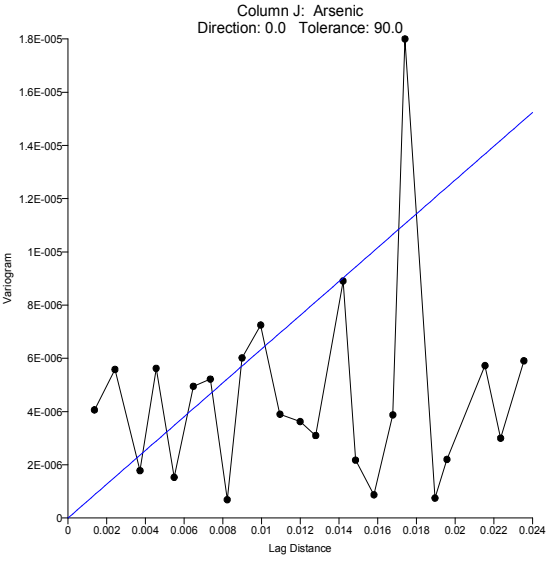

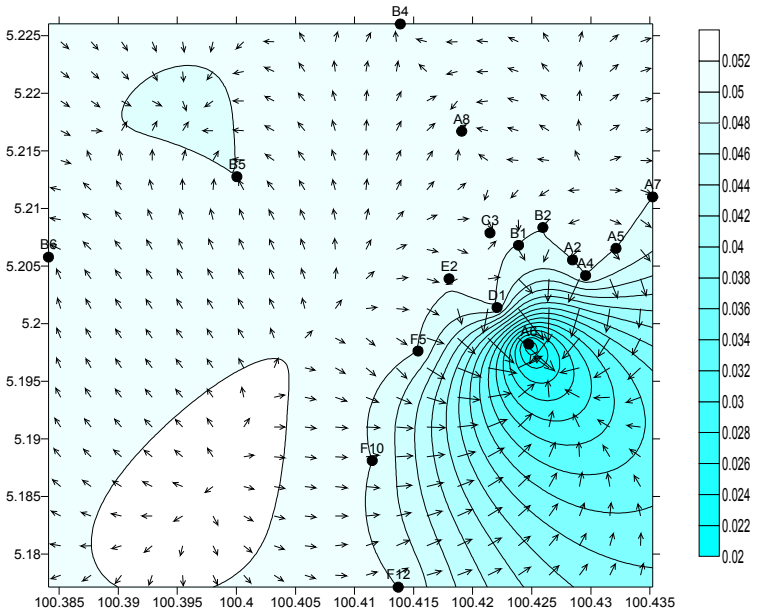
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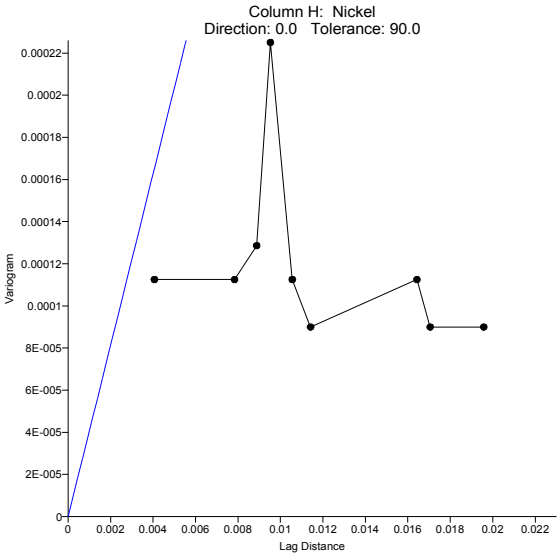
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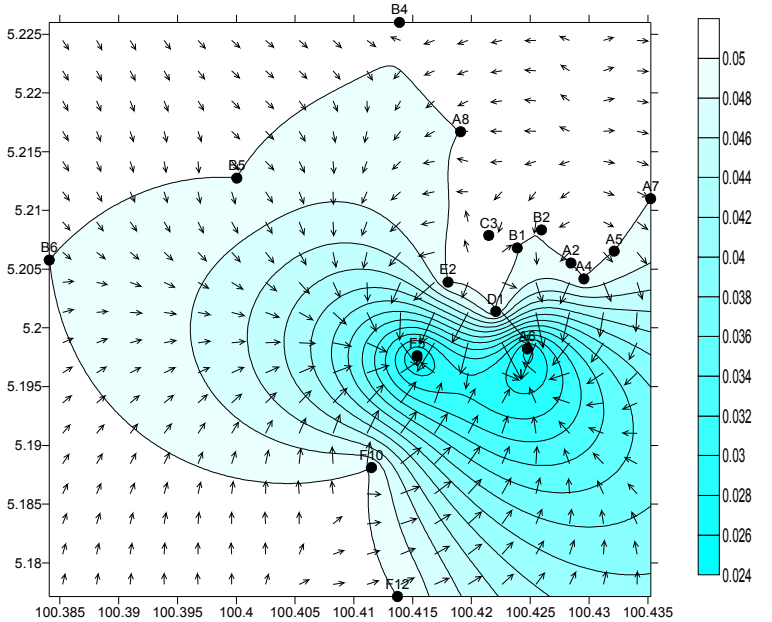
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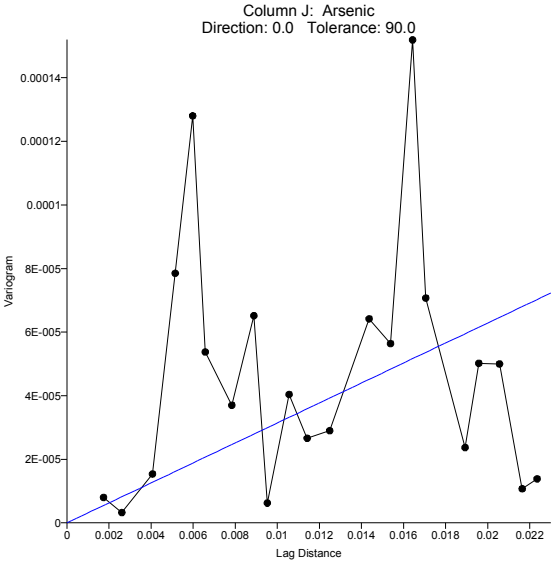
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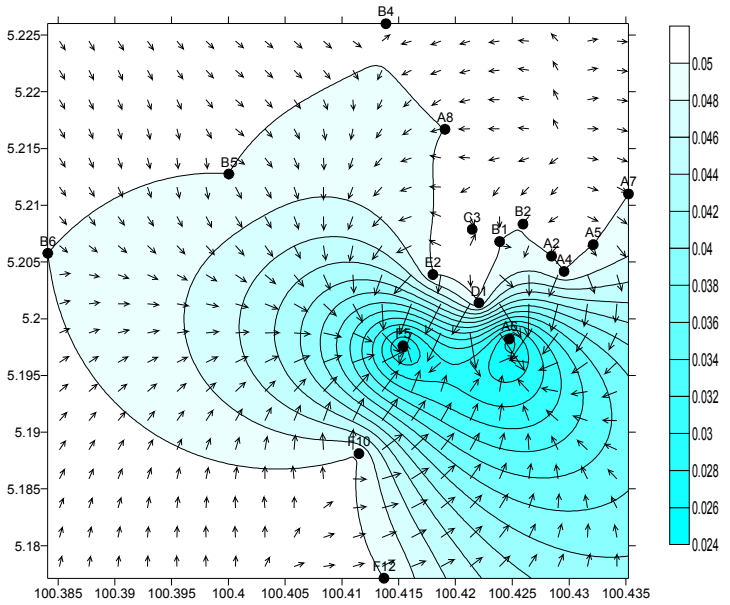
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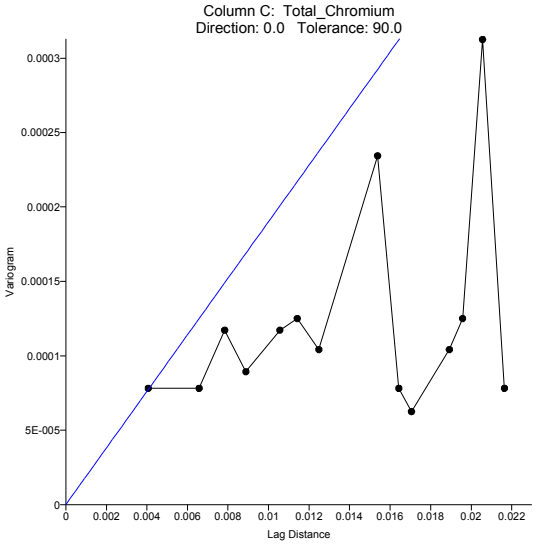
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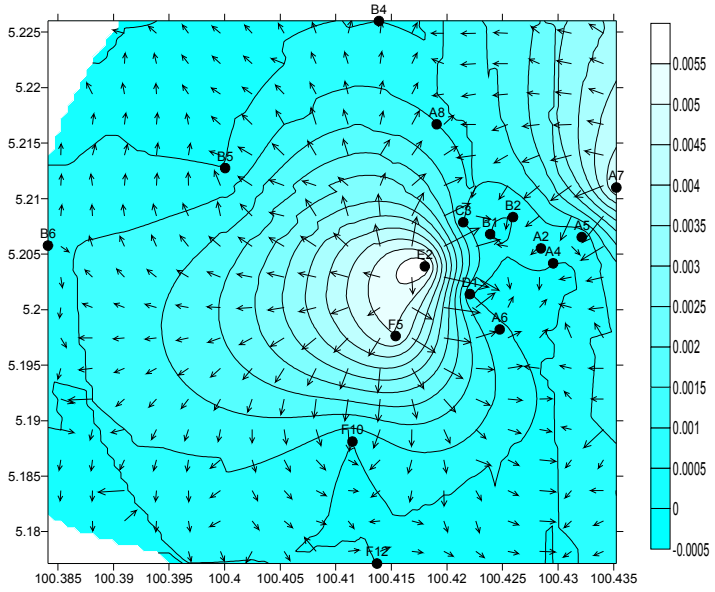
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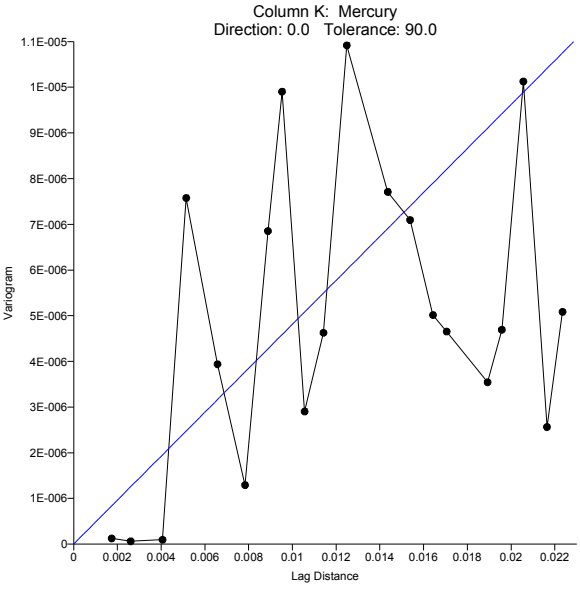
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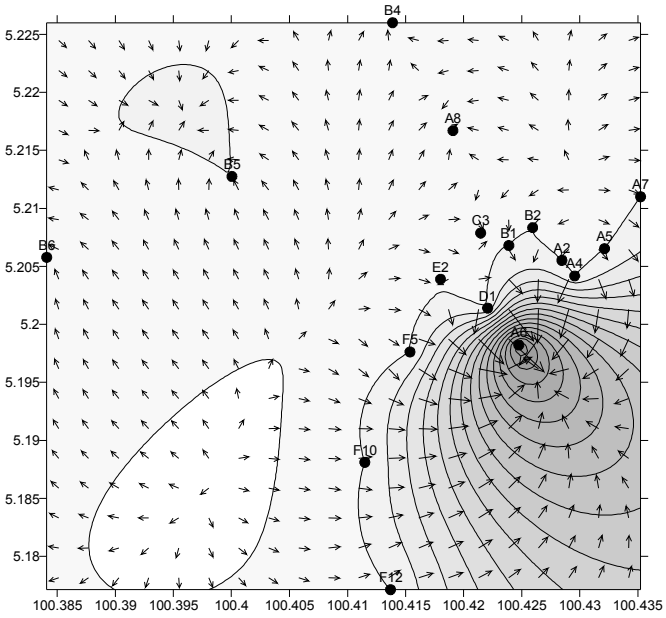
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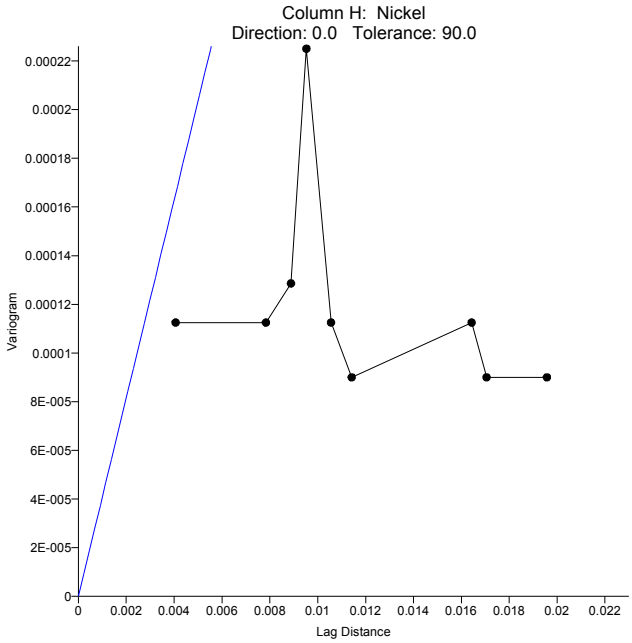
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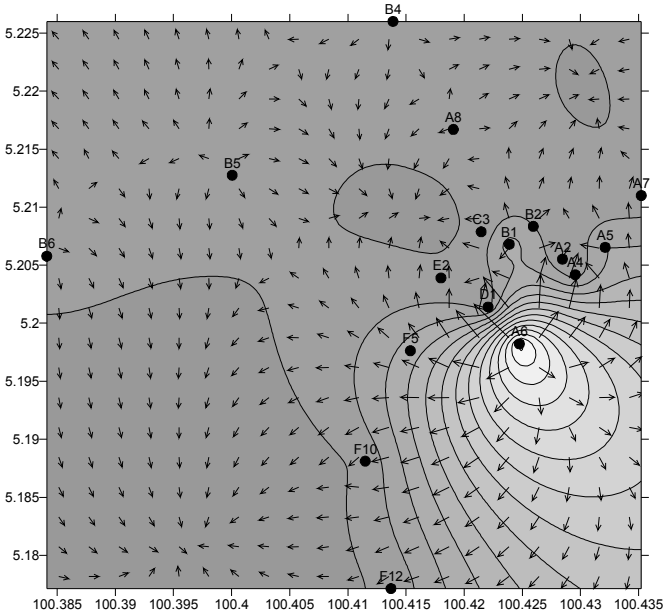
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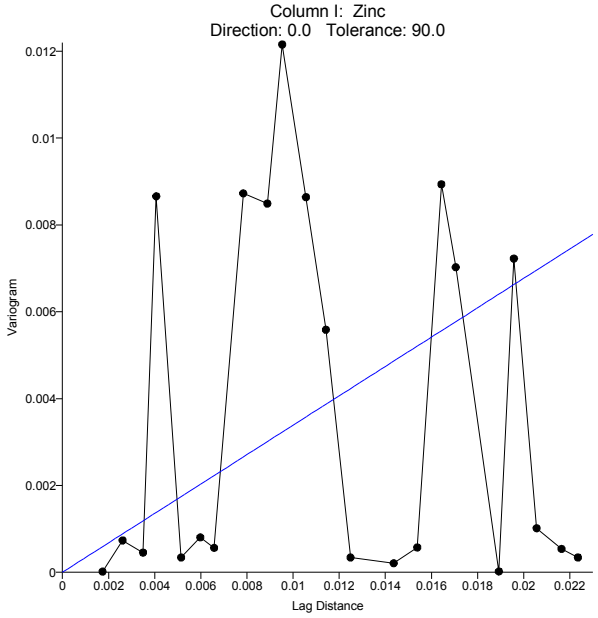
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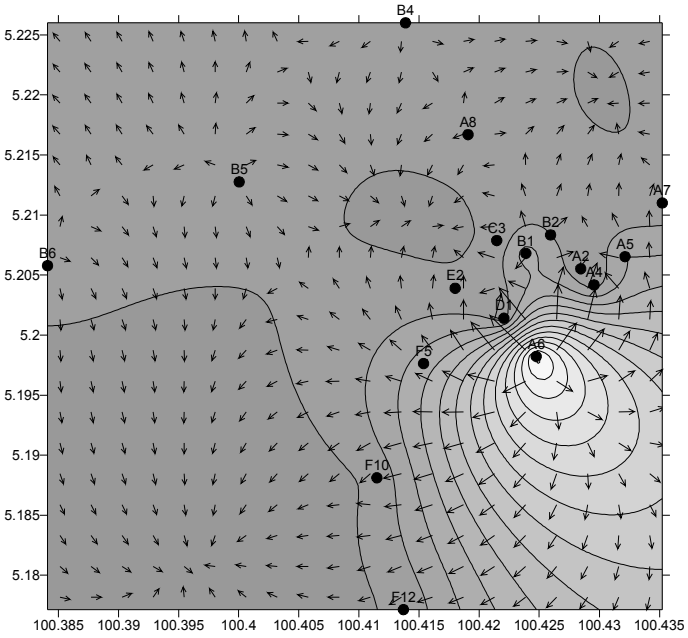
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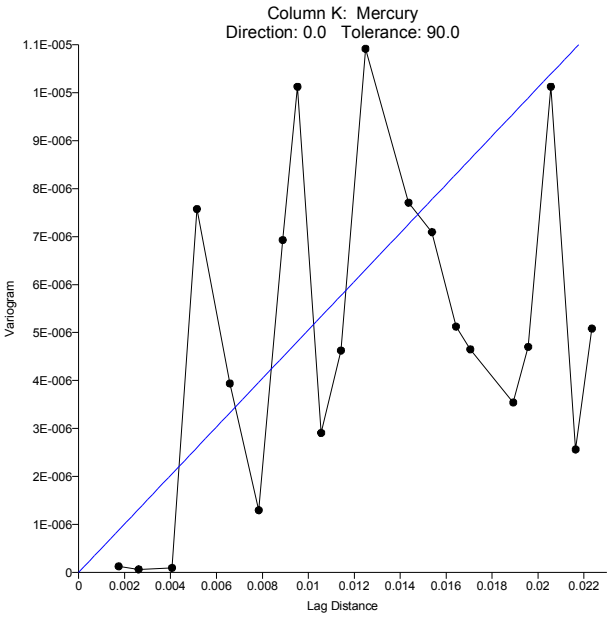
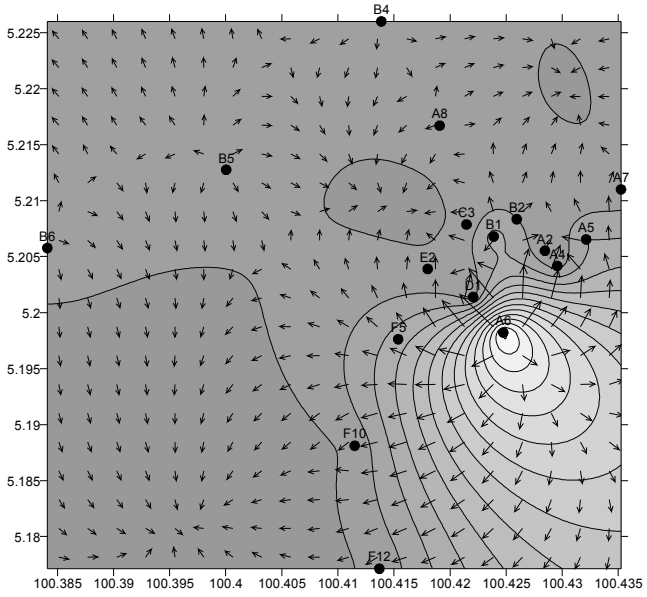
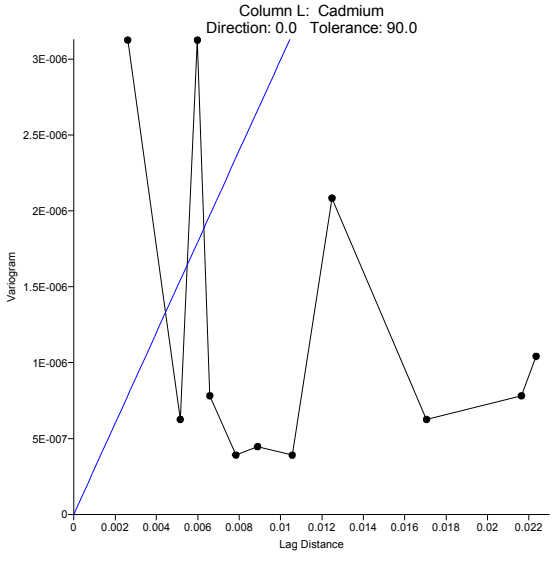
F10
F12
5.225
5.22
5.215
5.21
5.205
5.2
5.195
5.19
5.185
5.18
100.385
100.39
100.395
100.4
100.405
100.41
100.415
100.42
100.425
100.43
100.435


Column K: Mercury
Direction: 0.0 Tolerance: 90.0
Variogram
1.1E-005
1E-005
9E-006
8E-006
7E-006
6E-006
5E-006
4E-006
3E-006
2E-006
1E-006
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
0.016
0.018
0.02
0.022
Lag Distance


B4
A8
B5
A7
C3
B2
B1
A5
B6
A2
A4
E2
D1
A6
F5
F10
F12
5.225
5.22
5.215
5.21
5.205
5.2
5.195
5.19
5.185
5.18
100.385
100.39
100.395
100.4
100.405
100.41
100.415
100.42
100.425
100.43
100.435


Column L: Cadmium
Direction: 0.0 Tolerance: 90.0
Variogram
3E-006
2.5E-006
2E-006
1.5E-006
1E-006
5E-007
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
0.016
0.018
0.02
0.022
Lag Distance