Lessons Learned: How Plume Stability Affects Risk Assessment Conclusions

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Plume Stability Concepts

- Demonstrate plume stability before completion of risk assessment
- Importance of adequate groundwater monitoring interval
- Seasonal variability
- Analyze data before determining conclusions

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How Plume Stability Affects Risk Assessment Conclusions

- Overwork/Rework
- Delineation no longer delineated
- Expanding plume results in changing exposure domain

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Demonstrate Plume Stability Before Completing Risk Assessment

- Recalculate RCs
- Different outcomes in comparison to RBTLs/SSTLs
- Non-Residential to Non-Restricted NFRA

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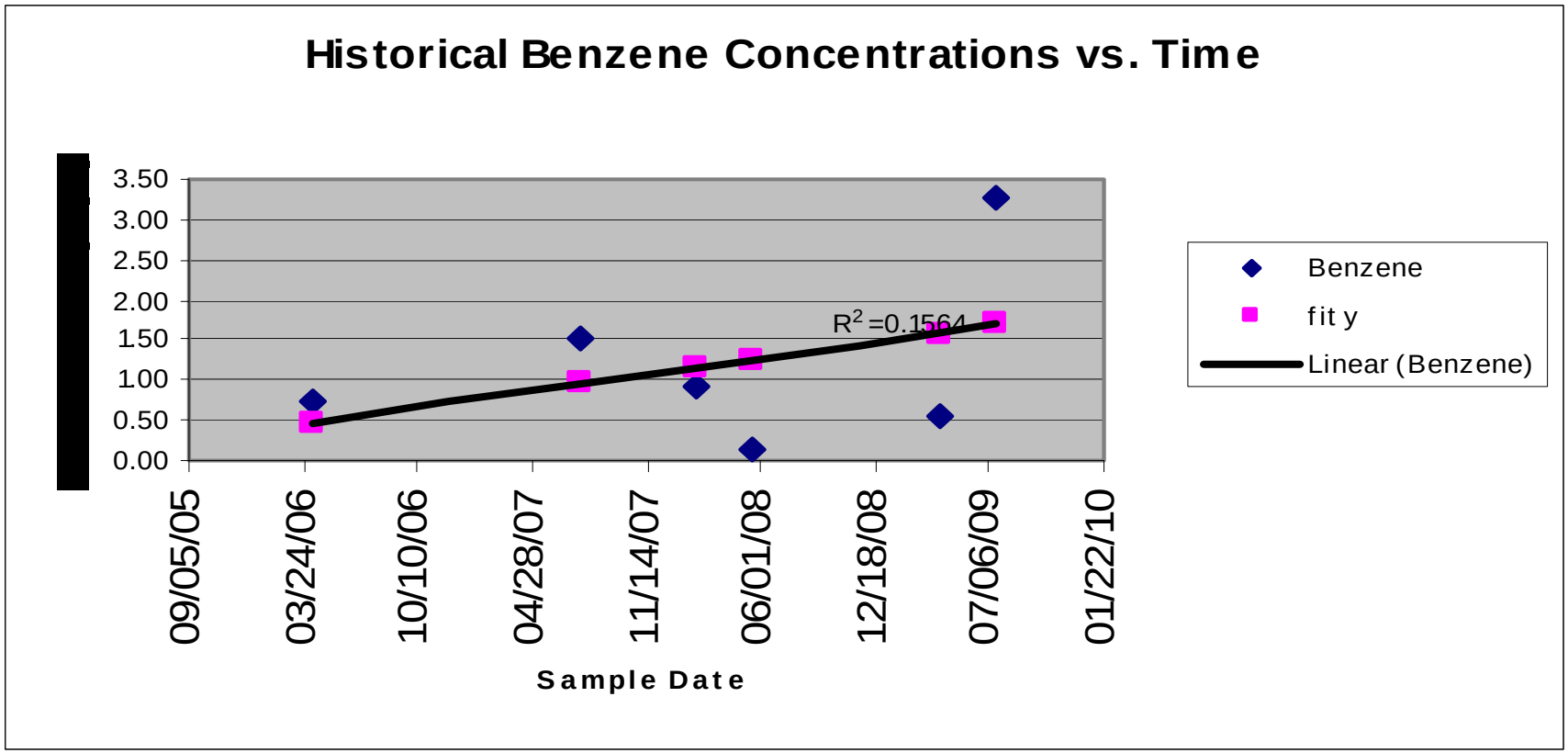
Demonstrate Plume Stability Before Completing Risk Assessment



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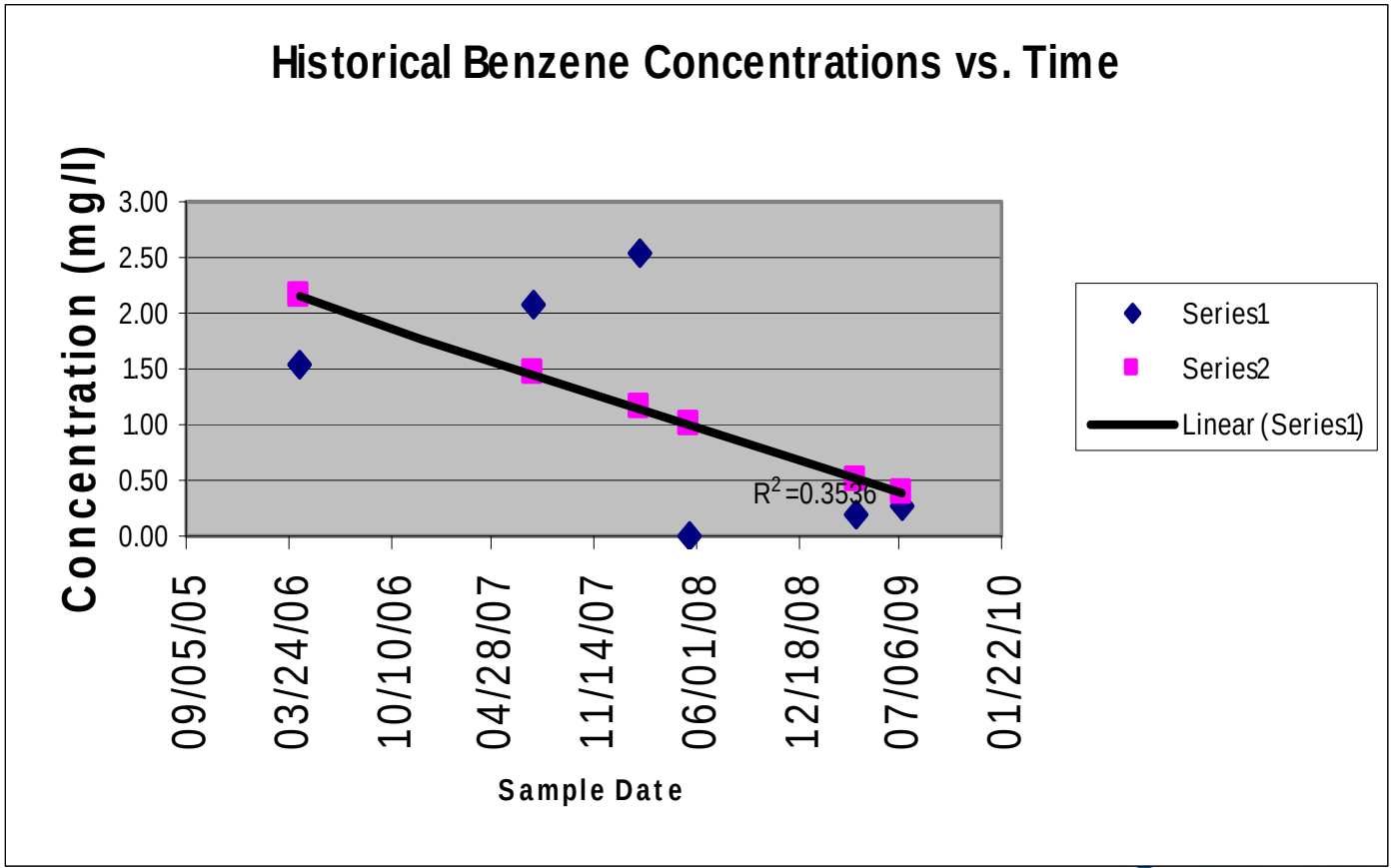
Plume Stability Before Risk Assessment (cont.)

Event	Sampling Date	Benzene (mg/l)
1	04/13/06	1.521
2	07/20/07	2.076
3	02/11/08	2.545
4	05/19/08	0.013
5	04/09/09	0.183
6	07/14/09	0.276



Importance of Adequate Groundwater Monitoring Interval

- Seasonal fluctuations
  - Represent every season
- Well established GW elevations
  - Affects soil samples used for indoor inhalation pathway
  - Groundwater within depth of construction

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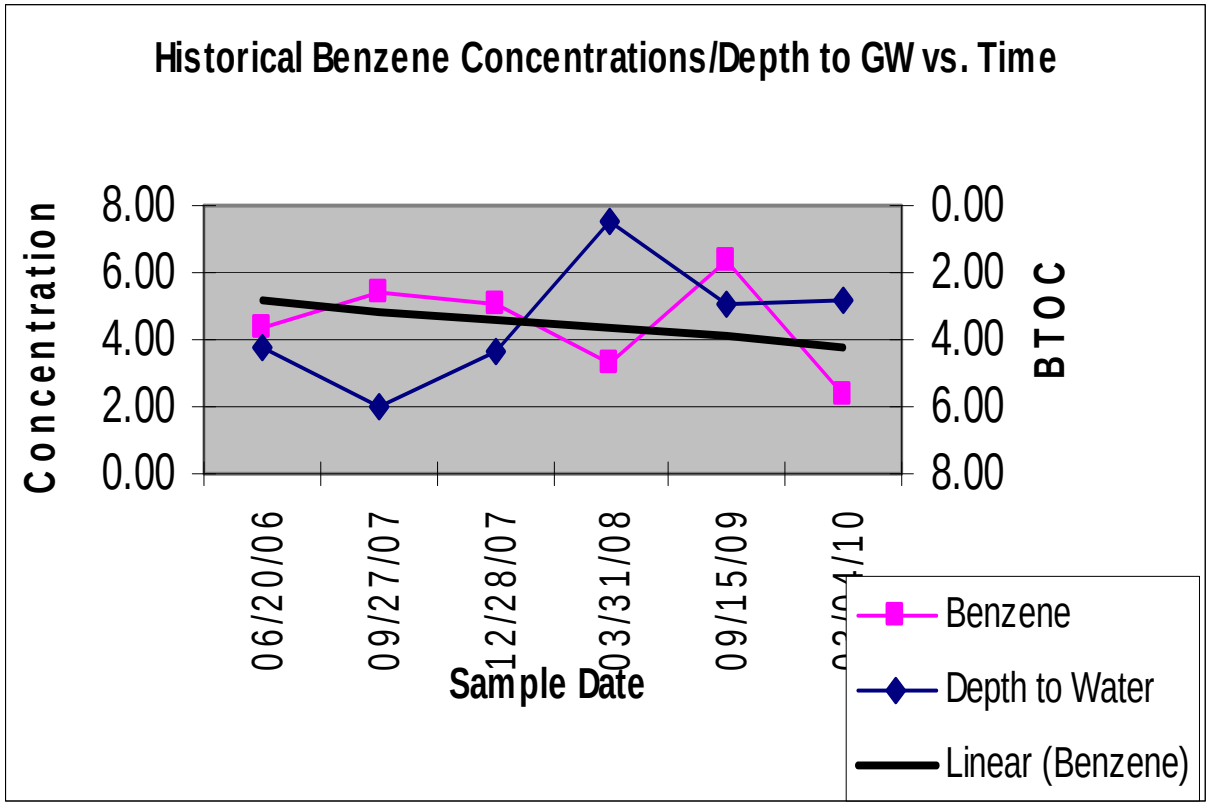
Seasonal Representation

Event Number	Sampling Date	H_2O level (feet BTOC)	Benzene (mg/l)
1	06/20/06	4.23	4.4000
2	09/27/07	6.05	5.4000
3	12/28/07	4.33	5.0100
4	03/31/08	0.45	3.3100
5	09/15/09	2.92	6.321
6	03/04/10	2.84	2.353

Number of Events (n) =	6
Average =	4.47
Standard Deviation =	1.443
Coefficient of Variation (CV) =	0.323

Test for	n	80%	90%
increasing	4		
or	5		
decreasing	6	0	0
Trends at	7		
80 and 90%	8		
+1=increasing	9		
-1=decreasing	10		
0=neither		Neither	Neither



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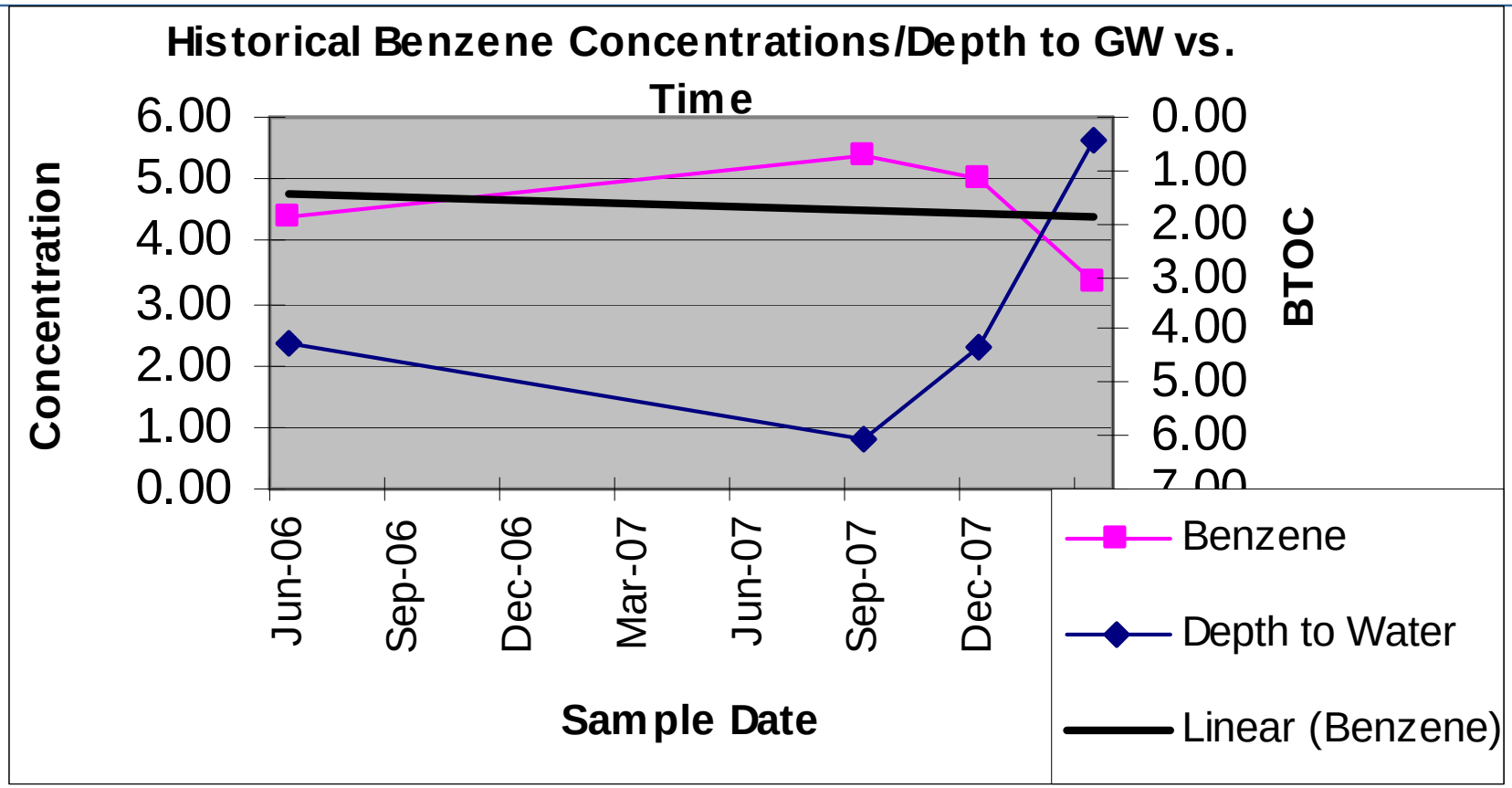
Seasonal Representation



Importance of Adequate Groundwater Monitoring Interval (cont.)

- Adequate base of data with which to draw conclusions
  - Mann-Kendall
    - 6-10 quarters
  - Linear Regression
    - More data = better fit line (higher R2 value)
  - Ricker Method
    - More data, better comparison vs. time

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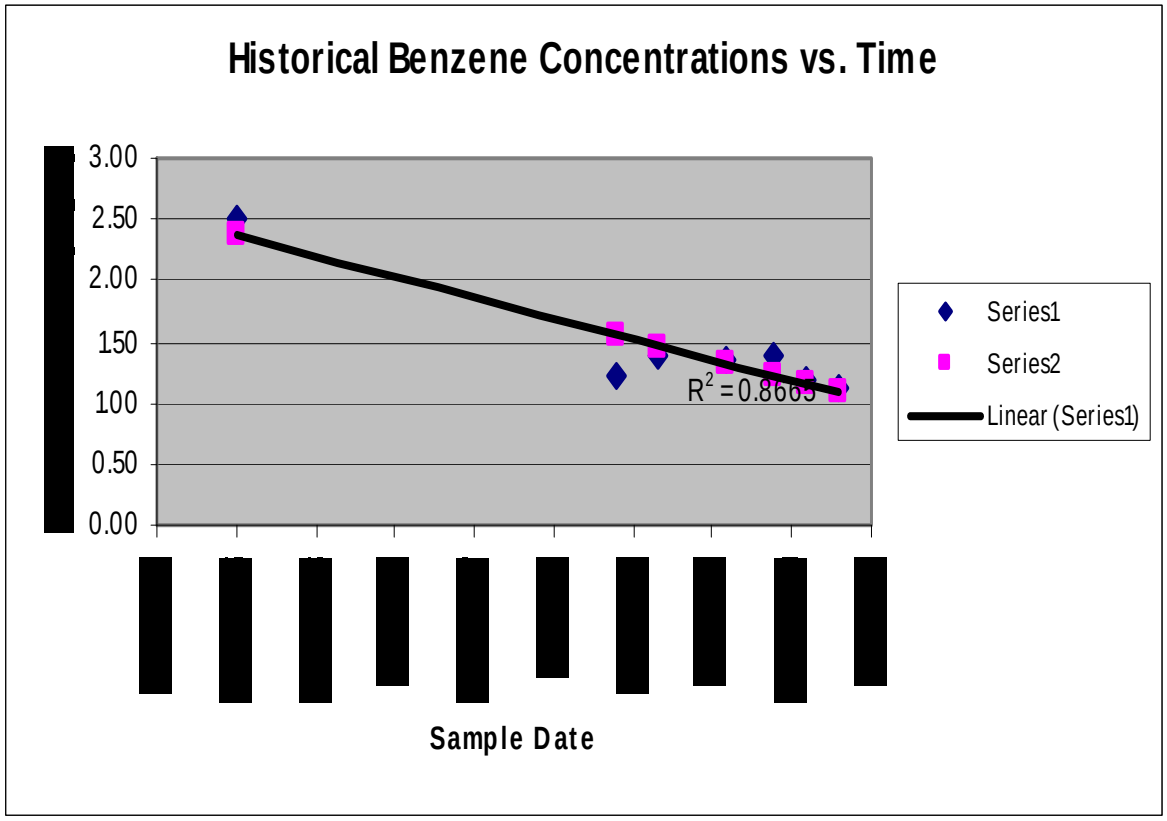
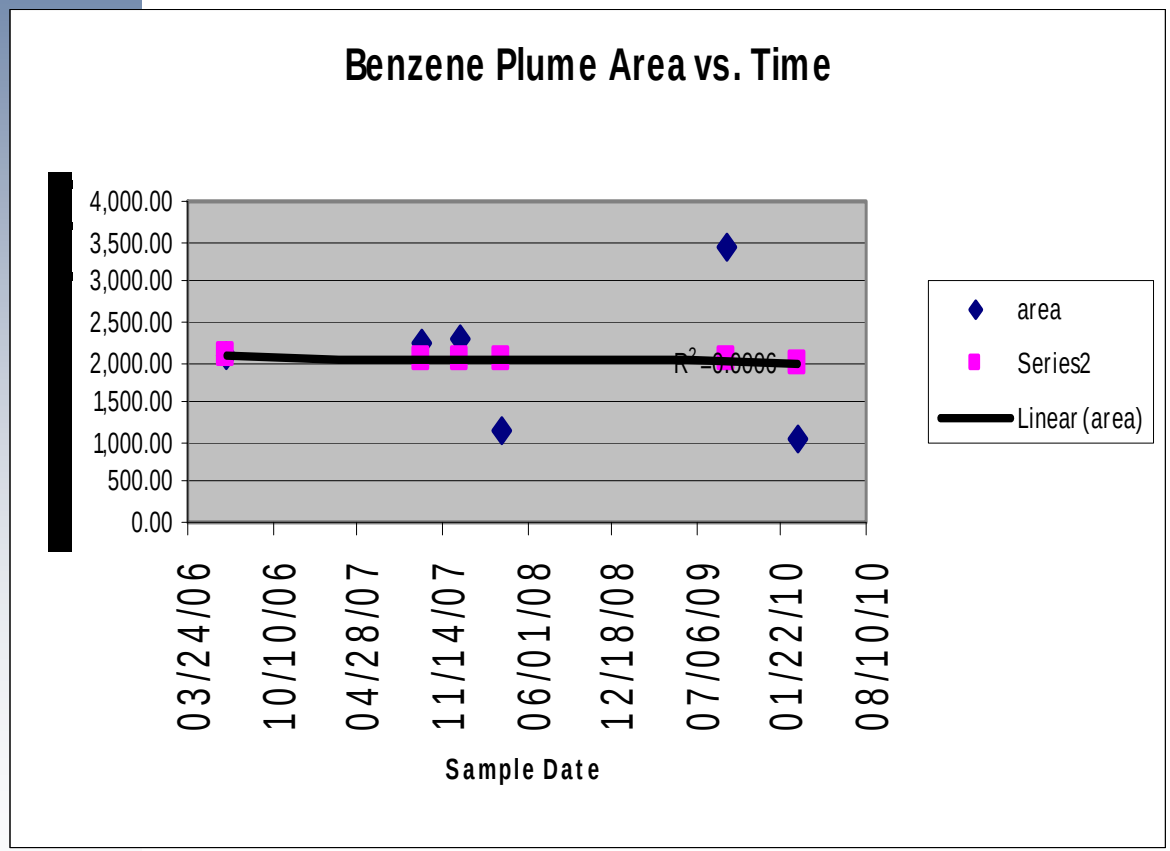
Importance of Adequate Groundwater Monitoring Interval (cont.)

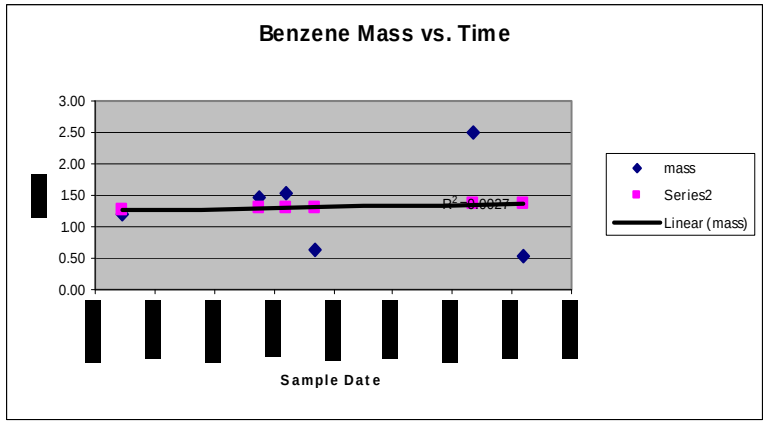
Benzene			
Slope:	-0.00085675	35.44573	:intercept
±:	0.00015042	5.969079	:±
r^2:	0.866457301	0.190223	:s(y)
F-Stat:	32.44120824	5	:freedom
reg. ss	1.173876351	0.180924	:res ss

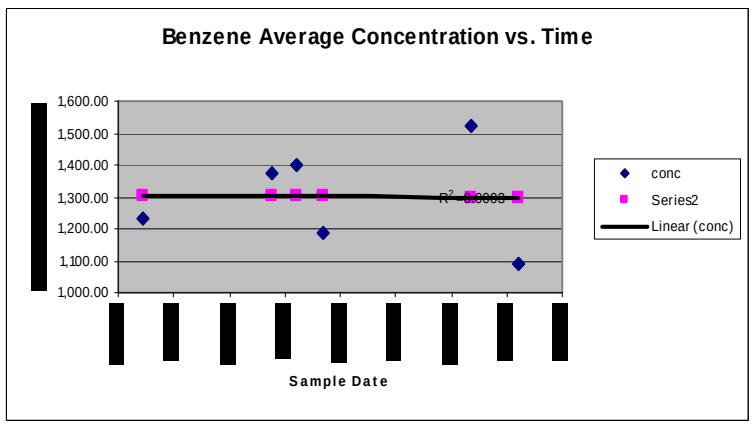
Event Number	Sampling Date	Benzene (mg/l)
1	09/06/05	2.500
2	04/16/08	1.210
3	07/31/08	1.380
4	01/22/09	1.360
5	05/20/09	1.3900
6	08/12/09	1.20
7	11/02/09	1.11



Importance of Adequate Groundwater Monitoring Interval (cont.)







Let Data Lead to Conclusions

- Generally self-evident
- Basic scientific method
- Reflects undue influence from stakeholders
- Hasty and incorrect conclusions provide no relief from liabilities

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Summary

- It is advantageous to demonstrate plume stability prior to completion of risk assessment for all stakeholders
- Data representing adequate number of consecutive quarterly sampling events are necessary to demonstrate stability.
- Data tell you what the conclusions are!

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