



# How to Read an Environmental Laboratory Report

What is really included in that appendix?

# Objectives

- Introduce the typical environmental industry data handling/management practices
- Improve ability to interpret an environmental laboratory report/quality assurance data
- Identify potential reasons to aid in your decisions on when to look deeper into the laboratory report

# Environmental Data Management Overview



## At lab:

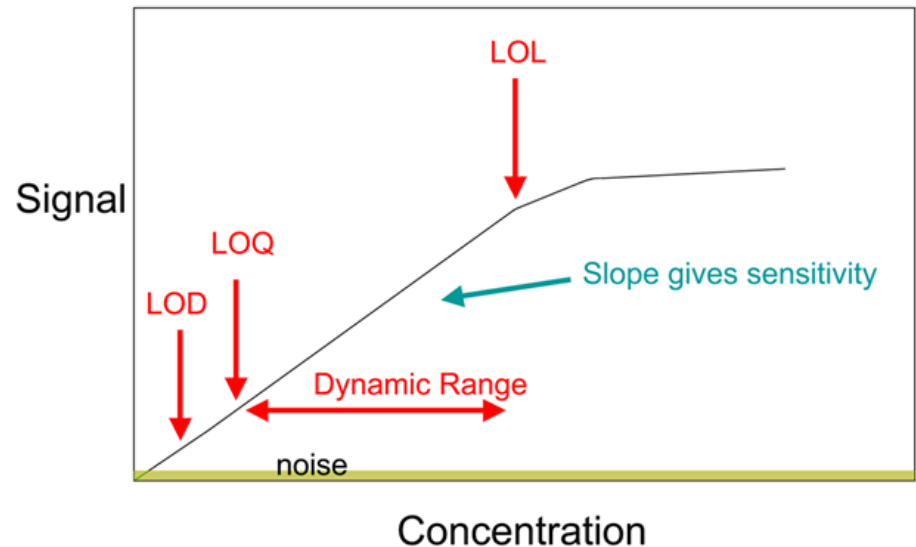
- Samples received
- Samples processed and analyzed
- Data validated and reported

## Outside of the lab:

- Data reviewed/revalidated
- Data summarized (tabularized)
- Lab report put in an appendix or as an attachment

# Environmental Data Management Overview: Quality Assurance Samples

- Main tools for diagnosing data problems
- Include checks on sampling and analysis procedures
- Some are produced during sampling, some in the laboratory
- Laboratory QA sample results are compared to criteria for evaluation



# Environmental Data Management Overview: Qualifiers

- Qualifiers – Indicators of limitations (or biases) in the data
- Introduced by the laboratory and/or by outside data reviewers (consultants, agencies, etc.)

Qualifier	
a	Estimated value, calculated using some or all values that are estimates.
b	Potential false positive value based on blank data validation procedures.
c	Coeluting compound.
e	Estimated value, exceeded the instrument calibration range.
f	Sample was collected at a flowrate exceeding the recommended rate of 200 mL/minute.
h	EPA recommended sample preservation, extraction or analysis holding time was exceeded.
i	Indeterminate value based on failure of blind duplicate data to meet quality assurance criteria.
j	Reported value is less than the stated laboratory quantitation limit and is considered an estimated value.
p	Relative percent difference is >40% (25% CLP pesticides) between primary and confirmation GC columns.
pp	Small peak in chromatogram below method detection limit.
r	The presence of the compound is suspect based on the ID criteria of the retention time and relative retention time obtained from the examination of the chromatograms.
s	Potential false positive value based on statistical analysis of blank sample data.
t	Sample positive for total coliforms but negative for <i>E. coli</i> .
v	Sample was collected under a vacuum of greater than XX inches of mercury.
*	Estimated value, QA/QC criteria not met.
**	Unusable value, QA/QC criteria not met.
AT	Sample chromatogram is noted to be atypical of a petroleum product.
EMPC	Estimated maximum possible concentration.

# Typical Data Summaries: What do we get?

**Table 1  
Any Site  
2013 Water Quality Data**

					Sample Name	MW-1	MW-12	MW-13
					Sample Date	7/27/2013	7/27/2013	12/21/2013
Chemical Name	Total or Dissolved	Analysis Location	MN Intervention Limits	MN GW Values Table				
<b>Effective Date</b>			6/6/2001	01/13/2011				
<b>Exceedance Key</b>			No Exceed	<u>Underline</u>				
<b>General Parameters</b>								
Dissolved oxygen	NA	Field			3.16 mg/l	6.8 mg/l	7.32 mg/l	
pH, standard units	NA	Field			7.24 pH units	6.81 pH units	7.27 pH units	
Redox (oxidation potential)	NA	Field			-84 mV	48.4 mV	65 mV	
Specific Conductance umhos@ 25oC	NA	Field			620 umhos/cm	654 umhos/cm	626 umhos/cm	
Temperature, degrees C	NA	Field			11.33 deg C	11.39 deg C	11.37 deg C	
Turbidity	NA	Field			4.52 NTU	1.35 NTU	1.47 NTU	
<b>Metals</b>								
Boron	Dissolved	Lab	[250 ug/l]	1000 RAA ug/l	< 100 ug/l	150 ug/l	370 ug/l*	
Boron	Total	Lab	[250 ug/l]	1000 RAA ug/l	4ug/l	200 ug/l*	400 ug/l*	
Chromium	Dissolved	Lab	30 ug/l	100 CR ug/l	< 10 ug/l	< 10 ug/l	< 10 ug/l	
Lead	Dissolved	Lab	5 ug/l		< 3.0 ug/l	< 3.0 ug/l	< 3.0 ug/l	
Nickel	Dissolved	Lab	30 ug/l	100 HRL93 ug/l	< 5.0 ug/l	5.7 ug/l	< 5.0 ug/l	

\* Estimated amount QA/QC not met

# Typical Data Summaries: What do we need?



- What do the qualifiers really mean?
- Are there other limitations of the data?
- What else happened during the analytical process?

# Environmental Laboratory Report: Where all the answers are

- Typical Elements:
  - Case narrative
  - Analytical results
  - Quality control data
  - Additional information
    - Chain of custody
    - Sample receipt form
    - Chromatograms (if applicable)





# Case Narrative: A Must Read

- Purpose – To give an overall assessment of the laboratory data and to summarize any issues that occurred during analysis
- Not to be confused with a laboratory cover letter



# Case Narrative: Example Cover Letter

RE: [REDACTED]

22/25-001 2006

Dear [REDACTED]

Order No: [REDACTED]

[REDACTED] received 3 samples on July 15, 2009 12:30 pm for the analyses presented in following report.

No problems were encountered during the analyses. Additionally, all results for the associated Quality Control samples were within EPA and/or [REDACTED] established limits. Any discrepancies associated with the analyses contained herein will be noted and submitted in the form of a project Case Narrative.

[REDACTED] certifications are as follows:

- NELAC/Florida Certification number [REDACTED] for analysis of Environmental Water, soil/hazardous waste, and Drinking Water Microbiology, effective 07/01/09-06/30/10.
- AIHA Certification [REDACTED] for Industrial Hygiene samples (Organics, Inorganics), Environmental Lead (Paint, Soil, Dust Wipes, Air), and Environmental Microbiology (Fungal) effective until 09/01/11.

These results relate only to the items tested. This report may only be reproduced in full.

If you have any questions regarding these test results, please feel free to call.

“No problems were encountered during the analysis. Additionally, all results for the associated quality control samples were within EPA and/or (laboratory) established limits.”

# Case Narrative:Example

Date: 24-Sep-09

Client:  
Project:  
Lab ID:

## Case Narrative

9/23/09 11:36a.m. per Andrea Nord, via phone, the QC report needs to be updated to reflect the EDD.

Metals Analysis by Method 7471A:

LCS-115701 recovery for mercury was outside control limits biased high. The target analyte was not detected in the analytical samples, and data is reportable with high bias.

Semi Volatile Organic Compounds Analysis by Method 8270D:

Due to sample matrix, samples 0907A23-001C, -002C and -003C required dilution during analysis resulting in elevated reporting limits.

Percent recovery for the internal standard compounds Acenaphthene-d10 and Perylene-12 on sample 0907A23-001D was outside control limits biased low due to suspected matrix interference. All other internal standard recoveries were within control limits.

Samples 0907A23-001D, -002D, and -003D and QC sample 0907A23-002DMS for Batch 115707 were prepped using method SW1312. The resulting SPLP Leachate was analyzed using SW8270D in order to report the requested analytes.

Volatile Organic Compounds Analysis by Method 8260B:

Due to sample matrix, sample 0907A23-003A required dilution during preparation and/or analysis resulting in elevated reporting limits.

# Analytical Results: Lots of Information



- Methodology
- Dates of analysis
- Reporting/detection limits
- Data limitation explanations

# Analytical Results: Example

Client Sample ID: **GSB-09-72\_9-10**  
Lab Sample ID: **0910219-01**  
Matrix: Soil

Sampled: 10/07/09 11:45  
Sampled By: SRS/NJB  
Received: 10/13/09 17:15

## Physical/Chemical Parameters by EPA/APHA/ASTM Methods

Analyte	Analytical Result	RL	Unit	Dilution Factor	Method	Date Analyzed	By	QC Batch
<b>Cyanide, Available</b>	<b>610</b>	230	ug/kg dry	2	USEPA OIA-1677	10/16/09	VAS	0912309
<b>Nitrogen, Ammonia</b>	<b>521000</b>	28400	ug/kg dry	25	USEPA-350.1 Rev. 2.0	10/22/09	GEH	0912303
Nitrogen, Nitrite (soluble)	<567	567	ug/kg dry	1	USEPA-353.2	10/24/09	HLB	0912617
<b>Nitrogen, Nitrate (soluble)</b>	<b>3800</b>	570	ug/kg dry	1	USEPA-353.2	10/24/09	HLB	0912618
<b>Sulfate (soluble)</b>	<b>1500000</b>	280000	ug/kg dry	5	USEPA-9038	10/20/09	GEH	0912352
<b>Percent Solids</b>	<b>88</b>	0.1	%	1	USEPA-3550B	10/19/09	KNC	0912324

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# Analytical Results: Example

Pace Project No.: 10118300

Sample: Area 1 Zone 1 Lab ID: 10118300001 Collected: 12/06/09 15:30 Received: 12/07/09 10:14 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>WIDRO GCS</b>		Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO						
Diesel Range Organics	39900	mg/kg	8590	100	12/07/09 10:13	12/08/09 13:44		T6, T7
n-Triacontane (S)	0	%	50-150	100	12/07/09 10:13	12/08/09 13:44		S4
<b>WIGRO GCV</b>		Analytical Method: WI MOD GRO Preparation Method: TPH GRO/PVOC WI ext.						
Benzene	84.4	mg/kg	2.7	50	12/07/09 13:23	12/08/09 08:53	71-43-2	L2
Ethylbenzene	69.4	mg/kg	2.7	50	12/07/09 13:23	12/08/09 08:53	100-41-4	L2
Gasoline Range Organics	10900	mg/kg	271	50	12/07/09 13:23	12/08/09 08:53		
Toluene	209	mg/kg	2.7	50	12/07/09 13:23	12/08/09 08:53	108-88-3	L2
Xylene (Total)	253	mg/kg	8.1	50	12/07/09 13:23	12/08/09 08:53	1330-20-7	
a,a,a-Trifluorotoluene (S)	63	%	80-125	50	12/07/09 13:23	12/08/09 08:53	98-08-8	2M

## ANALYTE QUALIFIERS

- 1M Sample flashed below 160 degrees Fahrenheit, but inadequate sample volume was received to run duplicate analysis.
- 2M Surrogate recovery outside laboratory control limits due to matrix interferences.
- C0 Result confirmed by second analysis.
- L0 Analyte recovery in the laboratory control sample (LCS) was outside QC limits.
- L2 Analyte recovery in the laboratory control sample (LCS) was below QC limits. Results may be biased low.
- M0 Matrix spike recovery and/or matrix spike duplicate recovery was outside laboratory control limits.
- S4 Surrogate recovery not evaluated against control limits due to sample dilution.
- S9 The laboratory is not accredited for this parameter by the certifying body for this state.
- T6 High boiling point hydrocarbons are present in the sample.
- T7 Low boiling point hydrocarbons are present in the sample.

# QA/QC Samples: What are they and how do they apply?



# QA/QC Samples

- Laboratory Control Sample
- Matrix Spike
- Method Blank
- Trip Blank
- Field Blank
- Others

# QA/QC Samples: Criteria

- Blanks – Any detection above reporting limit is criteria exceedance
- Accuracy Samples – Percent recoveries are used for evaluation
- Precision Samples – Relative percent difference (RPD) used for evaluation

# QA/QC Samples: Laboratory Control Sample

- A clean material (matrix dependent) spiked with the parameters of interest in the laboratory
  - This sample follows the same process as a standard environmental sample
- What does it tell you?
  - Gives indication of laboratory system performance

# QA/QC Samples: Laboratory Control Sample

QC Batch: OEXT/12032 Analysis Method: WI MOD DRO  
 QC Batch Method: WI MOD DRO Analysis Description: WIDRO GCS  
 Associated Lab Samples: 10118300001

METHOD BLANK: 723506 Matrix: Solid  
 Associated Lab Samples: 10118300001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Diesel Range Organics	mg/kg	ND	5.0	12/08/09 12:30	
n-Triacontane (S)	%	70	50-150	12/08/09 12:30	

LABORATORY CONTROL SAMPLE & LCSD: 723507		723508								
Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Diesel Range Organics	mg/kg	80	72.7	76.6	91	96	70-120	5	20	
n-Triacontane (S)	%				76	80	50-150			



# QA/QC Samples: Matrix Spike

- A project sample spiked with the parameters of interest in the laboratory
  - This sample follows the same process as a standard environmental sample
- What does it tell you?
  - Gives indication of laboratory system performance as well as any affects the sample matrix will have on analysis

# QA/QC Samples: Matrix Spike

MATRIX SPIKE & MATRIX SPIKE DUPLICATE:			724637		724638							
Parameter	Units	10116841002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	Max RPD	RPD	Qual
Arsenic	mg/L	ND	1	1	0.92	0.91	92	91	75-125	2	30	
Barium	mg/L	588 ug/L	1	1	1.6	1.5	99	95	75-125	2	30	
Cadmium	mg/L	ND	1	1	0.95	0.94	95	94	75-125	1	30	
Chromium	mg/L	ND	1	1	0.96	0.94	96	94	75-125	2	30	
Lead	mg/L	ND	1	1	0.94	0.93	94	93	75-125	1	30	
Selenium	mg/L	ND	1	1	0.94	0.94	94	94	75-125	0	30	
Silver	mg/L	ND	.5	.5	0.45	0.44	90	88	75-125	2	30	

# QA/QC Samples: Method Blank

- A clean sample prepared in the laboratory
  - This sample follows the same process as a standard environmental sample
- What does it tell you?
  - Gives indication of any contamination present in the laboratory

# QA/QC Samples: Method Blank

METHOD BLANK: 724635

Matrix: Water

Associated Lab Samples: 10118300001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Arsenic	mg/L	ND	0.050	12/10/09 10:12	
Barium	mg/L	ND	0.25	12/10/09 10:12	
Cadmium	mg/L	ND	0.0050	12/10/09 10:12	
Chromium	mg/L	ND	0.050	12/10/09 10:12	
Lead	mg/L	ND	0.015	12/10/09 10:12	
Selenium	mg/L	ND	0.075	12/10/09 10:12	
Silver	mg/L	ND	0.050	12/10/09 10:12	

# QA/QC: Other Samples

- Trip blank
- Field blank
- Surrogate standards
- Internal standards
- Initial calibration verification standard
- Continuing calibration verification standard

# Other Information: Chain of Custody Record

<b>TestAmerica Cedar Falls</b>				<b>Chain of Custody Record</b>				
704 Enterprise Drive								
Cedar Falls, IA 50613				Regulatory Program: <input type="checkbox"/> DW <input type="checkbox"/> NPDES <input type="checkbox"/> RCRA <input type="checkbox"/> Other:				
phone 319.277.2401 fax 319.277.2425								
<b>Client Contact</b>		<b>Project Manager:</b>		<b>Site Contact:</b>		<b>Date:</b>		
Your Company Name here		Tel/Fax:		Lab Contact:		Carrier:		
Address		<b>Analysis Turnaround Time</b>		Filtered Sample ( Y / N ) Perform MS / MSD ( Y / N )				
City/State/Zip		<input type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS						
(xxx) xxx-xxxx Phone		TAT if different from Below _____						
(xxx) xxx-xxxx FAX		<input type="checkbox"/> 2 weeks						
Project Name:		<input type="checkbox"/> 1 week						
Site:		<input type="checkbox"/> 2 days						
P O #		<input type="checkbox"/> 1 day						
<b>Sample Identification</b>		<b>Sample Date</b>	<b>Sample Time</b>	<b>Sample Type</b> <small>(C=Comp, G=Grab)</small>	<b>Matrix</b>	<b># of Cont.</b>		



# Other Information: Condition Upon Receipt

**ALS** PC

**Cooler Receipt and Preservation Form**

Client / Project: Barr Service Request: \_\_\_\_\_

Received: 5/7/13 Opened: 5/7/13 By: JMU Unloaded: 5/7/13 By: JMS

1. Samples were received via? Mail Fed Ex UPS DHL PDX Courier Hand Delivered

2. Samples were received in: (circle) Cooler Box Envelope Other

3. Were custody seals on coolers? NA Y N If yes, how many and where? 2 front + back NA

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID	Tracking Number	NA	Filed
<u>5.3</u>	<u>5.1</u>	<u>2.1</u>	<u>1.9</u>	<u>-0.2</u>	<u>334</u>	<u>NA</u>	_____		

7. Packing material: Inserts Baggies Bubble Wrap Gel Packs Wet Ice Dry Ice Sleeves

8. Were custody papers properly filled out (ink, signed, etc.)? NA Y N

9. Did all bottles arrive in good condition (unbroken)? Indicate in the table below. NA Y N

10. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N

11. Did all sample labels and tags agree with custody papers? Indicate major discrepancies in the table on page 2. NA Y N

12. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N

13. Were the pH-preserved bottles (see SMO GEN SOP) received at the appropriate pH? Indicate in the table below. NA Y N

14. Were VOA vials received without headspace? Indicate in the table below. NA Y N

15. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# Other Information: Chromatograms

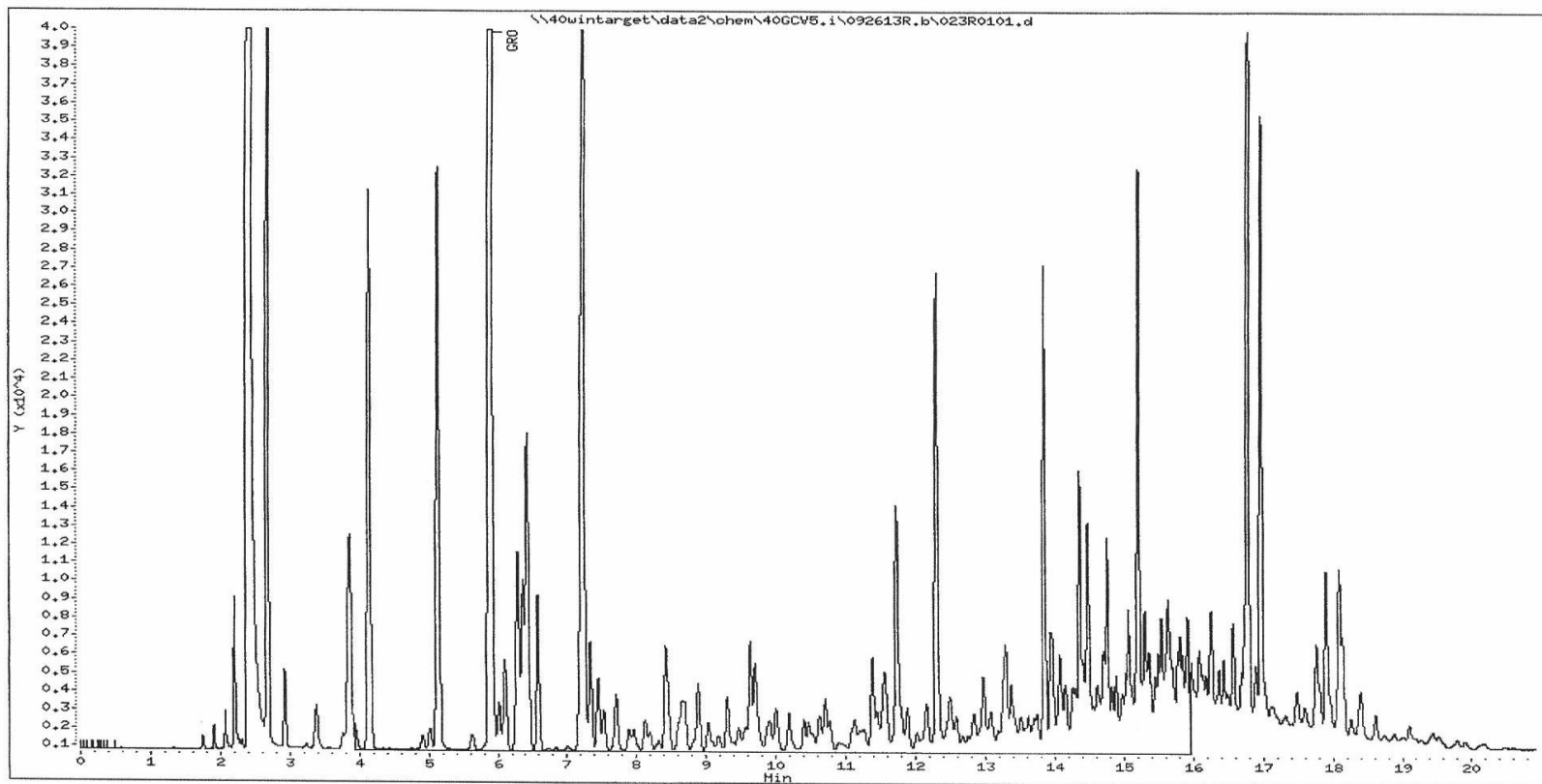
Data File: \\40wintarget\data2\chem\40GCV5.i\092613R.b\023R0101.d  
Date : 26-SEP-2013 18:41  
Client ID: 10243006002  
Sample Info: 10243006002 x2.5,,WD2.5  
Purge Volume: 5.0  
Column phase: FID

Page 2

Instrument: 40GCV5.i

Operator: MRS

Column diameter: 0.32





# Summary

- Environmental laboratory reports contain a lot of valuable information
- The case narrative is a valuable summary to read to get the laboratory perspective
- Qualifiers (and other issues) may merit a deeper dive into the analytical data and quality assurance sections

# Questions?

