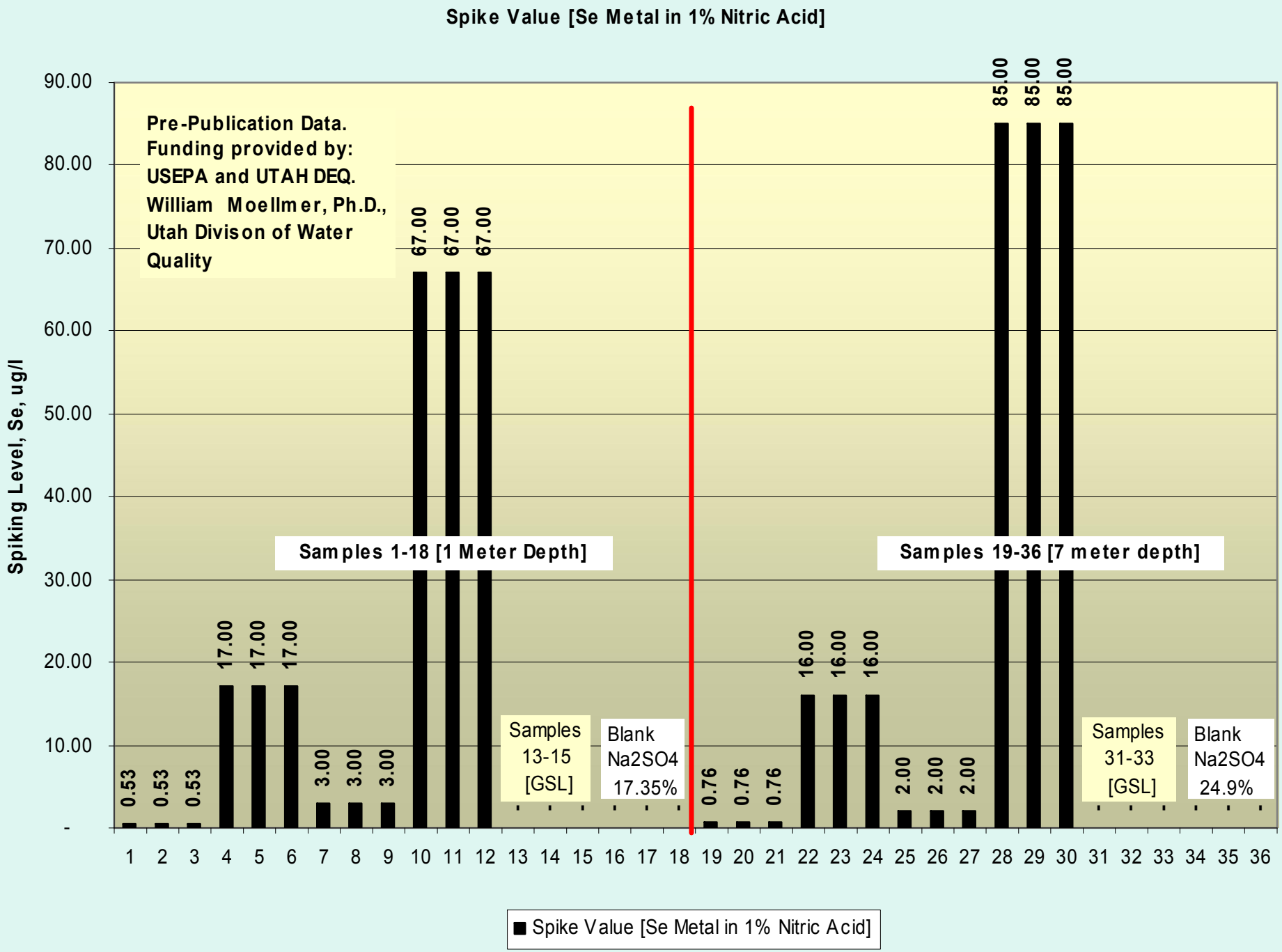
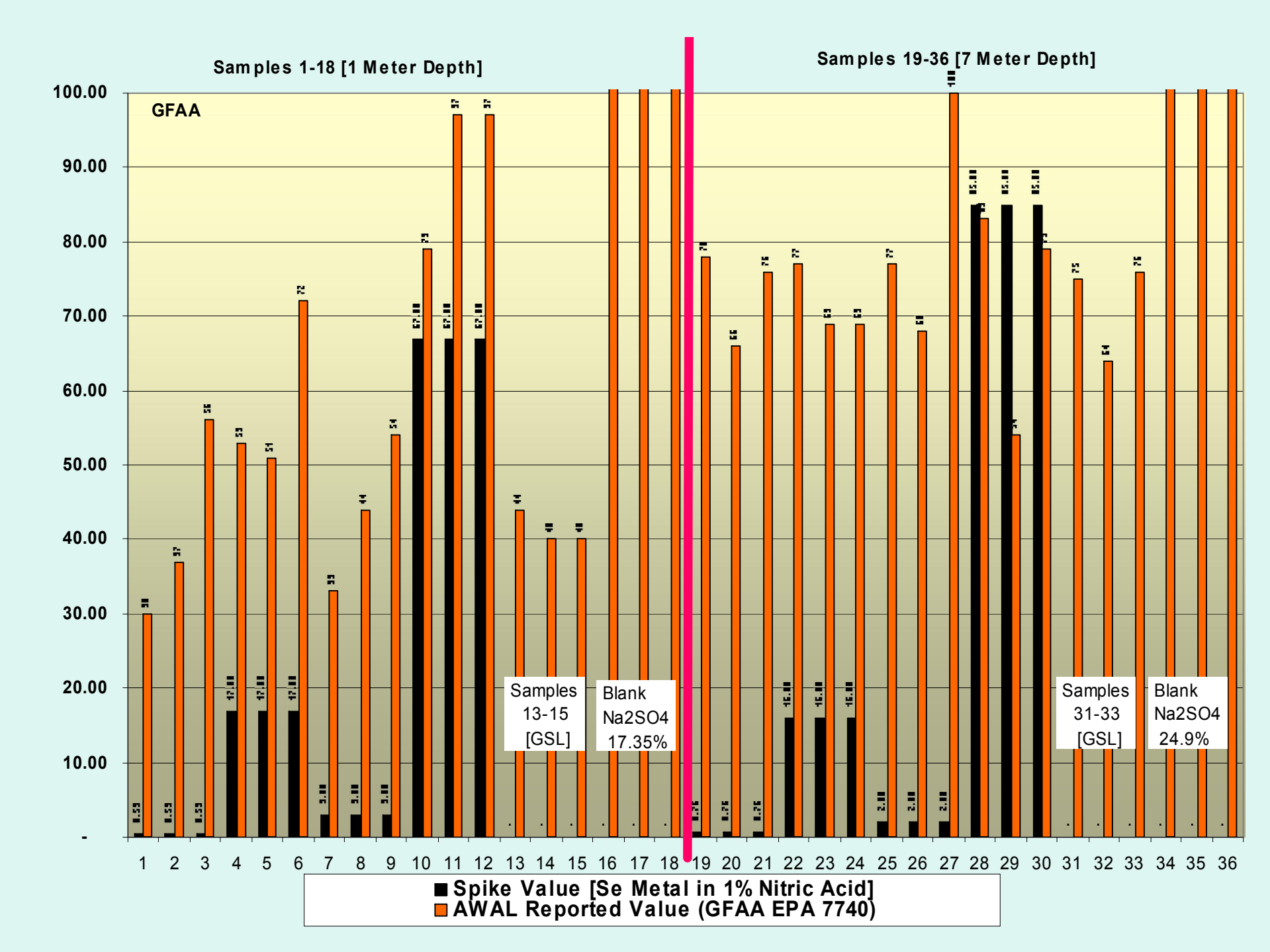
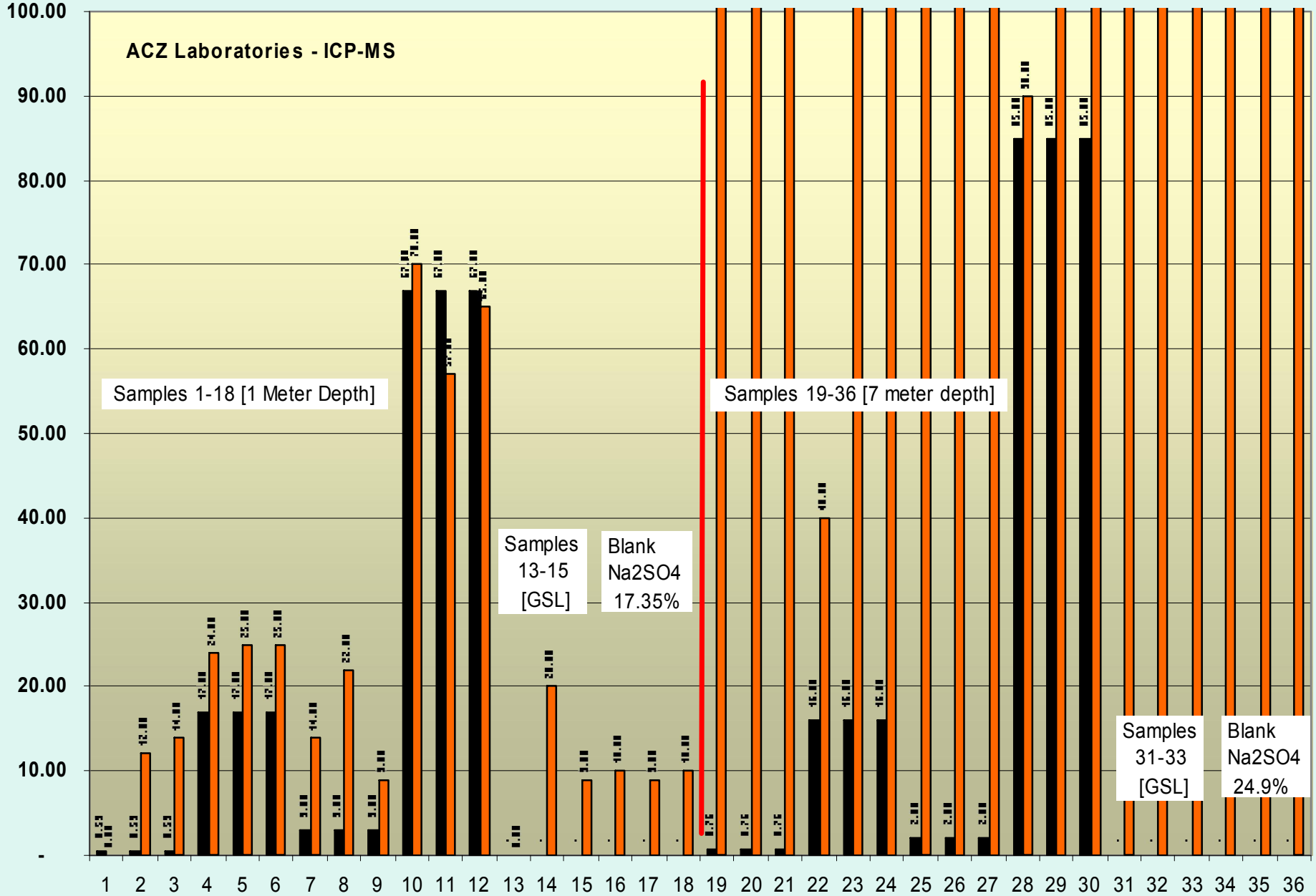
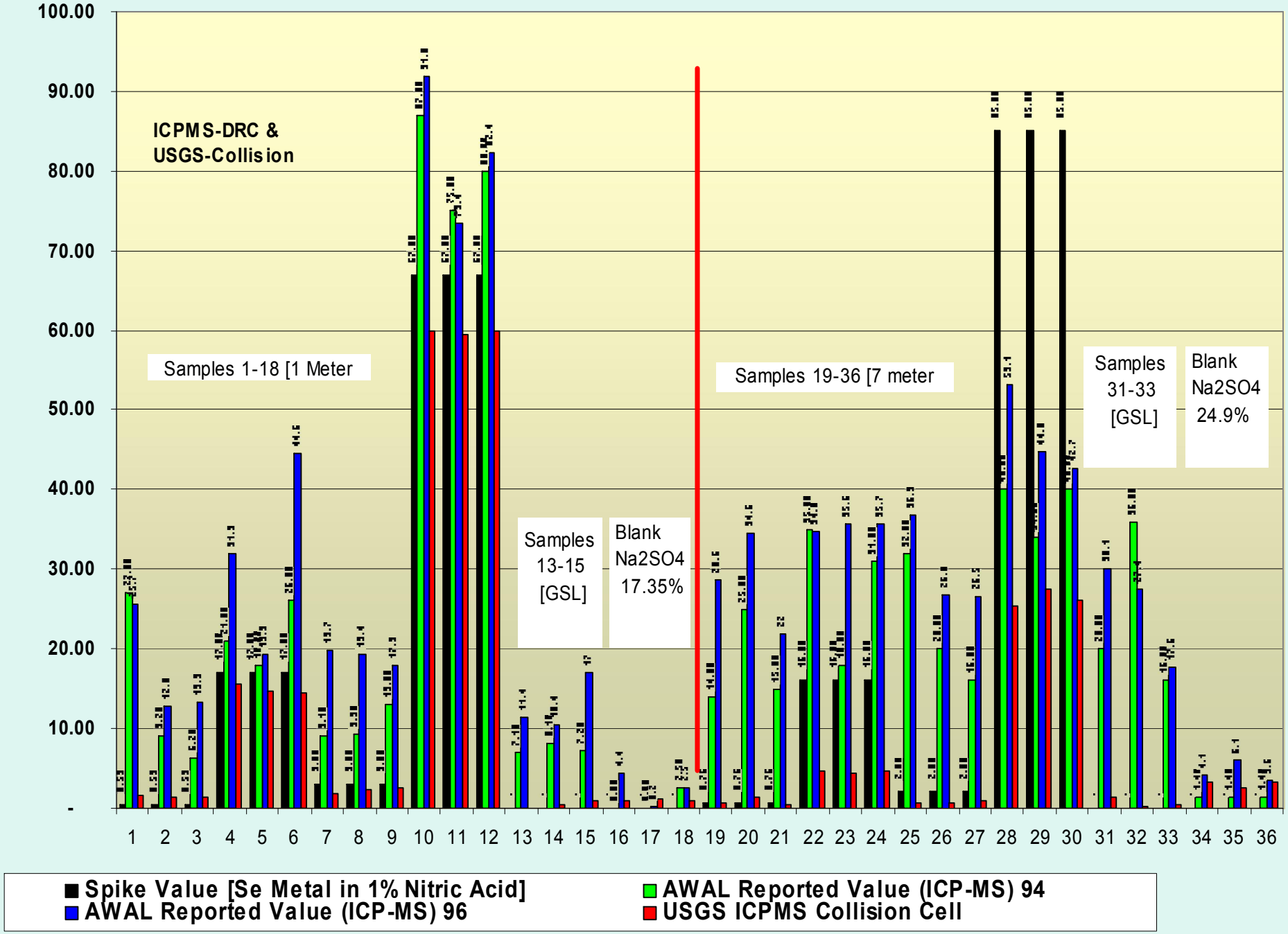
Status Report
Great Salt Lake
Selenium Science Panel

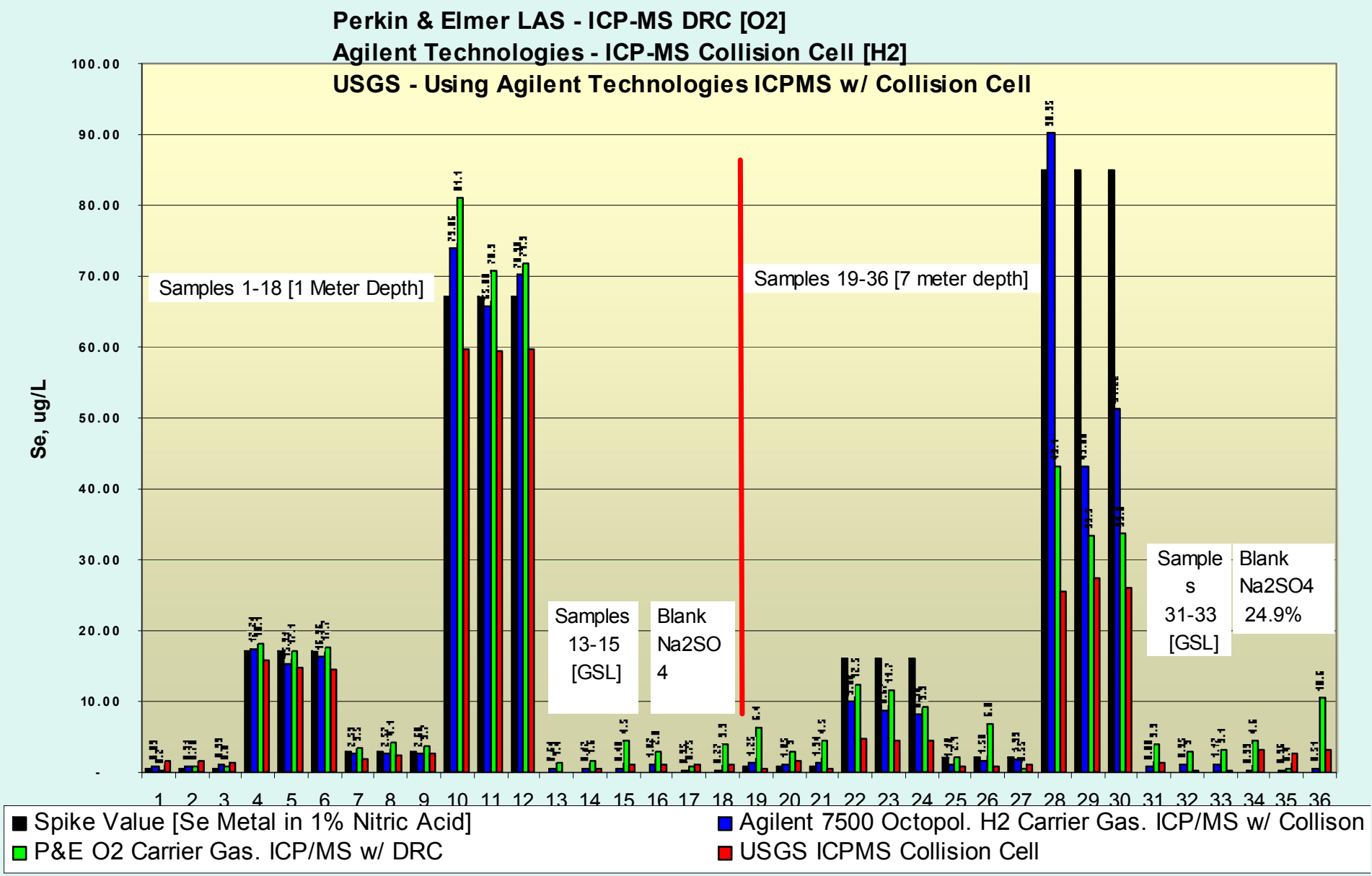
November 17, 2005

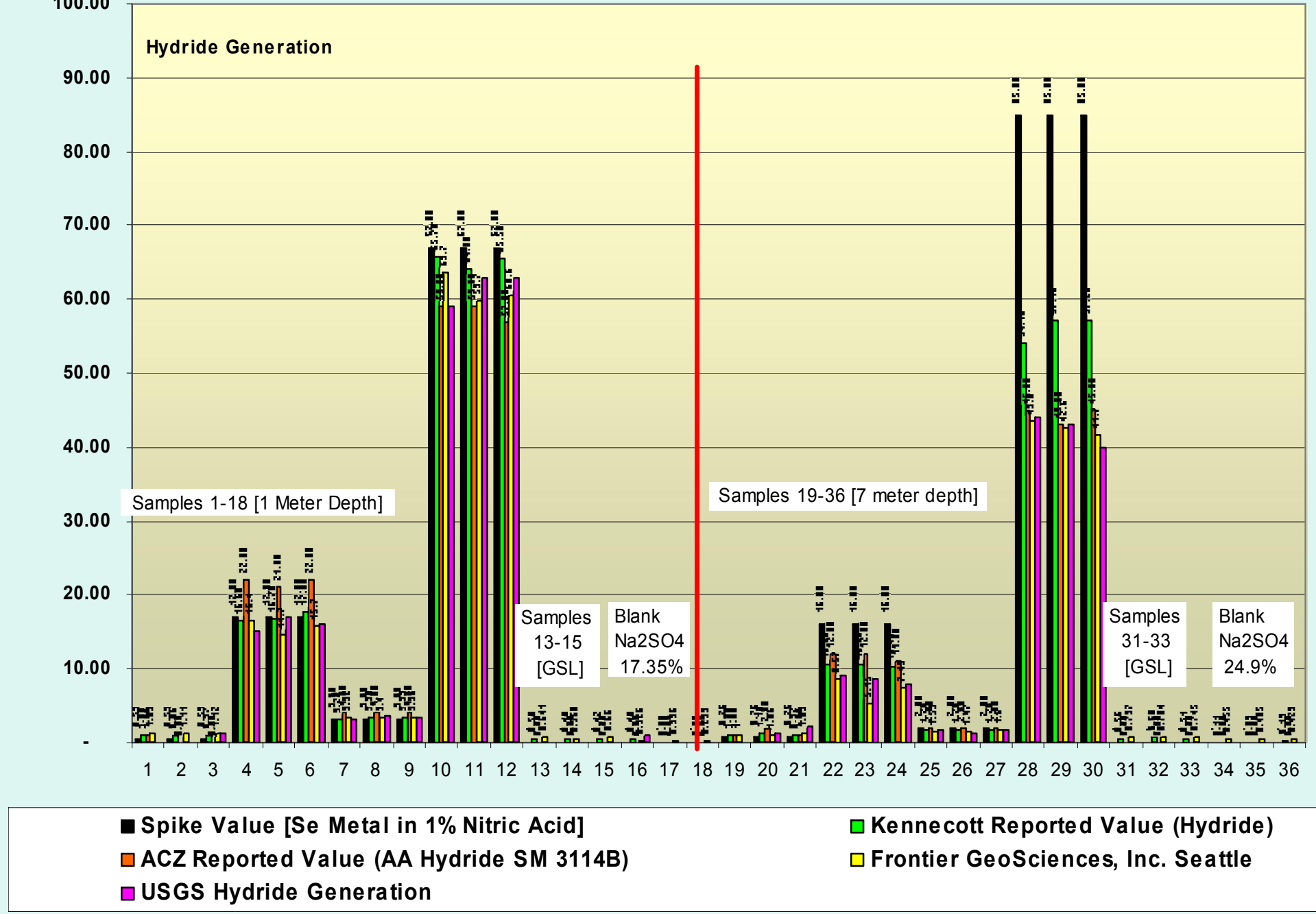

Spike Value [Se Metal in 1% Nitric Acid]
Pre-Publication Data.
Funding provided by:
USEPA and UTAH DEQ.
William Moellmer, Ph.D.,
Utah Divison of Water
Quality
Spiking Level, Se, ug/l
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
-
0.53
0.53
0.53
17.00
17.00
17.00
3.00
3.00
3.00
67.00
67.00
67.00
Samples 1-18 [1 Meter Depth]
Samples 13-15 [GSL]
Blank Na2SO4 17.35%
0.76
0.76
0.76
16.00
16.00
16.00
2.00
2.00
2.00
85.00
85.00
85.00
Samples 19-36 [7 meter depth]
Samples 31-33 [GSL]
Blank Na2SO4 24.9%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Spike Value [Se Metal in 1% Nitric Acid]

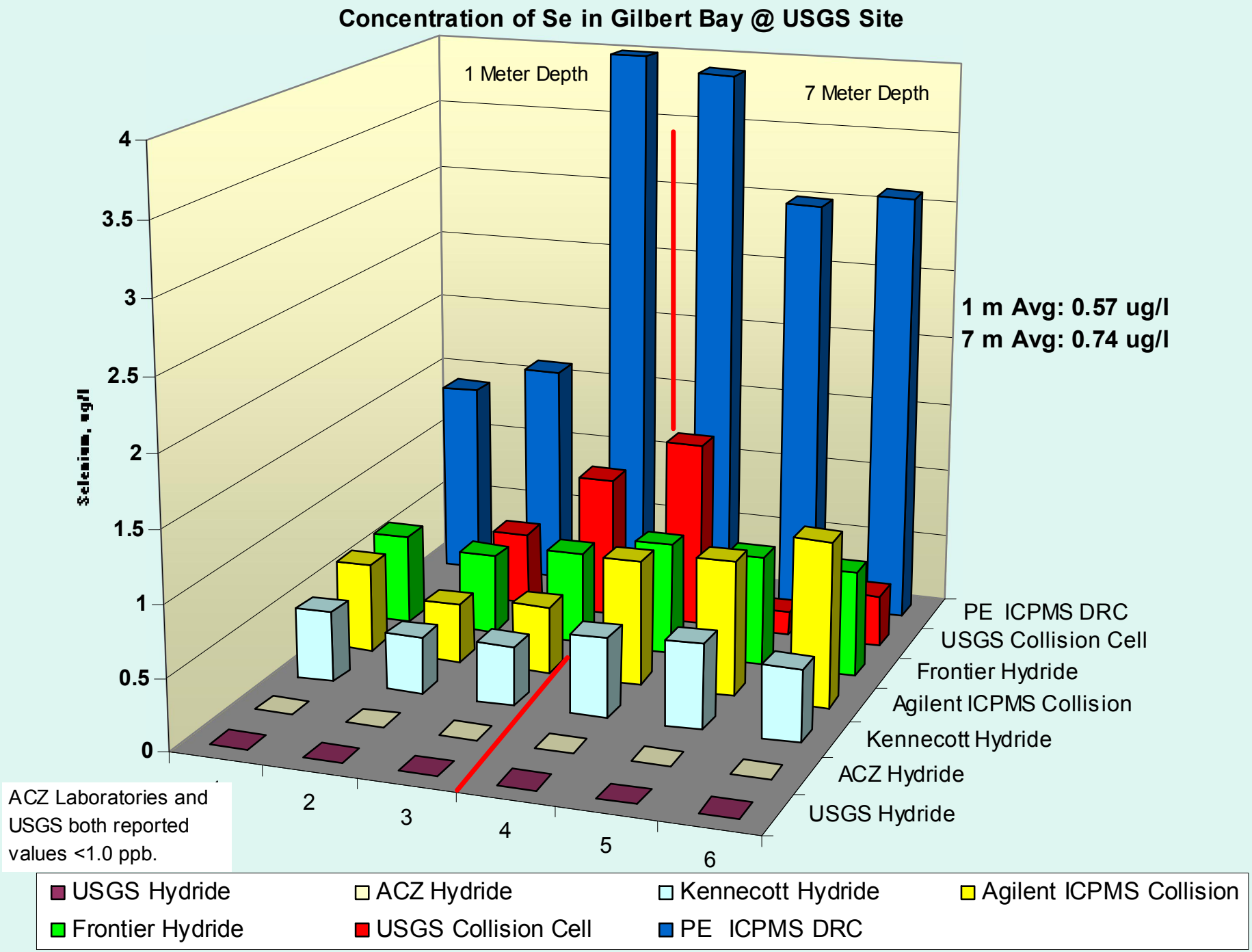

Samples 1-18 [1 Meter Depth]
Samples 19-36 [7 Meter Depth]
GFAA
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
-
Samples 13-15 [GSL]
Blank Na2SO4 17.35%
Samples 31-33 [GSL]
Blank Na2SO4 24.9%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Spike Value [Se Metal in 1% Nitric Acid]
AWAL Reported Value (GFAA EPA 7740)


ACZ Laboratories - ICP-MS
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
-
Samples 1-18 [1 Meter Depth]
Samples 19-36 [7 meter depth]
Samples 13-15 [GSL]
Blank Na2SO4 17.35%
Samples 31-33 [GSL]
Blank Na2SO4 24.9%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Spike Value [Se Metal in 1% Nitric Acid]
ACZ Reported Value (ICP-MS M200.8)


ICPMS-DRC &
USGS-Collision
Samples 1-18 [1 Meter
Samples 13-15 [GSL]
Blank Na2SO4 17.35%
Samples 19-36 [7 meter
Samples 31-33 [GSL]
Blank Na2SO4 24.9%
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
-
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Spike Value [Se Metal in 1% Nitric Acid]
AWAL Reported Value (ICP-MS) 94
AWAL Reported Value (ICP-MS) 96
USGS ICPMS Collision Cell

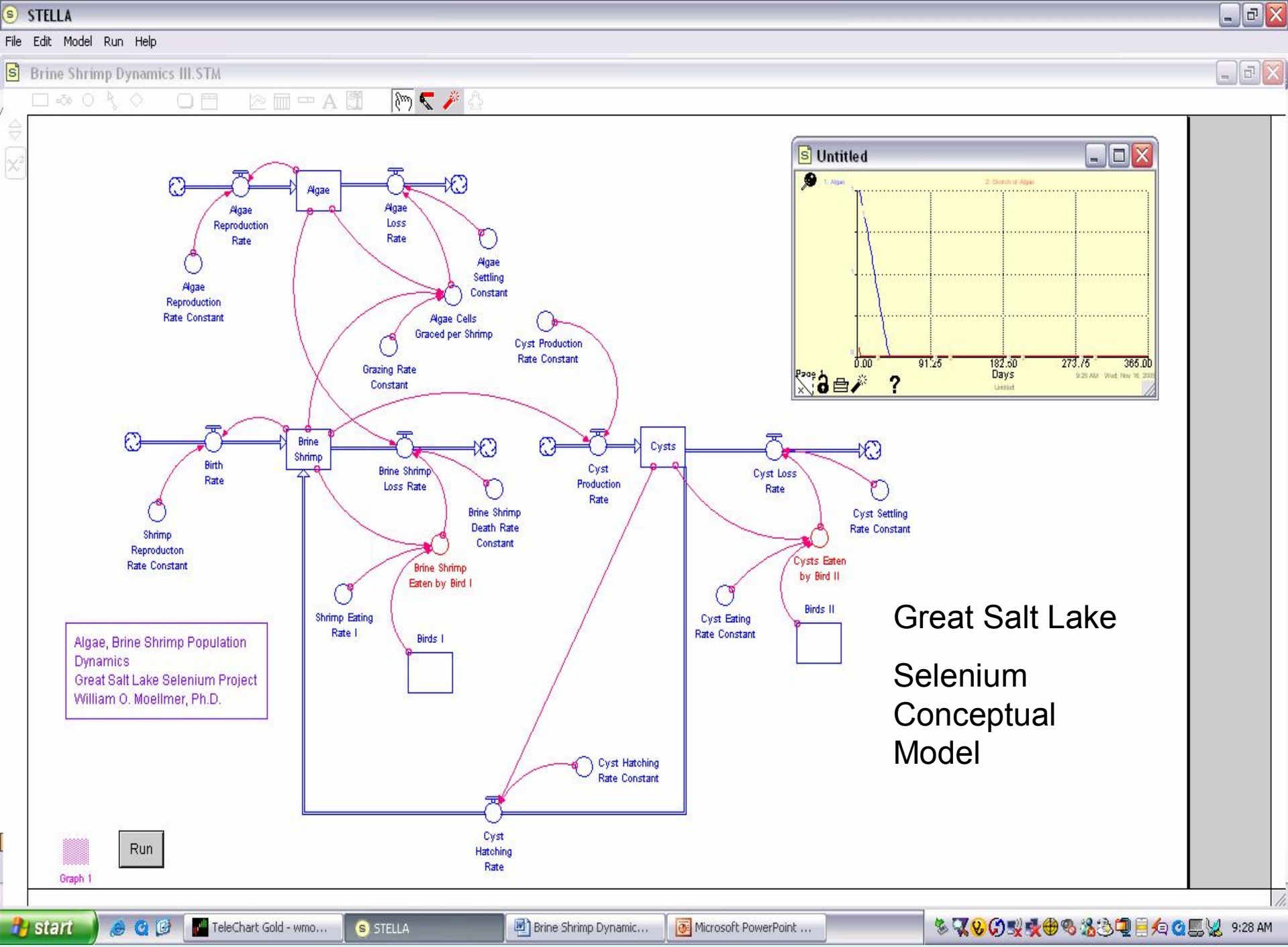

Perkin & Elmer LAS - ICP-MS DRC [O2]
Agilent Technologies - ICP-MS Collision Cell [H2]
USGS - Using Agilent Technologies ICPMS w/ Collision Cell
Se, ug/L
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
-
Samples 1-18 [1 Meter Depth]
Samples 19-36 [7 meter depth]
Samples 13-15 [GSL]
Blank Na2SO 4
Sample s 31-33 [GSL]
Blank Na2SO4 24.9%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Spike Value [Se Metal in 1% Nitric Acid]
Agilent 7500 Octopol. H2 Carrier Gas. ICP/MS w/ Collison
P&E O2 Carrier Gas. ICP/MS w/ DRC
USGS ICPMS Collision Cell


Hydride Generation
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
-
Samples 1-18 [1 Meter Depth]
Samples 19-36 [7 meter depth]
Samples 13-15 [GSL]
Blank Na2SO4 17.35%
Samples 31-33 [GSL]
Blank Na2SO4 24.9%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Spike Value [Se Metal in 1% Nitric Acid]
Kennecott Reported Value (Hydride)
ACZ Reported Value (AA Hydride SM 3114B)
Frontier GeoSciences, Inc. Seattle
USGS Hydride Generation


Concentration of Se in Gilbert Bay @ USGS Site
1 Meter Depth
7 Meter Depth
Selenium, ug/l
4
3.5
3
2.5
2
1.5
1
0.5
0
2
3
4
5
6
1 m Avg: 0.57 ug/l
7 m Avg: 0.74 ug/l
PE ICPMS DRC
USGS Collision Cell
Frontier Hydride
Agilent ICPMS Collision
Kennecott Hydride
ACZ Hydride
USGS Hydride
ACZ Laboratories and USGS both reported values <1.0 ppb.
USGS Hydride
ACZ Hydride
Kennecott Hydride
Agilent ICPMS Collision
Frontier Hydride
USGS Collision Cell
PE ICPMS DRC

Science Panel Recommendation

- Selenium measurement in The Great Salt Lake
  - Hydride Generation is an appropriate method
    - General: => 1.0 ppb
    - Ultra Low: Utilize Kennecott/Frontier preps.
  - ICP/MS “Collision Cell” (Agilent Technologies) is an acceptable method
  - ICP/MS “DRC” (Perkin Elmer) may be an acceptable method
- Standardizing a laboratory sample preparation procedure is necessary to “tune” the procedure.


STELLA
File Edit Model Run Help
Brine Shrimp Dynamics III.STM
Algae
Algae Reproduction Rate
Algae Loss Rate
Algae Settling Constant
Algae Reproduction Rate Constant
Algae Cells Graced per Shrimp
Grazing Rate Constant
Cyst Production Rate Constant
Brine Shrimp
Birth Rate
Brine Shrimp Loss Rate
Brine Shrimp Death Rate Constant
Shrimp Reproducton Rate Constant
Brine Shrimp Eaten by Bird I
Shrimp Eating Rate I
Birds I
Cysts
Cyst Production Rate
Cyst Loss Rate
Cyst Settling Rate Constant
Cysts Eaten by Bird II
Cyst Eating Rate Constant
Birds II
Cyst Hatching Rate Constant
Cyst Hatching Rate
Algae, Brine Shrimp Population Dynamics
Great Salt Lake Selenium Project
William O. Moellmer, Ph.D.
Run
Graph 1
Untitled
0.00
91.25
182.50
273.75
365.00
Days
Great Salt Lake
Selenium Conceptual Model
start
TeleChart Gold - wmo...
STELLA
Brine Shrimp Dynamic...
Microsoft PowerPoint ...
9:28 AM

Discussion of the Conceptual Model

- Dr. William Johnson
  - University of Utah

General Discussion Items

- Map bird census data usage on GLS map
- Identify species breeding on GSL
- Collect eggs from breeding avocets and shovelers
- Look for avocet eggs near the discharge
- Collect brine flies and brine shrimp that constitute the diet of the shovelers and avocets

Discussion Items, cont'd

- Adaptive Management Approach for an Interim Se Standard
  - Allows continuation of the clean up plan of sulfate-contaminated ground water from historic mining activities in southwest Salt Lake County.
  - Is there a present impairment of the beneficial use due to selenium?
    - Se concentration in GSL < 1 ug/l
    - No known teratogenic effects in birds

Adaptive Management Approach for an Interim Se Standard – Cont'd

- What is the biological significance of the Kennecott discharge?
- What is the load from rivers?
- Proposed issues needing answers was enumerated and discussed as an additional area of concern for consideration to "fast track" some projects
- Items included in potential projects for RFPs.

Additional Discussion Items

- Expand the data set on brine flies
- Conduct a synoptic sampling of brine shrimp and brine flies lake wide
- Target water samples for Selenium and suspended matter
- Consider caged studies near the outfall to validate trophic transfer
  - Compare with literature toxicity threshold values.

General Discussion of Potential Future Projects

- Determine selenium loadings to the lake
  - Lag times?
  - Equilibrium status?
  - Evaluate to see why we have 1 ug/l in the lake as compared to influx concentrations.
    - Stoichiometrics and kinetics
  - What happens to selenium in the sediments over time.
    - Stoichiometrics and kinetics

Science Panel Projects Recommended for RFPs

- 1. Map bird census data usage on USGS GLS map. Identify species breeding on the Lake and nesting populations [2006].
- 2. Analyze USGS samples that are being held [2005].
- 3. Develop RFP for collecting eggs [2006].
  - Avocets, stilts,and shovelers
  - Concurrent harvesting, testing of brine shrimp and brine flies.

Science Panel Projects Recommended for RFPs, cont'd.

- 5. RFP: Mass loadings to GSL. [2006]
  - Flow and concentrations from all sources
- 6. RFP: Selenium transfer/flux between the sediments and water column. [Long Term]
- 7. Review conceptual model contract and evaluate need for addendum for continuation. [2005]
- 8. Develop report (web) of round robin. [2005]