

2011 Las Conchas Fire Impacts to Water Quality in the Rio Grande

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Concerns were raised about potential effects on the water quality in the Rio Grande, particularly at the two public water supply intakes:

Buckman Direct Diversion (BDD)

and the

Albuquerque Bernalillo County Water Utility Authority
San Juan-Chama Drinking Water Project

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- Collaborative stormwater monitoring effort between San Ildefonso Pueblo, City of Santa Fe Buckman Direct Diversion (BDD) and New Mexico Environment Department (DOE Oversight Bureau)
 - Thirteen runoff events sampled, multiple samples collected per event
 - July – 2 events
 - August – 7 events
 - September – 4 events



▲ Taos

Rio Chama

Los Alamos

LANL

Las Conchas Fire Perimeter

San Ildefonso Pueblo

Rio Grande at Otowi

Rio Grande at Buckman Direct Diversion

▲ Santa Fe

Rio Grande

25

Rio Grande above Alameda Bridge

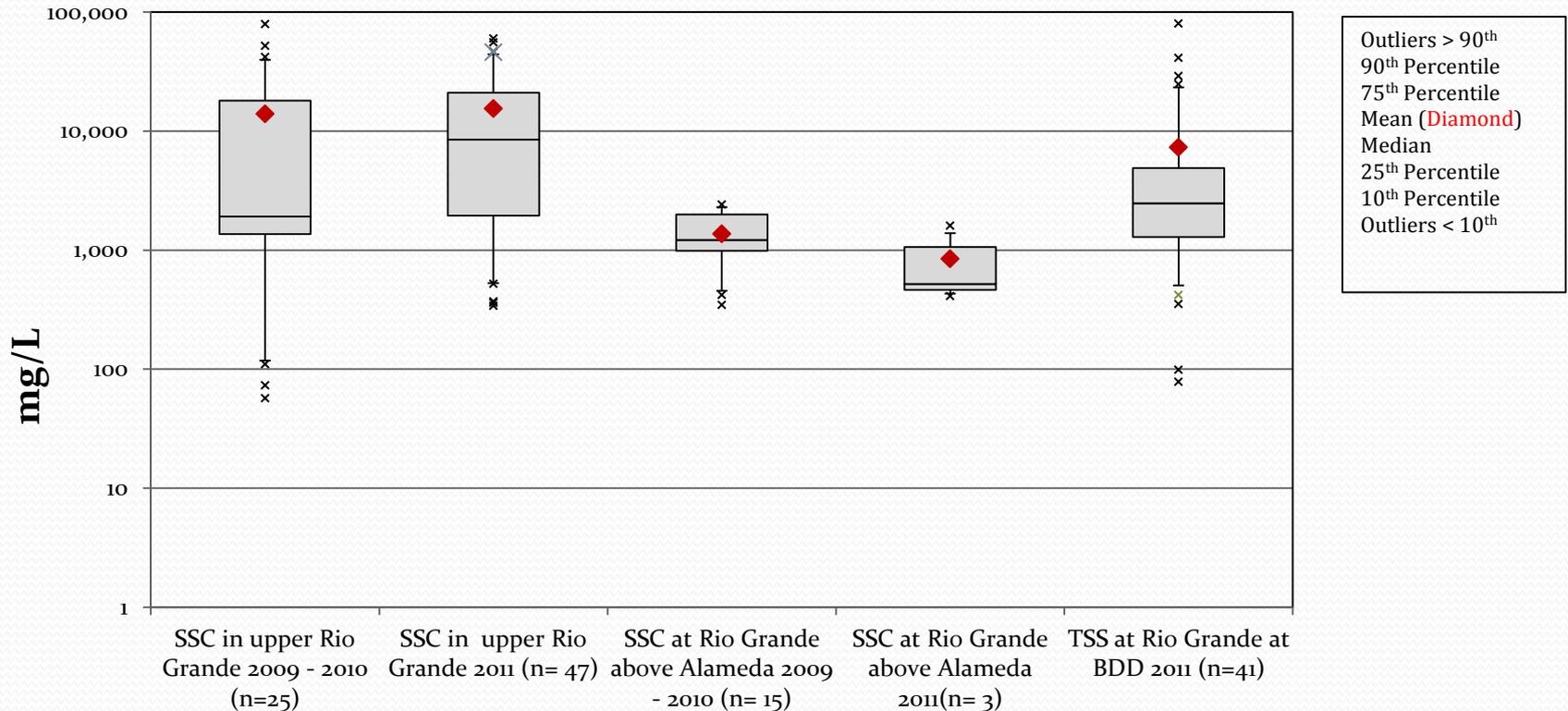
Albuquerque

40



- Otowi bridge and upstream from Alameda bridge
 - 1 sampler programmed to collect on a 500 CFS increase in flow over one hour
- Buckman Direct Diversion – 5 samplers
 - 3 samplers programmed to collect with 1 – 1 ½ hour delay based on telemetry indicating flow from lower Los Alamos Canyon (intended to detect LANL contributions)
 - 2 samplers programmed to collect on a 500 CFS increase in flow over one hour (intended to reflect regional conditions)

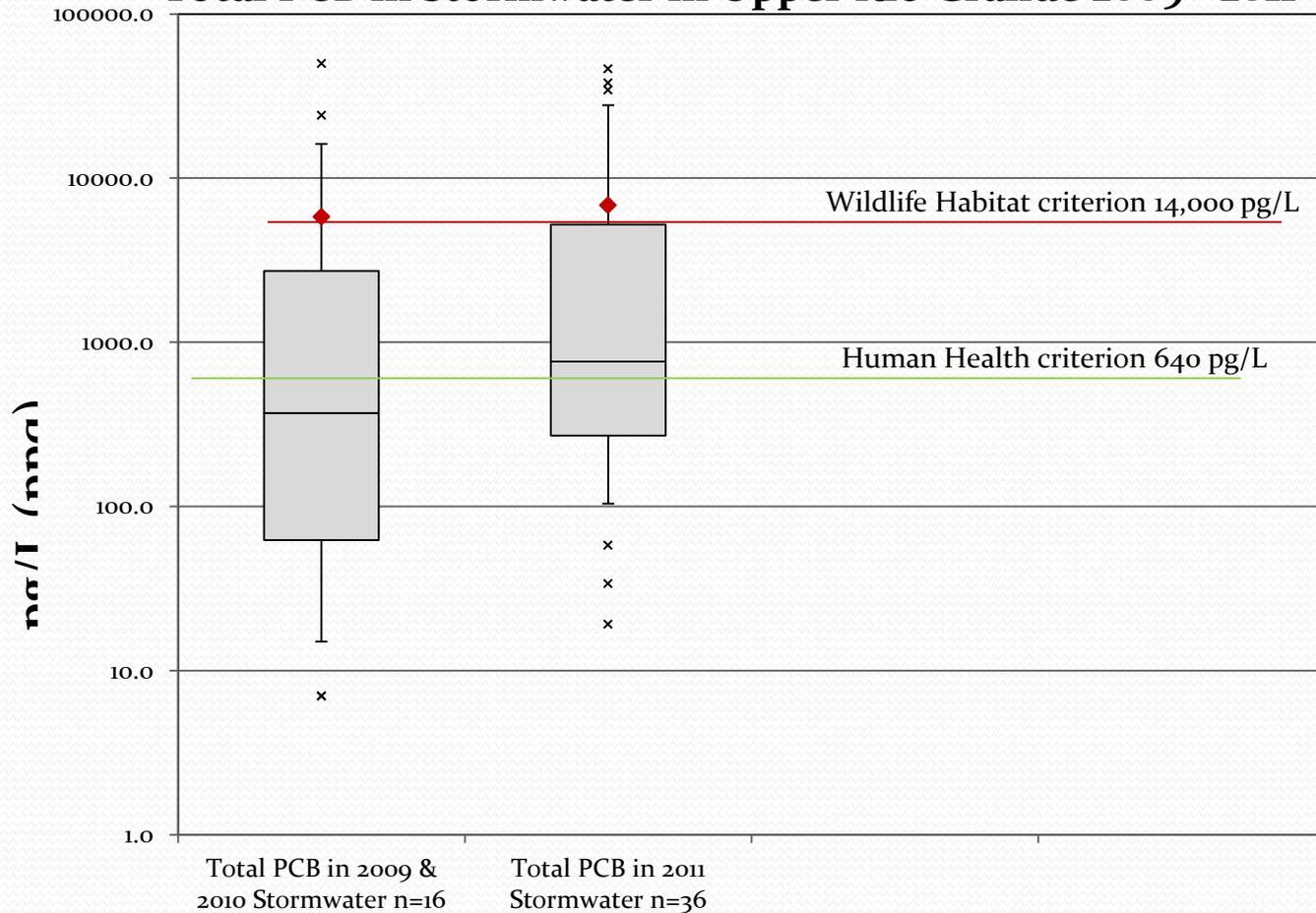
Suspended Sediment Concentration (SSC) and Total Suspended Sediment (TSS) in Stormwater from the Rio Grande 2009 - 2011



Mean	13,914	15,398	1,369	843	7,278
Median	1,912	8,500	1,221	520	2,480

Slight increase in SSC in upper Rio Grande compared to pre-fire. All events at Rio Grande above Alameda (2009 – 2010) in response to flows from North Diversion Channel. In 2011, only one event was in response to post-fire flood from Peralta Canyon and it produced only 1600 mg/L in Rio Grande above Alameda. As is expected, TSS results at BDD are lower than SSC results.

Total PCB in Stormwater in Upper Rio Grande 2009 - 2011



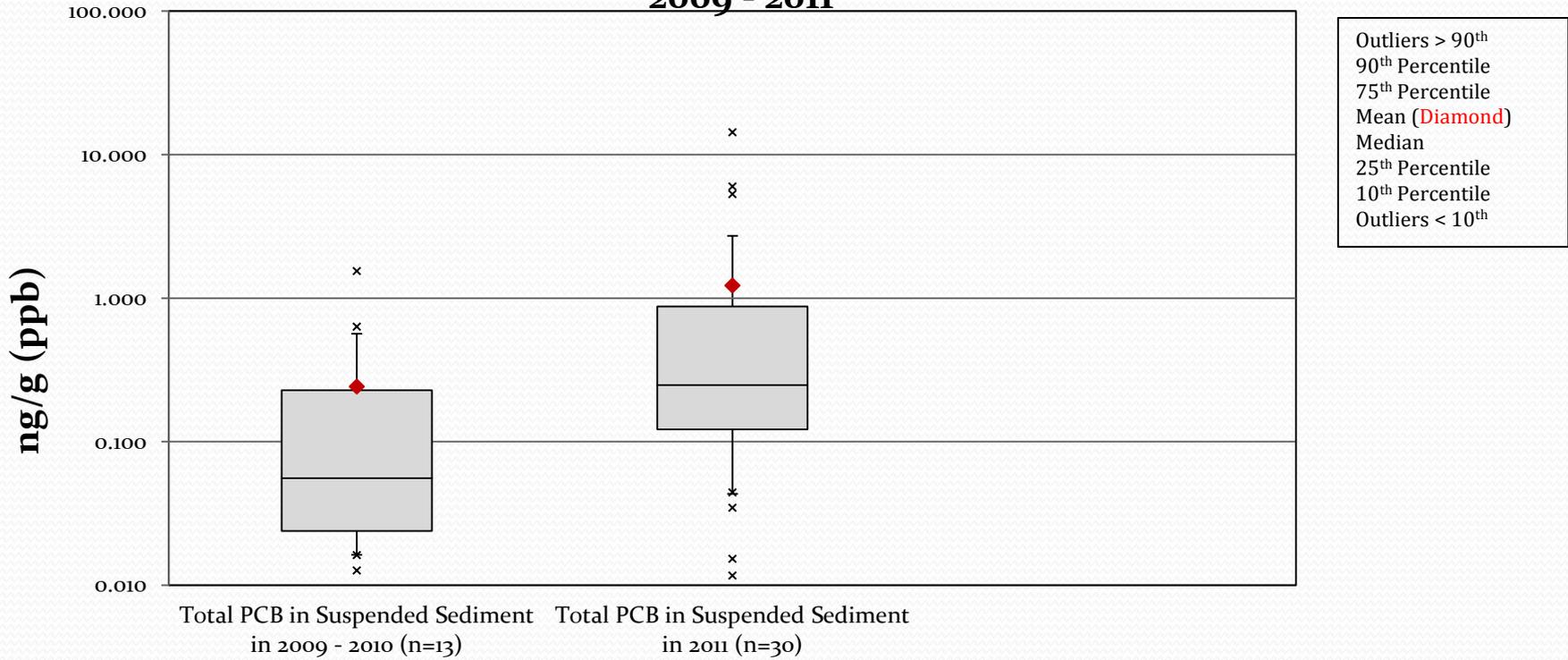
Outliers > 90th
 90th Percentile
 75th Percentile
 Mean (Diamond)
 Median
 25th Percentile
 10th Percentile
 Outliers < 10th

Mean	5,803	6,325
Median	370	826

Slight increase in total PCB in water compared to pre-fire.

Total PCB in Suspended Sediment in Upper Rio Grande Stormwater

2009 - 2011



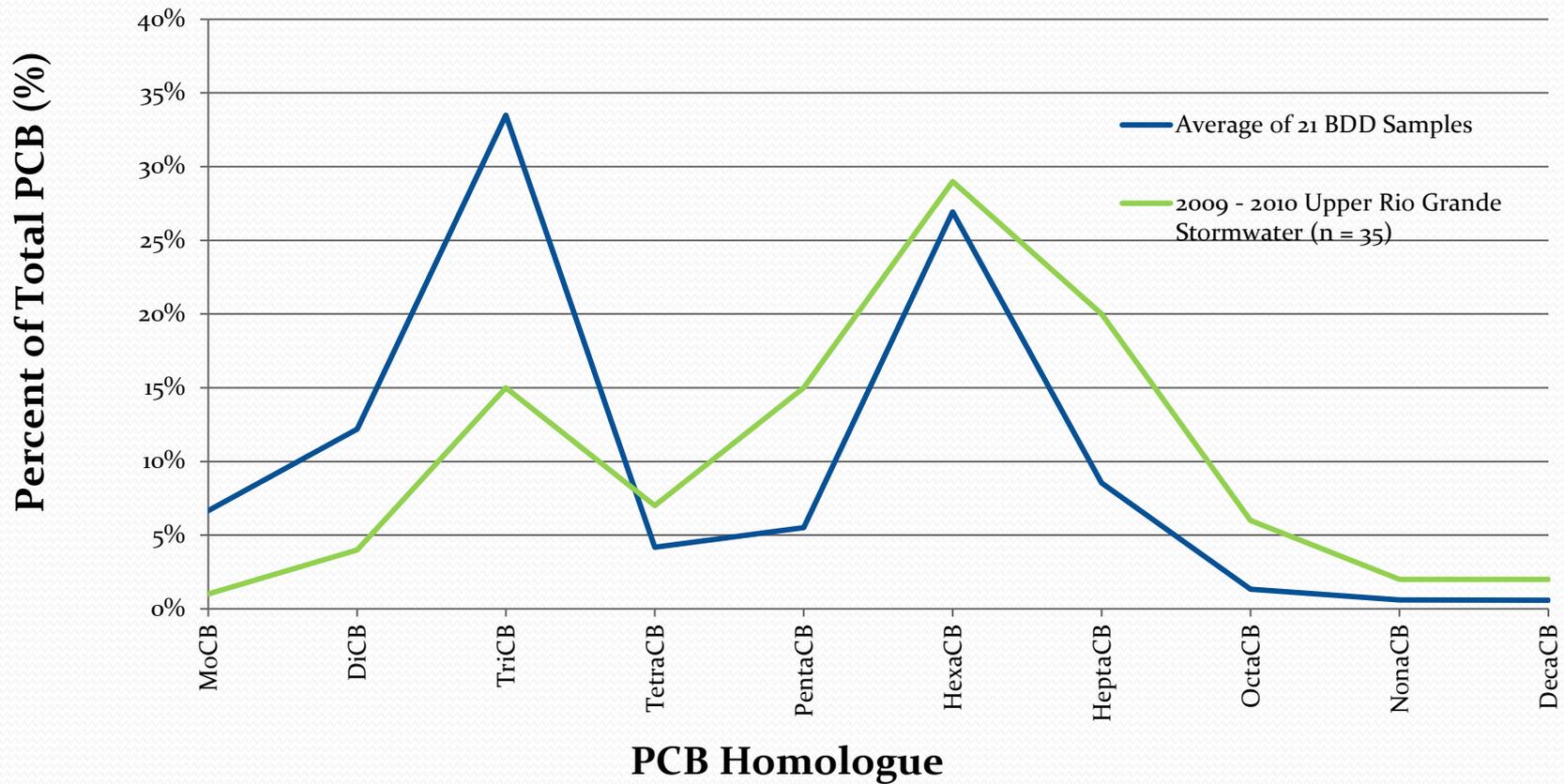
Outliers > 90th
 90th Percentile
 75th Percentile
 Mean (Diamond)
 Median
 25th Percentile
 10th Percentile
 Outliers < 10th

Mean	0.242	1.225
Median	0.056	0.248

Level of PCBs in suspended sediment in the upper Rio Grande increased by about 4 to 5 times.

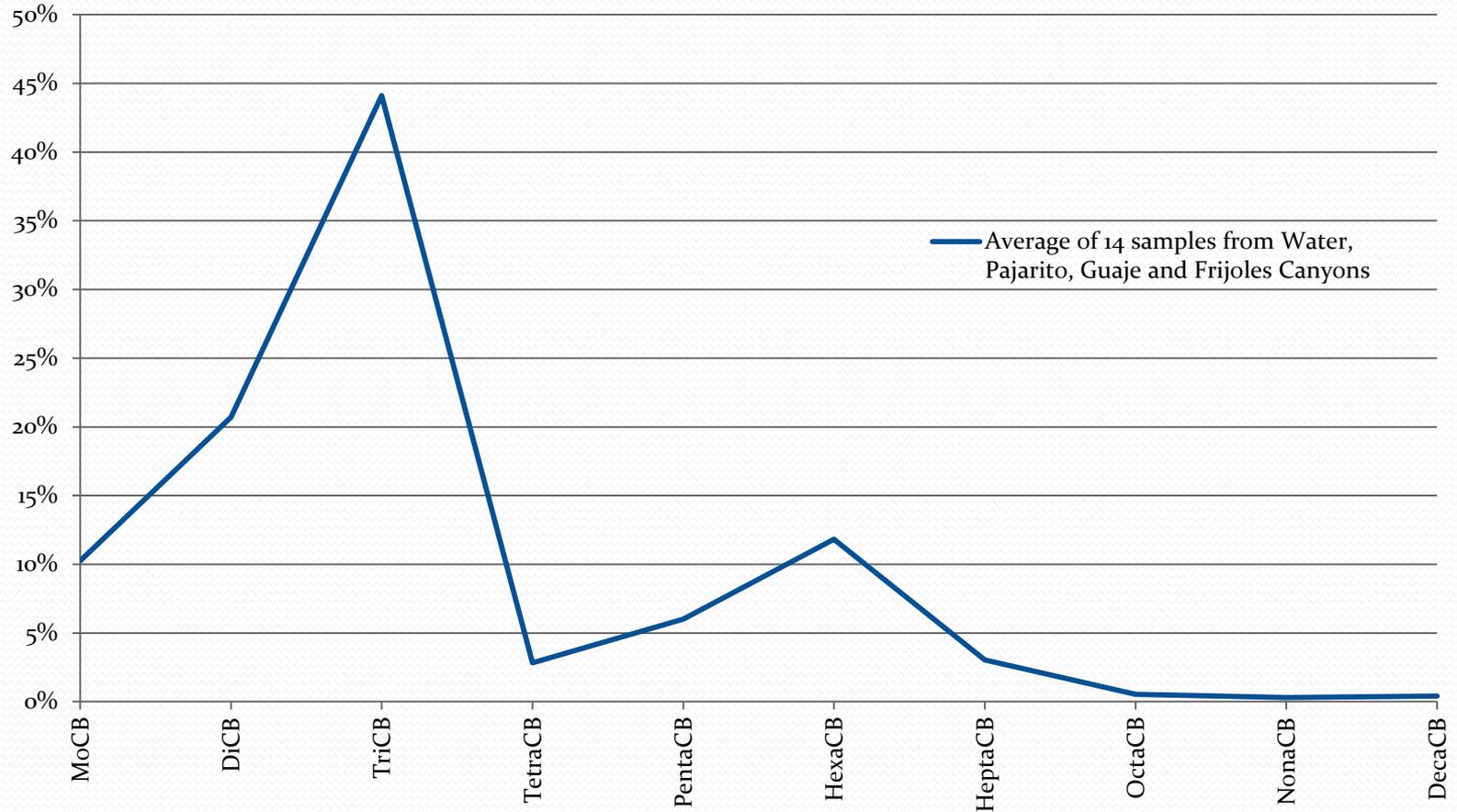
There were higher levels of PCB in suspended sediments post-fire compared to 2009 -2010 events but this resulted in only a slight increase in total PCB levels (previous slide) because SSC levels were not significantly elevated in 2011.

PCB Homologue Distribution in Rio Grande Stormwater at the Buckman Direct Diversion in 2011



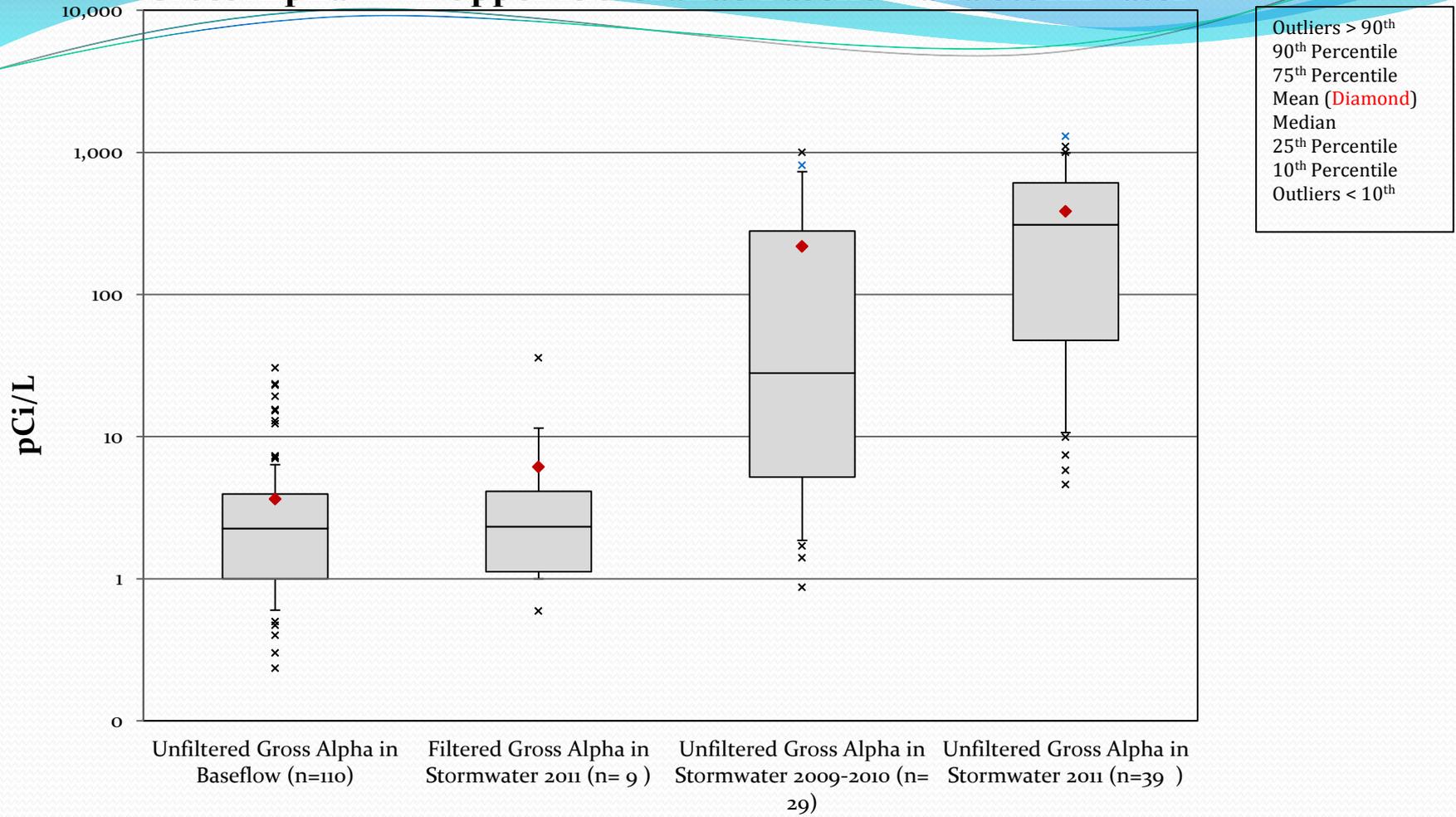
Both sets of data show a bimodal distribution with an increase in lower chlorinated congeners in the 2011 post-fire samples. No indication of industrial sources (no shift to higher chlorinated congeners)

PCB Homologue Distribution in Tributaries Downstream from Las Conchas Fire



Homologue distribution in tributaries to Rio Grande show a bimodal distribution with elevated levels of lower chlorinated congeners. Suggests Las Conchas fire stormwater runoff is responsible for the shift toward lower-chlorinated homologues in middle Rio Grande stormwater.

Gross Alpha in Upper Rio Grande Baseflow and Stormwater

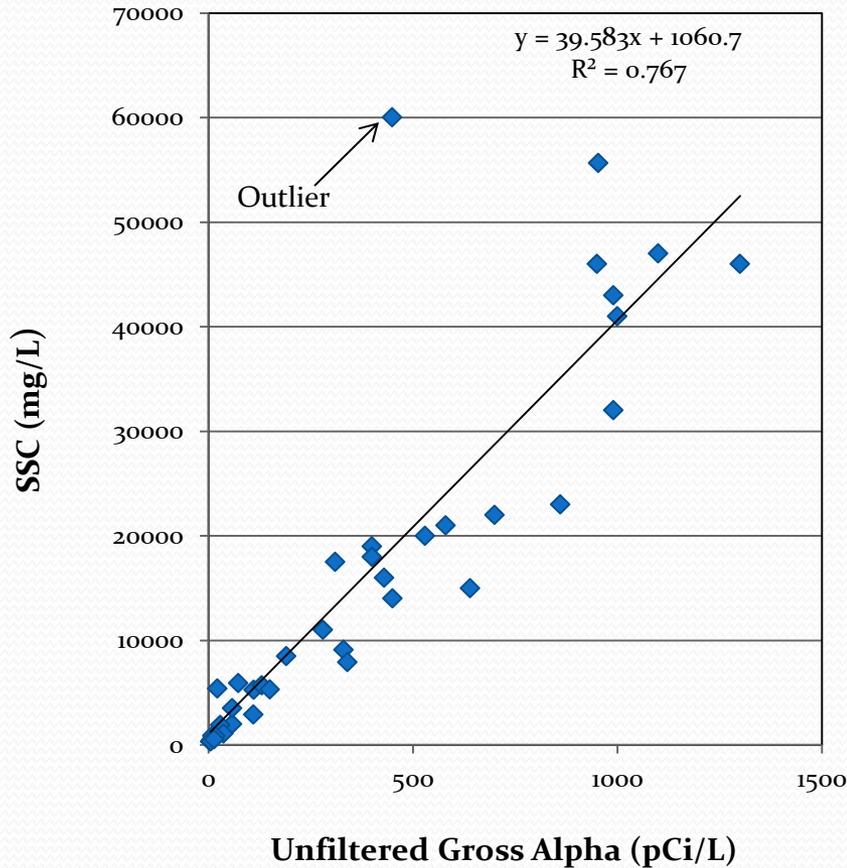


Mean

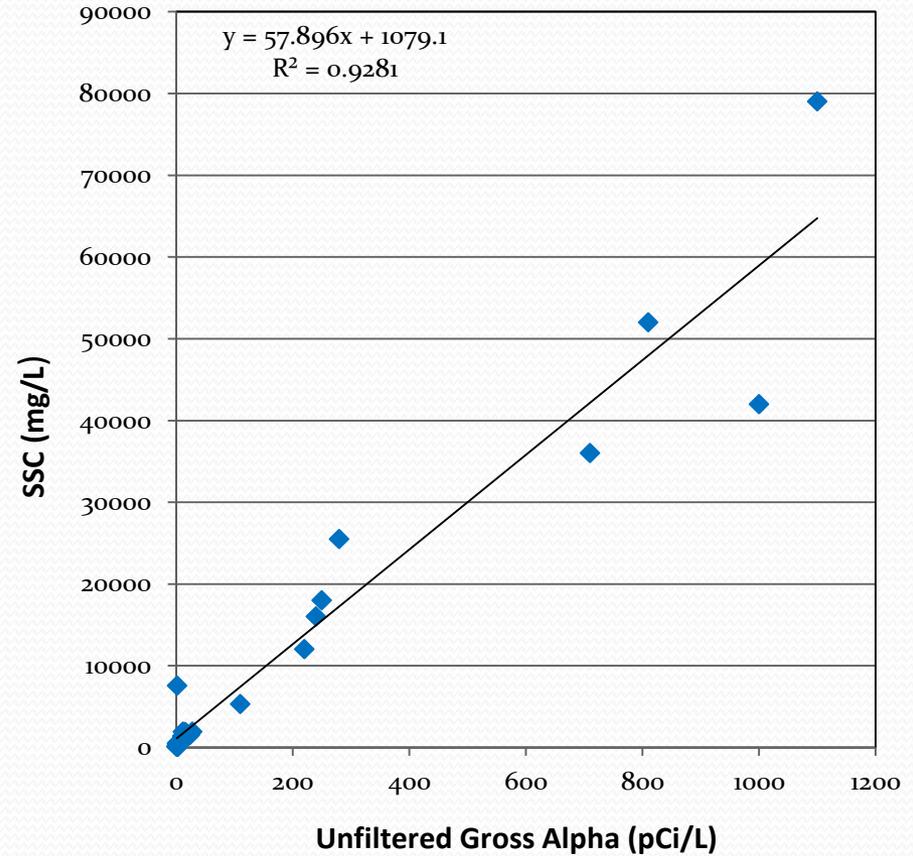
Median

Filtered gross alpha in stormwater very similar to unfiltered baseflow. Most likely due to low levels of suspended sediment in both. Slight increase in post-fire gross alpha compared to 2009 – 2010 due to relatively slight increase in SSC levels.

Gross Alpha vs SSC in Stormwater
in Upper Rio Grande 2011 (n=39)

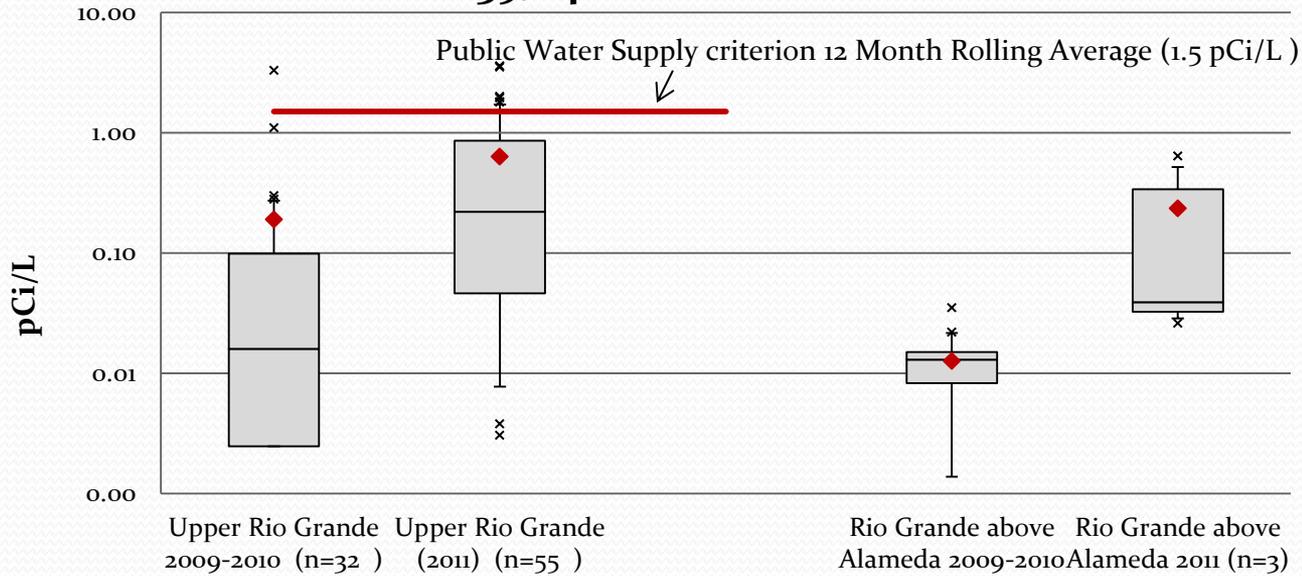


Gross Alpha vs SSC in Stormwater
in Upper Rio Grande 2009 - 2010 (n=23)



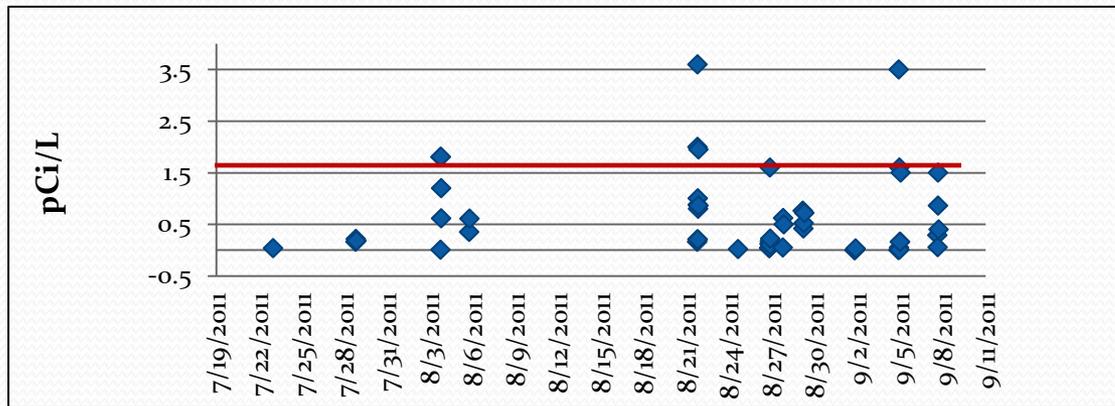
Strong correlation between SSC and gross alpha. If single outlier in 2011 data is removed R^2 is then 0.9036 and similar to what was seen in 2009 - 2011.

Total Pu-239/240 in Rio Grande Stormwater



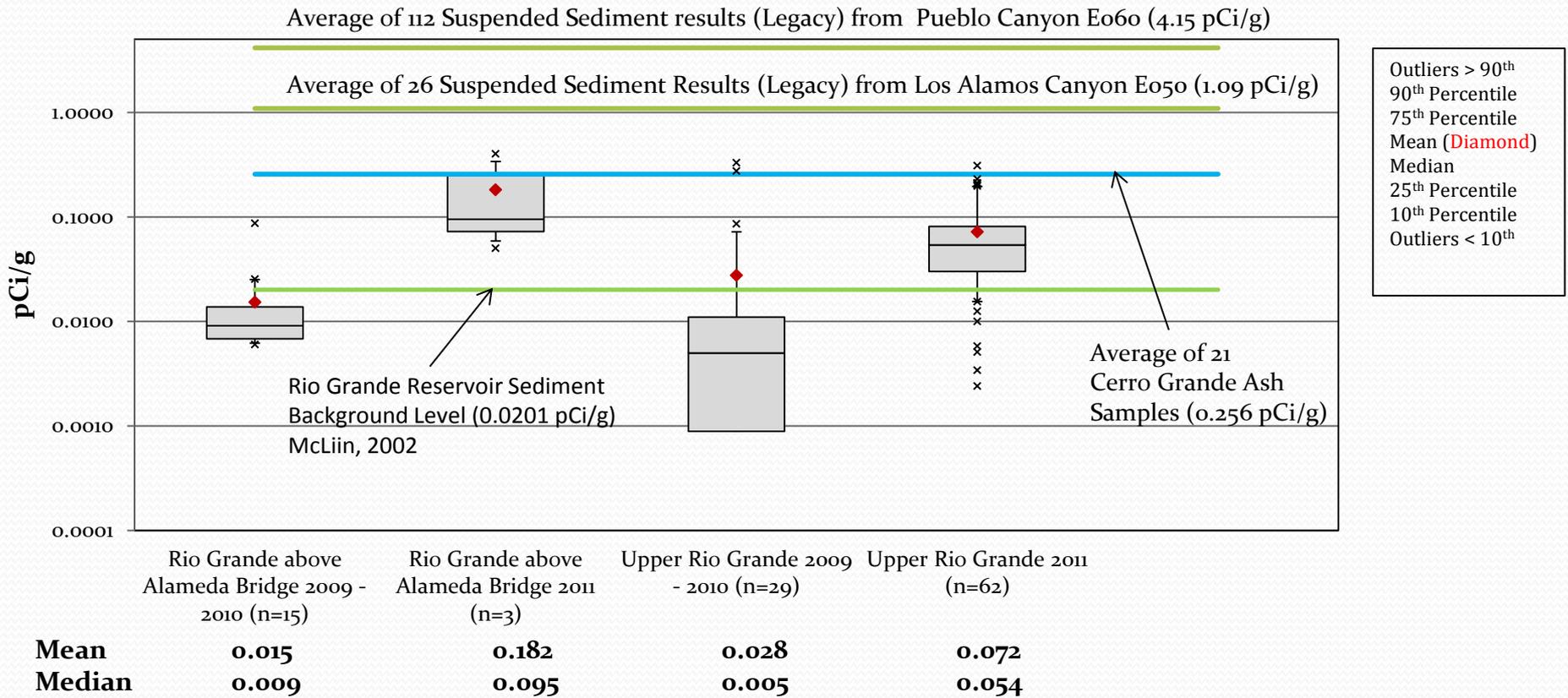
Outliers > 90th
 90th Percentile
 75th Percentile
 Mean (Diamond)
 Median
 25th Percentile
 10th Percentile
 Outliers < 10th

Mean	0.19	0.63	0.01	0.24
Median	0.02	0.22	0.01	0.04



In the upper Rio Grande, ten of the 55 results (18%) from 9/7/10 – 9/7/11 were greater than the 1.5 pCi/L Public Water Supply criterion though the 12 month average concentration was 0.63 pCi/L

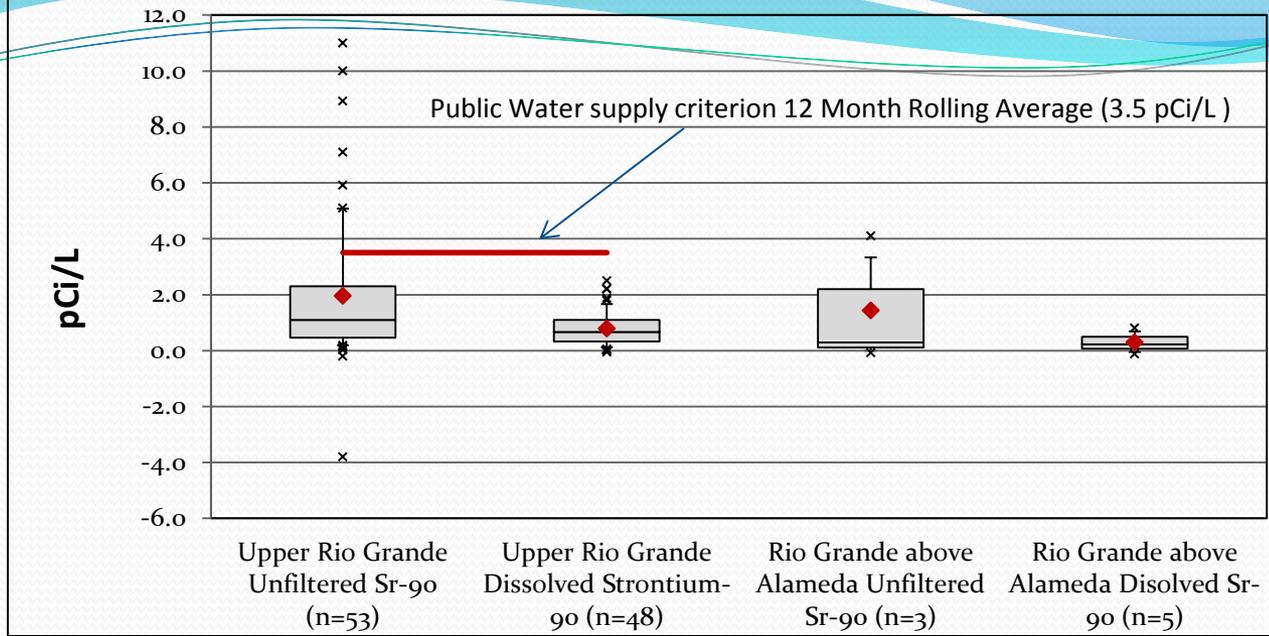
Plutonium 239/240 in Suspended Sediments in Upper Rio Grande Stormwat



Outliers > 90th
 90th Percentile
 75th Percentile
 Mean (Diamond)
 Median
 25th Percentile
 10th Percentile
 Outliers < 10th

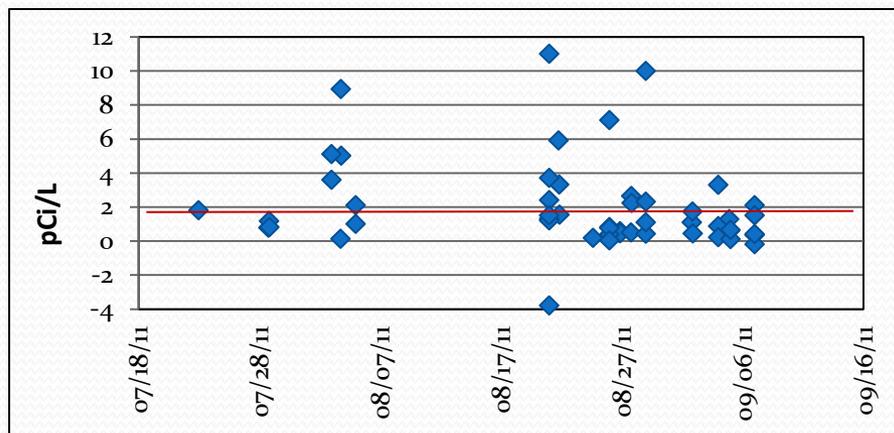
- Post-fire levels of Pu-239/240 in suspended sediments are about 10 times higher at the Rio Grande above Alameda location and 2.6 times greater in the upper Rio Grande locations.
- The levels of PU-239 in suspended sediments appear more similar to that found in ash samples from the Cerro Grande fire than typical legacy Pu-239 concentrations seen in Los Alamos and Pueblo Canyons.
- Any contribution of legacy contaminants appears to be overwhelmed by the levels found in the ash component of the stormwater.

Strontium -90 in Stormwater in the upper and middle Rio Grande 2011



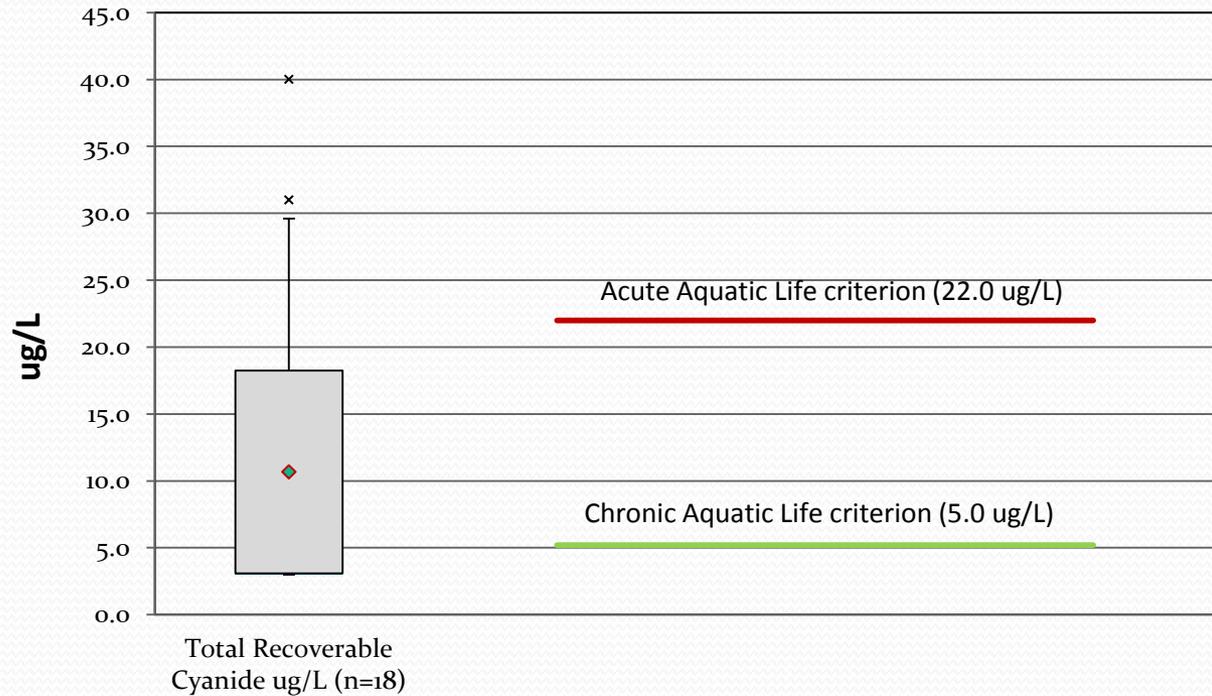
Outliers > 90th
 90th Percentile
 75th Percentile
 Mean (Diamond)
 Median
 25th Percentile
 10th Percentile
 Outliers < 10th

Mean	2.0	0.8	1.4	0.3
Median	1.1	0.7	0.3	0.2



Nine of the 56 results (16%) from 9/29/10 – 9/29/11 were greater than the 3.5 pCi/L Public Water Supply criterion though the 12 month average concentration was 1.86 pCi/L

Total Recoverable Cyanide in Stormwater in upper Rio Grande 2011

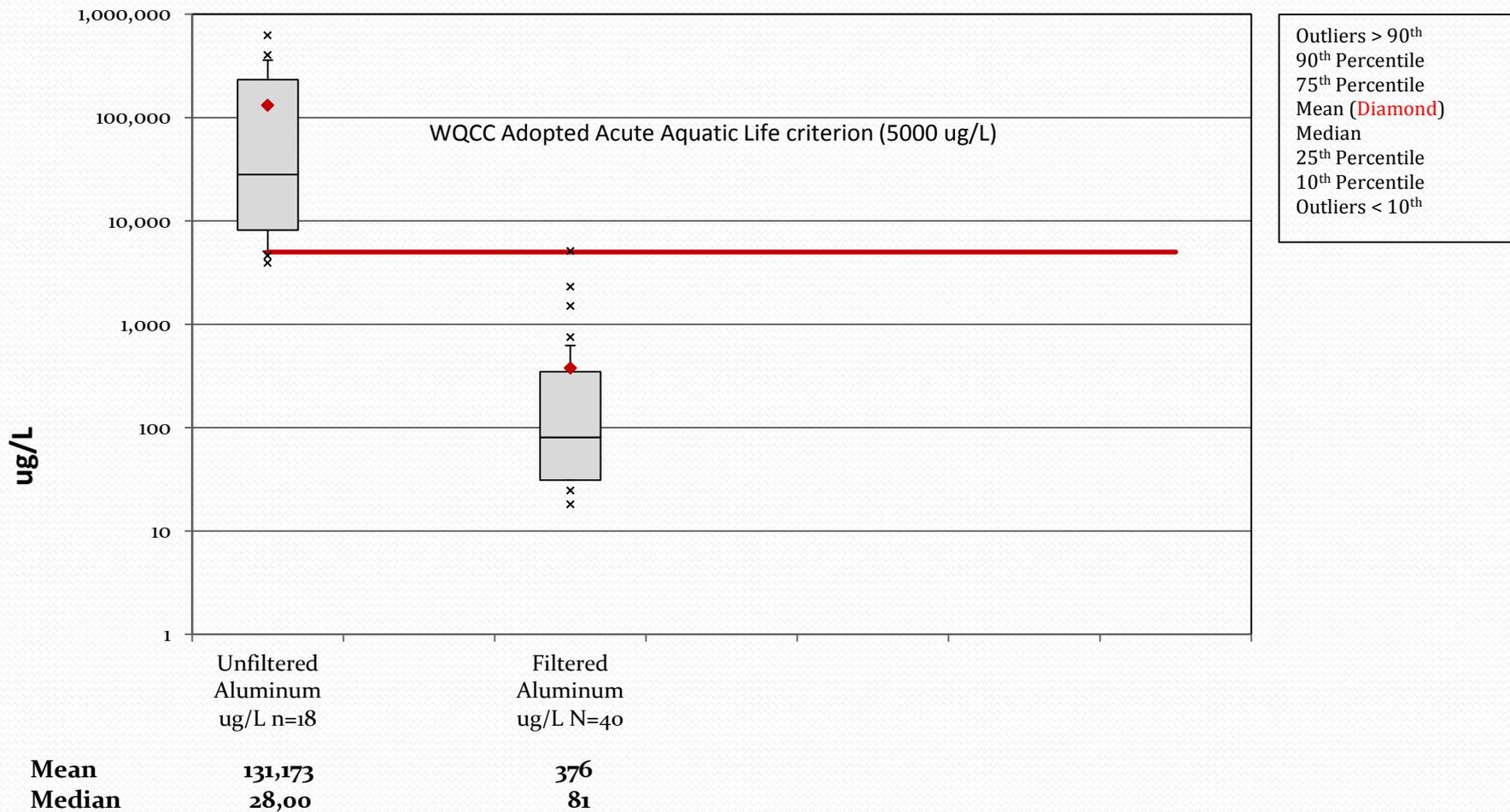


Outliers > 90th
 90th Percentile
 75th Percentile
 Mean (Diamond)
 Median
 25th Percentile
 10th Percentile
 Outliers < 10th

Mean 10.7
 Median 3.1
 DL - 3.1 ug/L

Six of eighteen measurements for cyanide were detections and ranged from 16 ug/L to 40 ug/L. Three of the six detections were above the Acute Aquatic Life criterion.

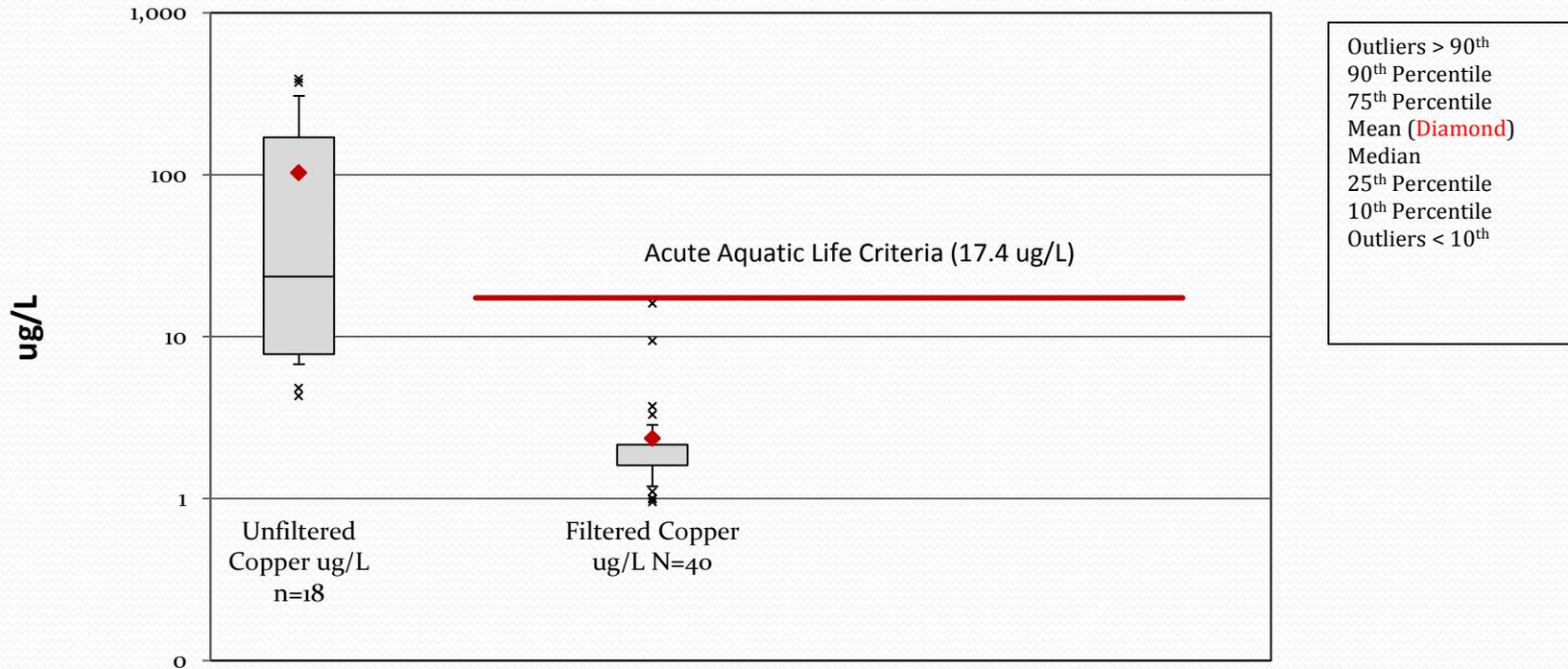
Total and Dissolved Aluminum in upper Rio Grande Stormwater during 2011



Filtered stormwater aluminum values are obtained from using a 0.45 micron filter and may not be directly comparable to the Acute Aquatic Life Criterion (does not include some colloidal forms of aluminum which should be accounted for)

Total and Dissolved Copper in upper Rio Grande Stormwater in 2011

Average Dissolved Hardness = 132 ug/L

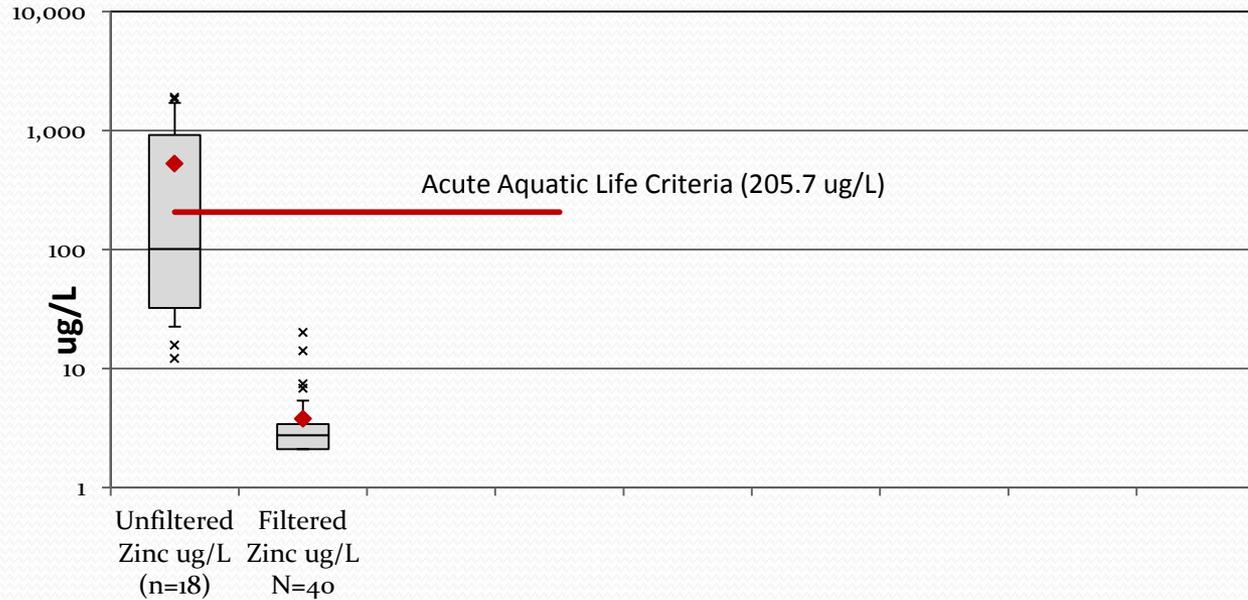


Filtered Copper Mean 2.4
 Filtered Copper Median 1.6
 Copper DL - 1.6 ug/L

Only filtered copper is compared to the aquatic life criteria.
 Stormwater is compared only to Acute Aquatic Life criterion.

Total and Dissolved Zinc in upper Rio Grande Stormwater in 2011

Average Dissolved Hardness = 132 ug/L



Outliers > 90th
 90th Percentile
 75th Percentile
 Mean (Diamond)
 Median
 25th Percentile
 10th Percentile
 Outliers < 10th

Filtered Zinc Mean 3.76
Filtered Zinc Median 2.75
 Zinc DL - 2.1 - 3.3 ug/L

Only filtered zinc is compared to the Aquatic Life criterion.
 Stormwater is compared only to Acute Aquatic Life criterion.

Summary

- Suspended sediment levels were slightly increased compared to pre-fire levels.
- Sediment bound constituents (e.g., gross alpha, PCB) also showed slight increases in concentrations.
- PCB homologue distributions in Rio Grande demonstrate influence from burned area runoff, not industrial sources.
- Eighteen percent of the Pu-239/249 and sixteen percent of the total Sr-90 levels exceed the Public Water Supply criteria but twelve month average levels were 42% and 53% of criteria respectively.
- Pu-239 levels in suspended sediment are above Rio Grande Reservoir Sediment background level but similar to what was seen in Cerro Grande ash. No apparent evidence of legacy inputs.
- Levels of dissolved metals were generally lower than Chronic Aquatic Life criteria though total recoverable cyanide exceeded the Acute Aquatic Life criterion in 3 of 18 measurements.

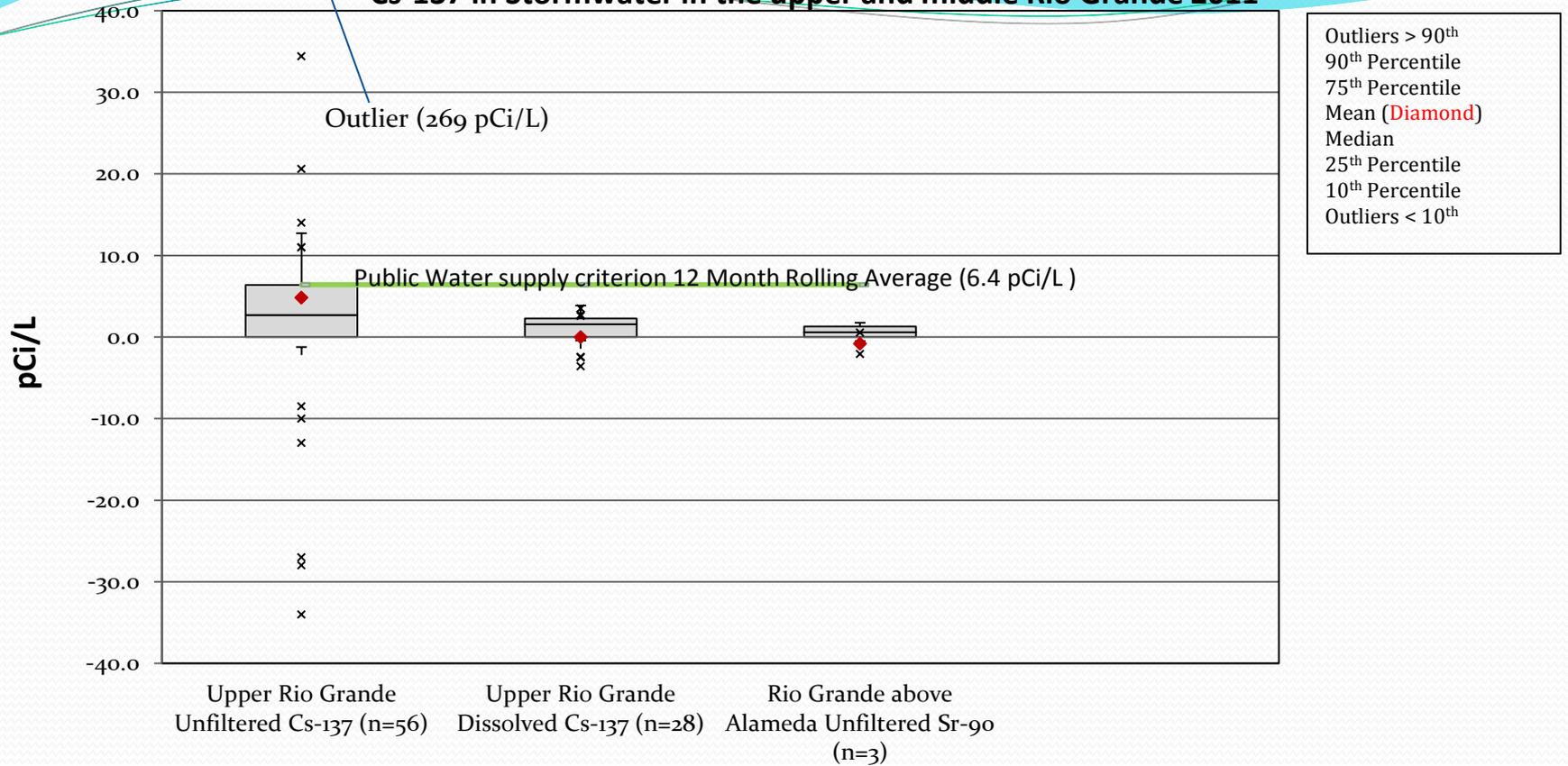
Acknowledgements

- I would like to thank the Pueblo de San Ildefonso, Pueblo de Cochiti, the City of Santa Fe Buckman Direct Diversion and the Open Space Division, Parks and Recreation Department of the City of Albuquerque for access to their lands and facilities. I would also like to thank the following individuals for their help: David Englert, Kim Granzow, Bill Bartels, Courtney Perkins, Erika Schwender and all the BDD staff, Phoebe Suina, Ken Wilhelm and Alex King.

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Cs-137 in Stormwater in the upper and middle Rio Grande 2011



	Upper Rio Grande Unfiltered Cs-137 (n=56)	Upper Rio Grande Dissolved Cs-137 (n=28)	Rio Grande above Alameda Unfiltered Sr-90 (n=3)
Unfiltered Cs-137 Mean	4.8	0.0	-0.8
Filtered Cs-137 Median	0.5	0.1	-0.9

Unfiltered Cs-137 -- four of fifty-six results were detections. One outlier of 269 pCi/L is suspect and is being investigated by the analytical laboratory. The average (including 269 pCi/L outlier) is 4.8 pCi/L and is below the Public Water Supply criterion of 6.4 pCi/L.