2009 EPA Quality Management Conference

Data Invalidation Case Study

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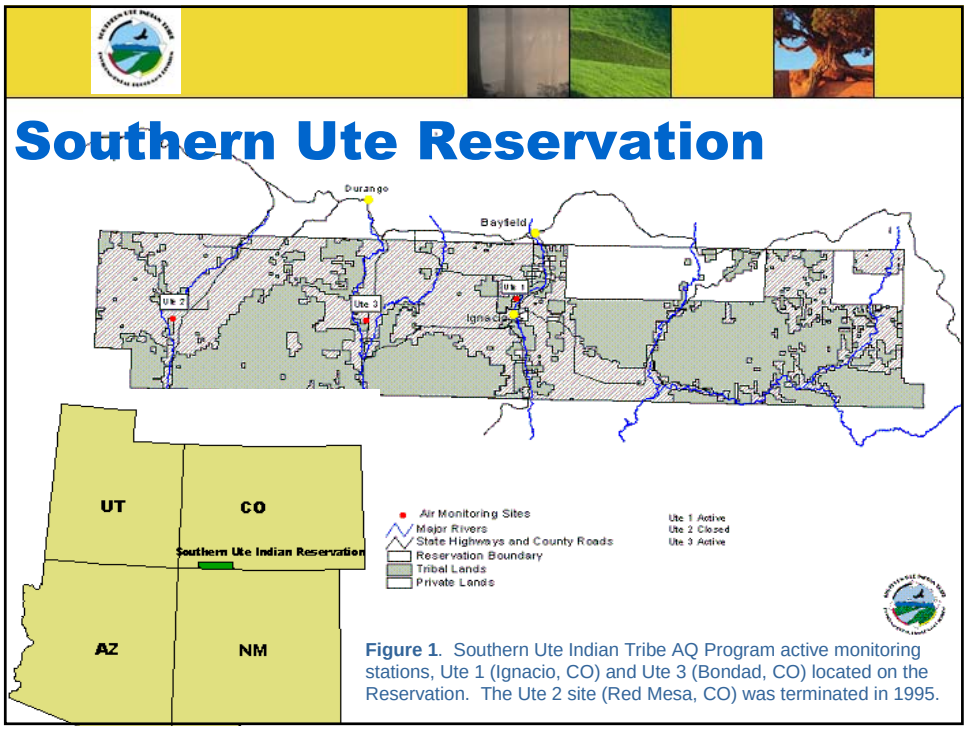


Figure 1. Southern Ute Indian Tribe AQ Program active monitoring stations, Ute 1 (Ignacio, CO) and Ute 3 (Bondad, CO) located on the Reservation. The Ute 2 site (Red Mesa, CO) was terminated in 1995.

Air Monitoring Background

- Ute 1 was established when the Air Quality Program began in the early 1980s.
- Ute 2 was also established in the early 1980s, but was terminated in 1995.
- Ute 3 was established in 1997 and continues in operation today.

Current Air Monitoring Sites

UTE 1

Elevation: 6,500 feet MSL
37°08'20" N, 107°37'54" W

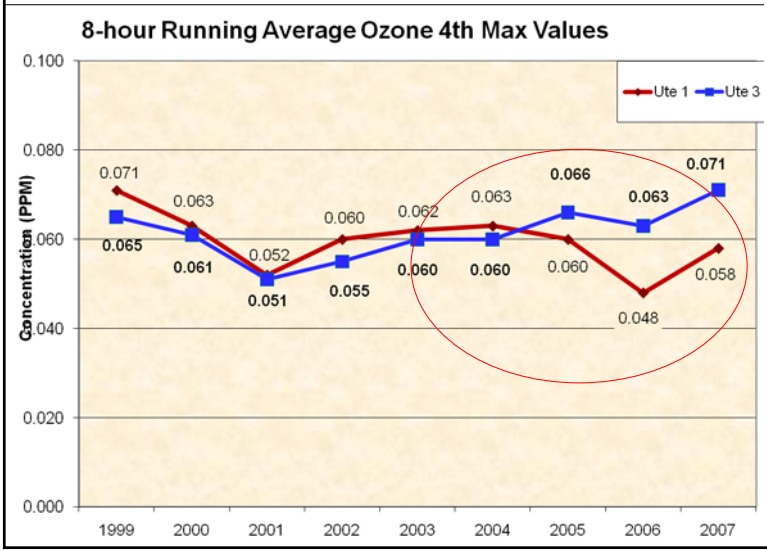
Ozone (O3)
Oxides of Nitrogen (NO, NO2, NOx)
Carbon Monoxide (CO)
In-Station Calibrator
Meteorological Parameters: WS, WS, Sol Rad, Temp., Rel. Humidity and Precipitation

UTE 3

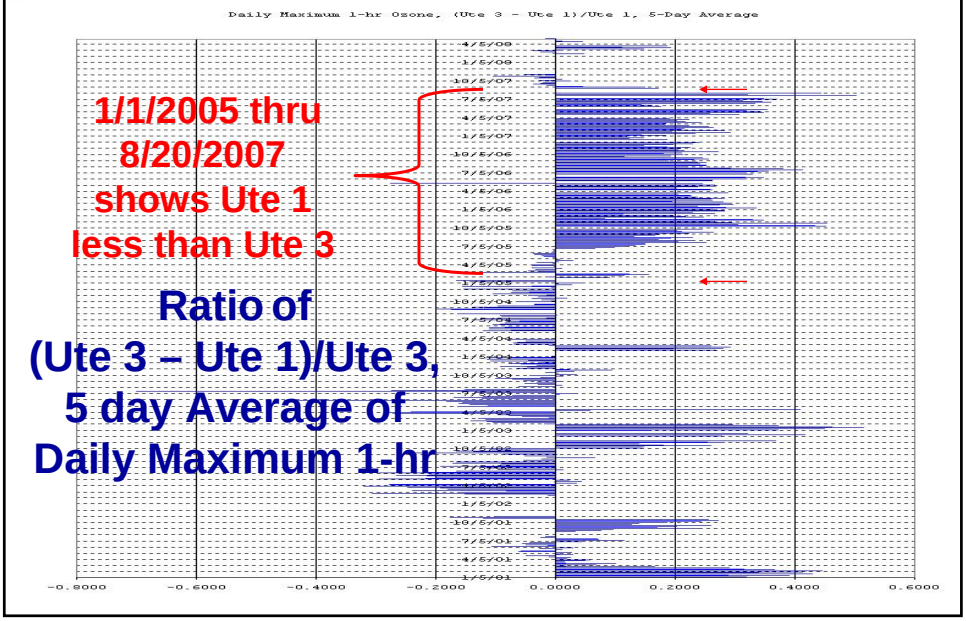
Elevation: 6,300 feet MSL
37°06'09" N, 107°52'13" W

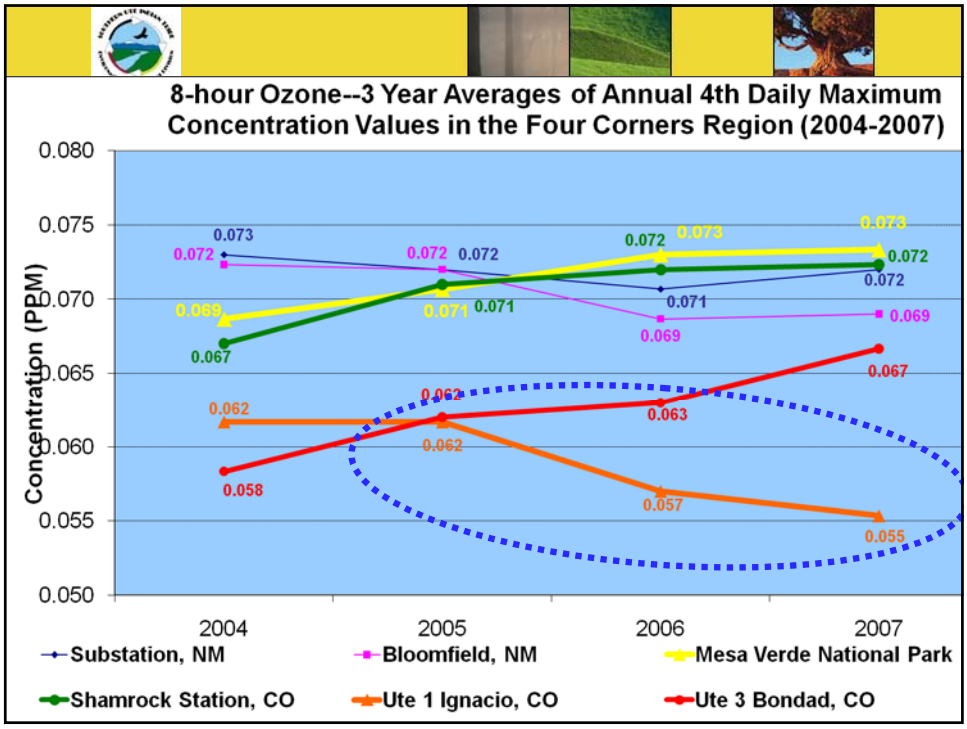
Ozone (O3)
Oxides of Nitrogen (NO, NO2, NOx)
In-Station Calibrator
Meteorological Parameters: WS, WS, Sol Rad, Temp., Rel. Humidity and Precipitation
Passive Ammonia Sampling study (2006- 2007)

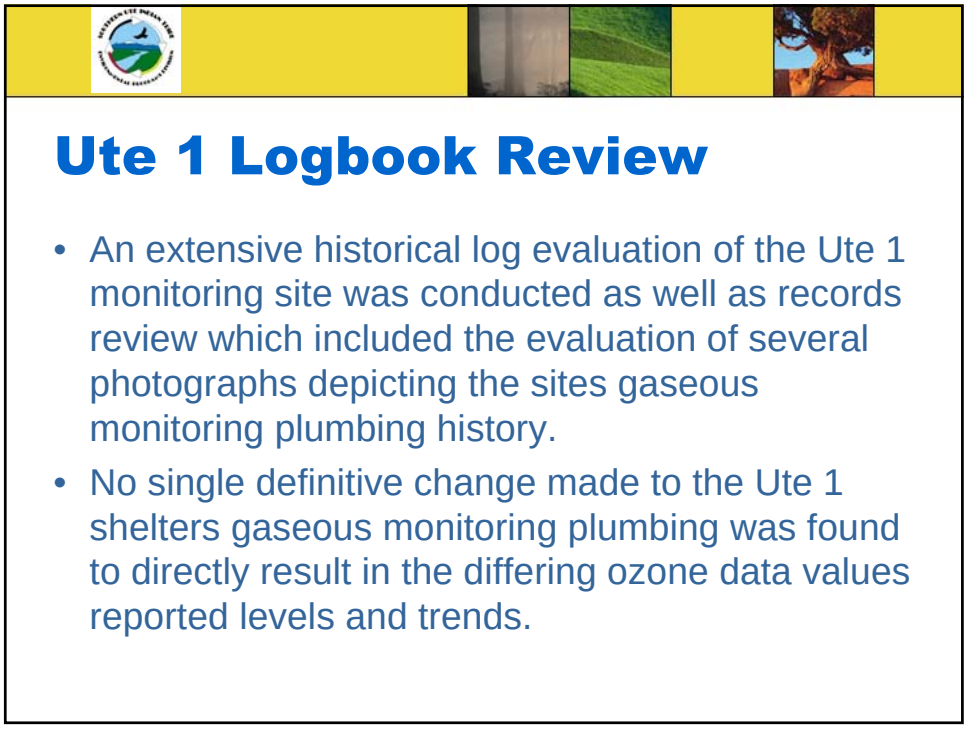
--▲--Ute 1, --■--Ute 3



- Divergent trend began in early 2005; Ute 1 no longer tracking Ute 3, but Ute 1 had values lower by ~ 75%

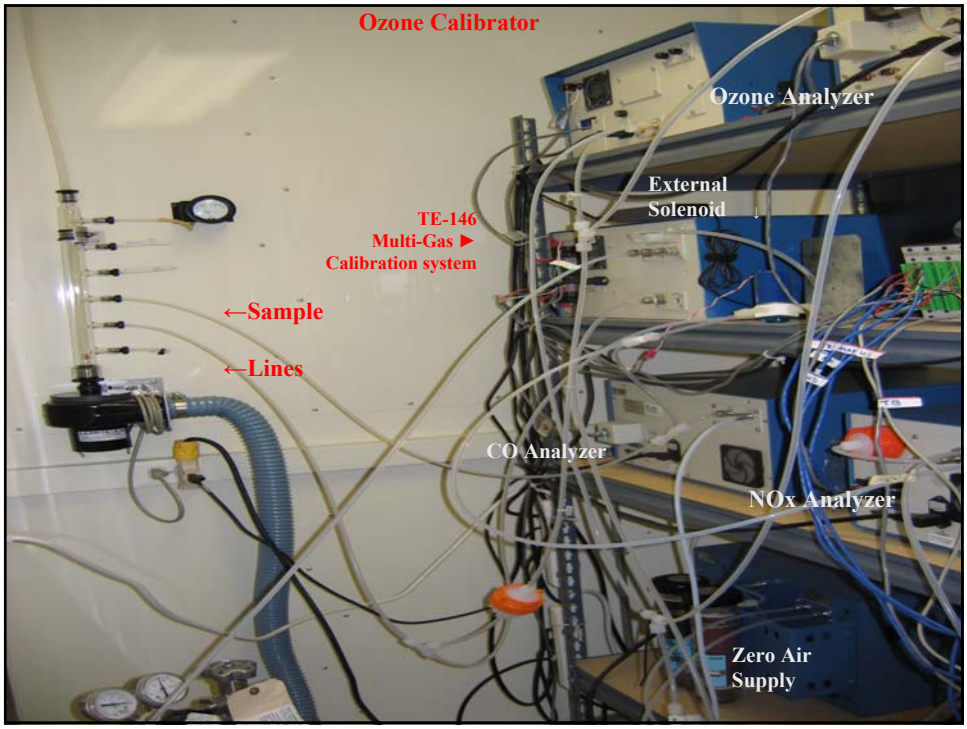


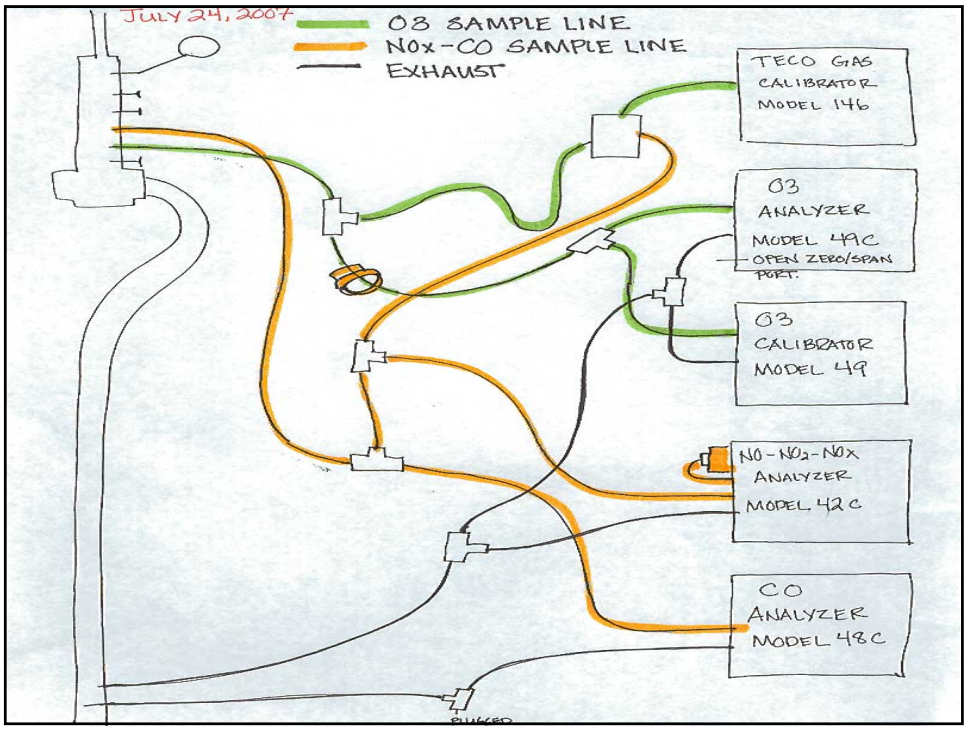




Ute 1 Logbook Review

- An extensive historical log evaluation of the Ute 1 monitoring site was conducted as well as records review which included the evaluation of several photographs depicting the sites gaseous monitoring plumbing history.
- No single definitive change made to the Ute 1 shelters gaseous monitoring plumbing was found to directly result in the differing ozone data values reported levels and trends.

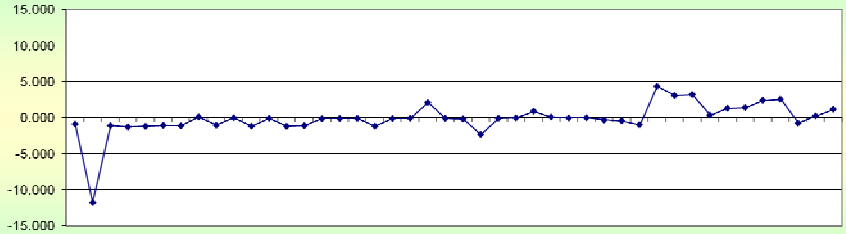

Ozone Calibrator
Ozone Analyzer
External
Solenoid
TE-146
Multi-Gas ►
Calibration system
←Sample
←Lines
CO Analyzer
NOx Analyzer
Zero Air
Supply


JULY 24, 2007
O3 SAMPLE LINE
NOx-CO SAMPLE LINE
EXHAUST
TECO GAS
CALIBRATOR
MODEL 146
O3
ANALYZER
MODEL 49C
OPEN ZERO/SPAN
PORT.
O3
CALIBRATOR
MODEL 49
NO-NO2-NOx
ANALYZER
MODEL 42C
CO
ANALYZER
MODEL 48C
PLUGGED

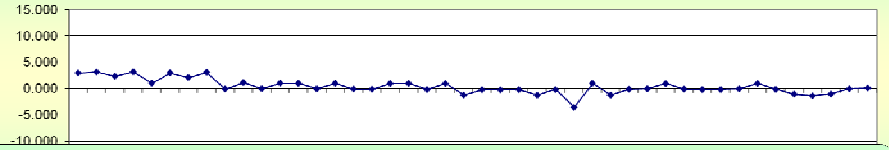
Precision & Accuracy Data Review

- All weekly Z/S/P checks within limits at both sites, from 2004-2008, except once on 2/11/2005, but CL well less than 7%
- Results from DASC:

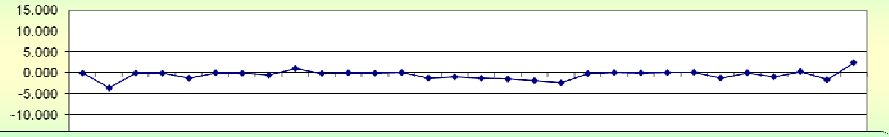
2005:



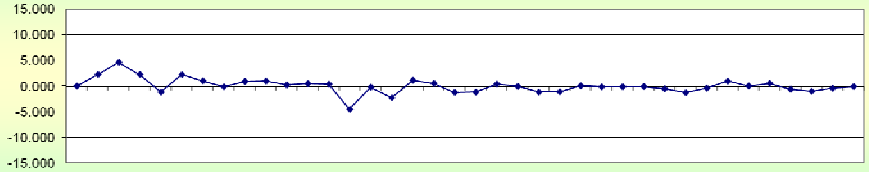
2006:



2007:



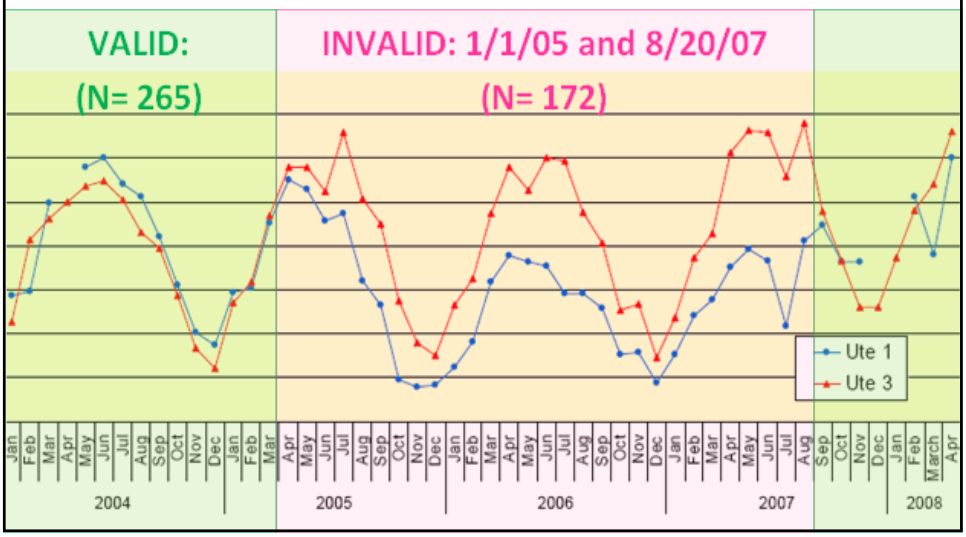
2008:



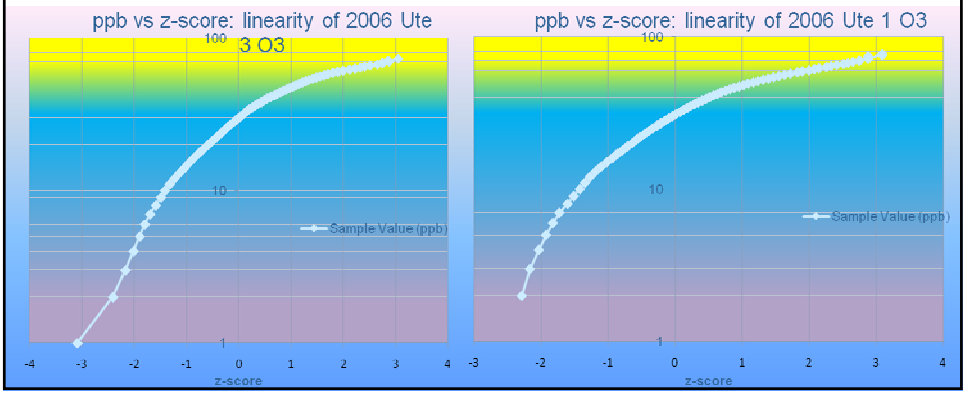
External quarterly audits:

- Thru-the-probe in Aug 2007 passed, although auditor asked about plumbing
- (Same plumbing set-up had produced valid results from ongoing quarterly external audits)
- Quarterly external audits all passed for both sites: from Jan 2005 thru March 2009, with one exception at Ute 1 that was followed by recalibration and invalidation of 2.5 months of data until next passing audit (parts replacement)

Statistical analyses of Ute 1:



THERE A DIFFERENCE BETWEEN THE INVALID AND THE VALID DATA? **(what is the probability that they come from the same underlying distributions?)**



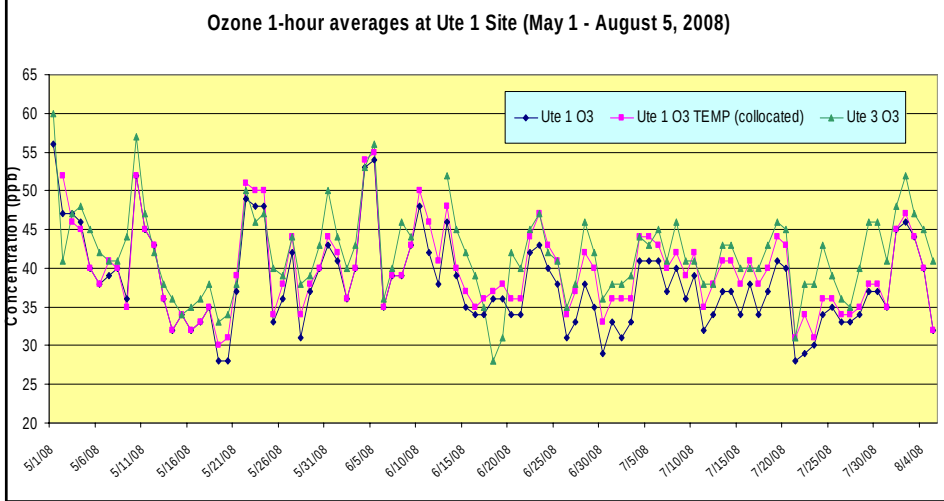
t-Test: Two-Sample Assuming Unequal Variances shows significant difference:

	INVALID	*VALID*
Mean	**0.196**	**-0.0079**
Variance	**0.0169**	**0.029**
Observations	**172**	**265**
Hypothesized Mean Difference	**0**	
df	**424**	
t Stat	**14.1543**	
P(T<=t) one-tail	**8.01E-38**	

Verifying Ute 1's ozone analyzer operation:

- To ensure the validity of the ozone data at Ute 1 for the 2008 ozone season, this site was co-located with a secondary ozone analyzer. The co-located ozone analyzer had a direct sampling line to outdoor ambient air. This co-located ozone analyzer provided verification that the current Ute 1 plumbing system is functioning correctly .

Co-located ozone analyzers at Ute 1: m=1.02, r^2=0.99



TTP Audit:

- A Through-The-Probe Audit was conducted in September 2008 by US EPA Region VII at both Ute 1 and Ute 3 sites.
- Both sites passed with flying colors!

Ute 1: Upgrade Analyzer Set Up

Previous Ute 1 Set Up pre-March 2009

Current Ute 1 Set Up March 2009

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