INTEROFFICE COMMUNICATION

## WASHINGTON STATE PATROL

TO: Dr. Barry K. Logan, State Toxicologist

FROM: Sgt. Rod Gullberg, Breath Test Section

SUBJECT: Approval of Alco-Sensor FST PBT Instrument

DATE: September 27, 2004

The Breath Test Section has been evaluating the Alco-Sensor FST
PBT (Intoximeters, Inc., St. Louis, MO) breath test instrument
for the past few months. This instrument is now being
manufactured to replace our current model - the Alco-Sensor III.
Our evaluation is complete and the summary reports have been
provided here for your review. The analytical results have been
excellent. In addition, the instrument has several features
that are superior to our current Alco-Sensor III instrument.
Based on this information and the results of our evaluation, we
are recommending that the Alco-Sensor FST PBT instrument be
identified in the Washington Administrative Code as an approved
pre-arrest screening device acceptable for law enforcement
purposes in Washington State.
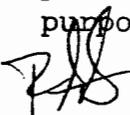
RGG:rg

Cc: Lt. R. S. Reichert, Implied Consent Section

Evaluation of Alco-Sensor FST Pre-Arrest Breath Test Instrument

Summary Report

Instrument Name:

Alco-Sensor FST

Serial Numbers:

Manufacturer:

Intoximeters, Inc.
St. Louis, MO

Instrument Technology:

Electrochemical cell

Instrument Features:

Automatic blank test performance
Large digital display capable of backlighting for night use
Automatic breath sampling parameters
Immediate display of results
Error messages

Instrument Evaluation Results

All analyses noted below were performed at the Roanoke office of the Breath Test Section between March and May 2004

Accuracy and Precision:

Replicate measurements (n=10) were performed on the instrument at four concentrations typical of performing a Quality Assurance Procedure on the Datamaster. The replicate tests were performed on both the Alco-Sensor FST and on a currently approved Alco-

Sensor III. The table below lists both the systematic errors and the coefficient of variation (CV%) for each instrument.

	Approximate concentrations (g/210L)			
	0.04	0.08	0.10	0.15
Alco-Sensor FST (SN 005007)	1.96 (2.40)	3.72 (3.59)	-0.88 (2.87)	1.92 (1.81)
Alco-Sensor III (Tag# SPXM002237)	-5.88 (2.86)	-8.31 (2.98)	-9.50 (3.68)	-21.60 (4.47)

Accuracy and precision were also evaluated by performing either n=15 or n=10 measurements from a simulator on the Alco-Sensor FST, the Alco-Sensor III and on a Datamaster. Simulator solution batch #04002 with a target value near 0.08 g/210L was employed. The results for accuracy and precision (CV) are listed below. On these results, the Alco-Sensor III would not obtain a pre-test blank of 0.003 or less after the second measurement. The run of n=15 on the Alco-Sensor FST was completed in 10 minutes while the run of n=10 was completed in 6 minutes. The runs of n=15 for both PBT instruments were also plotted.

	Systematic Error	Precision (%CV)	n
Alco-Sensor FST (SN 005007)	0.36	2.09	15
Alco-Sensor FST (SN 005007)	-1.33	1.89	10
Alco-Sensor III (Tag# SPXM002237)	-2.37	2.58	15
Datamaster (949241)	5.07	0.85	10

Instrument Recovery Evaluation

The ability of the instrument to recover between extreme sample concentrations was evaluated by introducing both 0.04 and 0.45 g/210L simulator samples in alternating sequence until n=10 measurements were performed at each level. The Alco-Sensor III failed to operate after the fourth test. The mean and standard deviation estimates are shown below. The results were also plotted. All n=20 measurements on the Alco-Sensor FST were completed within 18 minutes.

	0.04		**0.44**	
	Mean	SD	Mean	SD
Alco-Sensor FST (SN 005007)	0.0394	0.0026	0.4447	0.0097
Alco-Sensor III (Tag# SPXM002237)	0.0448	0.0103	0.4038	0.0103

Computing Level of Detection (LOD)

Replicate (n=10) samples were introduced from a simulator with an alcohol concentration near 0.01 g/210L. The LOD was estimated according to: LOD=3SD. The measurements on the Alco-Sensor FST were completed within eight minutes. The results are shown below.

	Mean	SD	LOD
Alco-Sensor FST (SN 005007)	0.0115	0.00085	0.00255
Datamaster (949225)	0.0097	0.0005	0.0015

Acetone Evaluation

These tests were performed on the Alco-Sensor FST. A simulator solution containing 500 ml volume with only ethanol was tested by performing n=3 tests with the results shown below. Acetone (0.5 ml) was then added to the same solution. A total of n=10 tests were then performed again with the instrument. The results are shown below also. Finally, 0.5 ml of acetone was added to a total volume of 500 ml of water only. Again, n=10 tests were performed on this solution containing acetone only with the results shown below.

Alcohol Only		Alcohol + Acetone		Acetone Only	
1	0.083	1	0.082	1	0.000
2	0.083	2	0.086	2	0.000
3	0.083	3	0.083	3	0.000
		4	0.083	4	0.000
		5	0.084	5	0.000
		6	0.086	6	0.000
		7	0.082	7	0.000
		8	0.086	8	0.000
		9	0.083	9	0.000
		10	0.084	10	0.000
mean =	0.083		0.0839		0
SD =	0		0.001595		0

Conclusions: A acetone/water solution containing 0.5 ml acetone has a vapor concentration of 2310 μg/L of acetone. This far exceeds that found on the breath of even diabetics in a state of ketoacidosis. The fuel cell in the Alco-Sensor FST is insensitive to the presence of acetone and continues to provide accurate measurement of vapor ethanol when combined with vapor acetone.

Extreme Concentrations

A solution of fermented apple cider was placed in a simulator and heated to 34^0 C. Three measurements were performed in the Alco-Sensor FST. The following were the results:

1.10 g/210L
       1.12 g/210L
       1.14 g/210L

This indicates the extreme range for the instrument. The
measurements were performed as with any others at lower levels.
The fuel cell cleared as quickly as it does at lower
concentrations with blank values of 0.000 g/210L being observed.
The fuel cell clears very quickly even at these extreme
concentrations.

Results From Arrested DUI Subjects

Alco-Sensor FST PBT instruments were used by a few troopers during
the summer of 2004 in association with routine DUI arrests. In
addition, an Alco-Sensor FST PBT was also used to test willing
subjects arrested for DUI during an emphasis patrol in September
2004. The mean of duplicate Datamaster results were used to
compare to a single FST PBT result. The times between the
Datamaster and FST PBT tests ranged from one minute to 19 minutes.
A t-test for paired data (n=28) was performed in addition to
computing a 95% confidence interval for the difference. A summary
of the results are shown below:

| Mean Difference (Datamaster – FST)	t-statistic	p-value	95% CI
-0.00073 g/210L	-0.58	0.57	-0.0032 to 0.0018

The results show there were no significant differences between the
mean of the Datamaster results and the single FST PBT results.
Attached are three plots summarizing these results.

9/27/2004
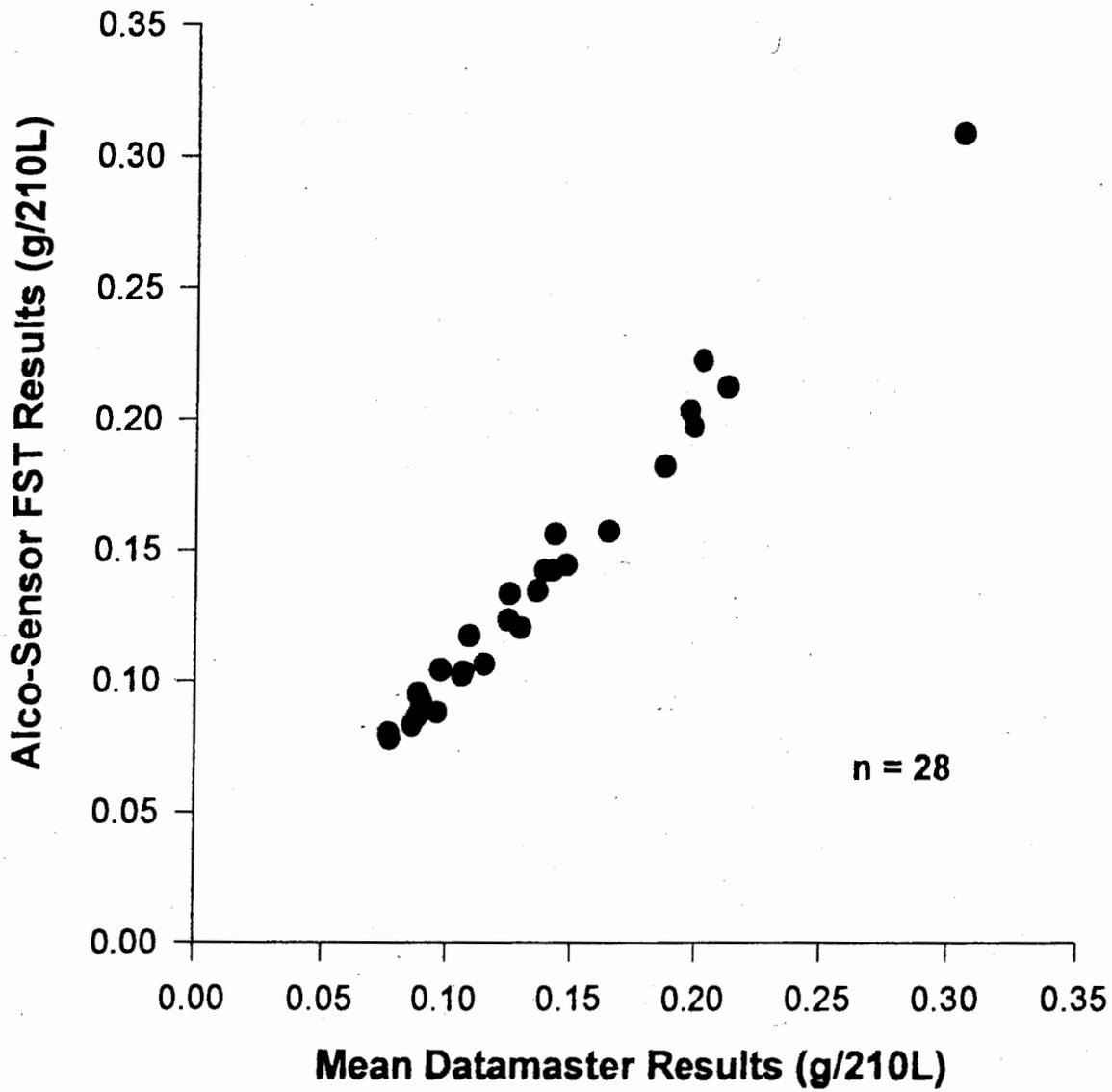
Plot of Breath Alcohol Results Measured By The Alco-Sensor FST Against The Mean of Duplicate Measurements By the BAC Datamaster

Plot of Breath Alcohol Results Measured By The Alco-Sensor FST Against The Mean of Duplicate Measurements By the BAC Datamaster

$Y = 1.02X - 0.0024$
$S_{yx} = 0.0067$ g/210L
$r = 0.99$
$n = 28$
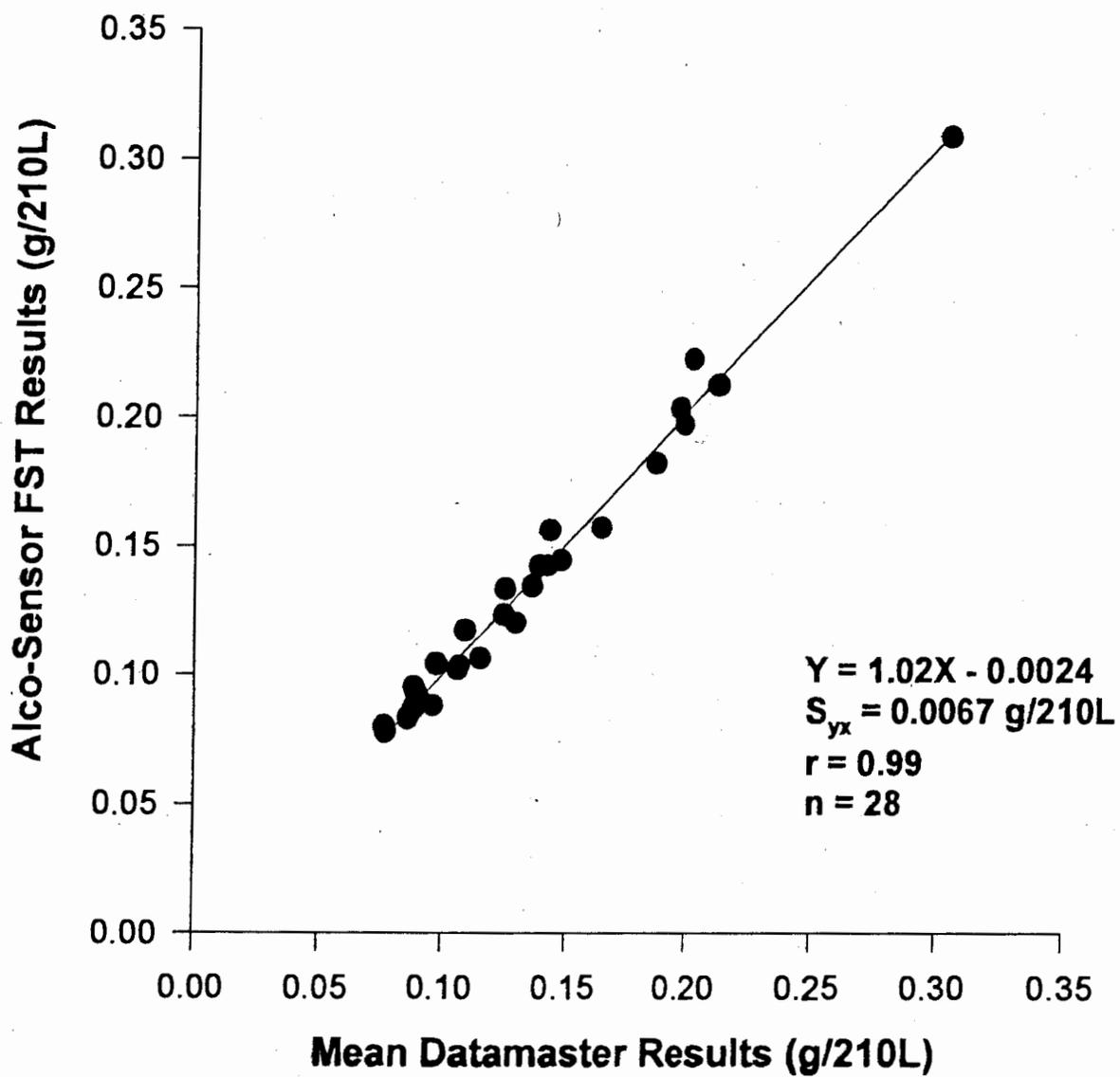
Plot of The Difference (Datamaster - PBT) Between Datamaster Result and AlcoSensor FST Result Against Their Mean Result