A.9 WET ELECTROSTATIC PRECIPITATOR FOR PM CONTROL--FACILITY I

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EXAMPLE COMPLIANCE ASSURANCE MONITORING:
WET ELECTROSTATIC PRECIPITATOR FOR PM CONTROL--FACILITY I

I. Background

A. Emissions Unit

Description:	Green Dryers No. 1 & 2
Identification:	203, 205
Facility:	Facility I Anytown, USA

B. Applicable Regulation, Emission Limits, and Monitoring Requirements

Regulation No.:	OAR 340-21, permit
Emission limits :	
Particulate Matter:	0.2 gr/dscf (No. 1) 0.1 gr/dscf (No. 2) (3-hour average)
Monitoring requirements:	WESP secondary voltage

C. Control Technology
Wet electrostatic precipitator (WESP).

II. Monitoring Approach

The key elements of the monitoring approach are presented in Table A.9-1.

TABLE A.9-1. MONITORING APPROACH

I. Indicator	WESP voltage.
Measurement Approach	The WESP voltage is measured using a voltmeter.
II. Indicator Range	An excursion is defined as a voltage less than 30 kV for more than 6 minutes, continuously. Excursions trigger an inspection, corrective action, and a reporting requirement.
QIP Threshold[a]	Six excursions in a 6-month reporting period.
III. Performance Criteria A. Data Representativeness[b]	The voltmeter is part of the WESP design and is included in the transformer/rectifier set. It has a minimum accuracy of $\pm$1 kV.
B. Verification of Operational Status	NA
C. QA/QC Practices and Criteria	Confirm voltmeter zero when unit not operating (at least semi-annually).
D. Monitoring Frequency	Measured continuously.
Data Collection Procedures	Recorded as a 6-minute average.
Averaging Period	6-minute average.

[a]Note: The QIP is an optional tool for States; QIP thresholds are not required in the CAM submittal.
[b]Values listed for accuracy specifications are specific to this example and are not intended to provide the criteria for this type of measurement device in general.

MONITORING APPROACH JUSTIFICATION

I. Background

The pollutant-specific emission units are green dryers No. 1 and No. 2. The dryers are three pass horizontal rotary drum dryers, with direct heat sources of sanderdust, natural gas, distillate fuel oil, boiler flue gas, or any combination thereof. Green dryer No. 1 was manufactured by Heil and green dryer No. 2 was manufactured by Westec America. Green wood shavings are dried in these dryers before mixing with dry wood shavings and drying in the dry dryers. Wood entering the green dryers may range from 25 to 50 percent moisture and exit with 15 to 20 percent moisture. The green dryer exhaust streams are each controlled by a Geoenergy WESP.

II. Rationale for Selection of Performance Indicator

In a WESP, electric fields are established by applying a direct-current voltage across a pair of electrodes: a discharge electrode and a collection electrode. Particulate matter and water droplets suspended in the gas stream are electrically charged by passing through the electric field around each discharge electrode (the negatively charged electrode). The negatively charged particles and droplets then migrate toward the positively charged collection electrodes. The particulate matter is separated from the gas stream by retention on the collection electrode. Particulate is removed from the collection plates by an intermittent spray of water. The WESP voltage was selected as a performance indicator because the voltage drops when a malfunction, such as grounded electrodes, occurs in the WESP. When the voltage drops, less particulate is charged and collected.

The dryer exhaust will bypass its associated WESP if the WESP is shut down while the process is operating. These periods are documented and reported.

III. Rationale for Selection of Indicator Range

The selected indicator level is a voltage of greater than 30 kV. An excursion is defined as any period during which the voltage is less than 30 kV for more than 6 minutes, continuously. When an excursion occurs, corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. All excursions will be documented and reported.

The indicator range for the WESP voltage was selected based upon the level maintained during normal operation and during the performance test. The normal operating voltage is set at the highest level achievable without having an excessive spark rate. Based on field experience, voltage levels less than 30 kV during normal operation result in unacceptable opacity readings. During abnormal operation or a malfunction (such as grounded electrodes), the WESP kV levels are appreciably lower than normal operational levels. A time interval of 6 minutes was chosen to account for the routine 2-minute flush cycles the WESP's undergo, which cause the voltage to drop below 30 kV. Data obtained during the most recent performance test confirmed the unit was in compliance with the particulate matter emissions limit. During testing, the WESP's operated with voltages in the range of 34 to 45 kV.

The most recent performance test using compliance test methods (ODEQ Method 7 for

particulate and RM 9 for visible emissions) was conducted on April 22 and 25, 1996. Three test runs were conducted on each dryer. During this test, the measured PM emissions ranged from 0.009 to 0.013 gr/dscf. Visible emission opacity observations were conducted during the particulate testing. All visible emissions observations during the performance test were 0 to 5 percent opacity (no reading exceeded the permit limit of 20 percent). During the emissions tests, the WESP voltages were measured continuously, and 6-minute averages were charted. During the performance test, the measured particulate emissions were well below the emission limitations (0.2 gr/dscf for green dryer No. 1 and 0.1 gr/dscf for green dryer No. 2). The complete test results are documented in the test report.

Indicator data for the period of October through December of 1996 have been reviewed. These data include 6-minute average WESP voltage graphs and copies of entries in the logbook used to record equipment malfunctions and maintenance. Voltage excursions resulting in an alarm occurred two times during the 3-month period on the WESP on dryer No. 1. One alarm was the result of recycle water overflow and one was the result of a full E-tube chamber. Voltage excursions resulting in an alarm occurred three times during the 3-month period on the WESP on dryer No. 2; once because the recycle water system was plugged, once due to a recycle flow warning, and once because 4 probes were misaligned. Normal operation was in the range of 40 to 50 kV, except during the short flush cycles. Based on the data collected, the indicator level of 30 kV is adequate.

Based on a review of historical data, the QIP threshold established for the WESP voltage is six excursions in a 6-month reporting period. This level is less than 1 percent of the WESP operating time. If the QIP threshold is exceeded in a semiannual reporting period, a QIP will be developed and implemented. (Note: Submitting a proposed QIP threshold with the monitoring approach is not required.)

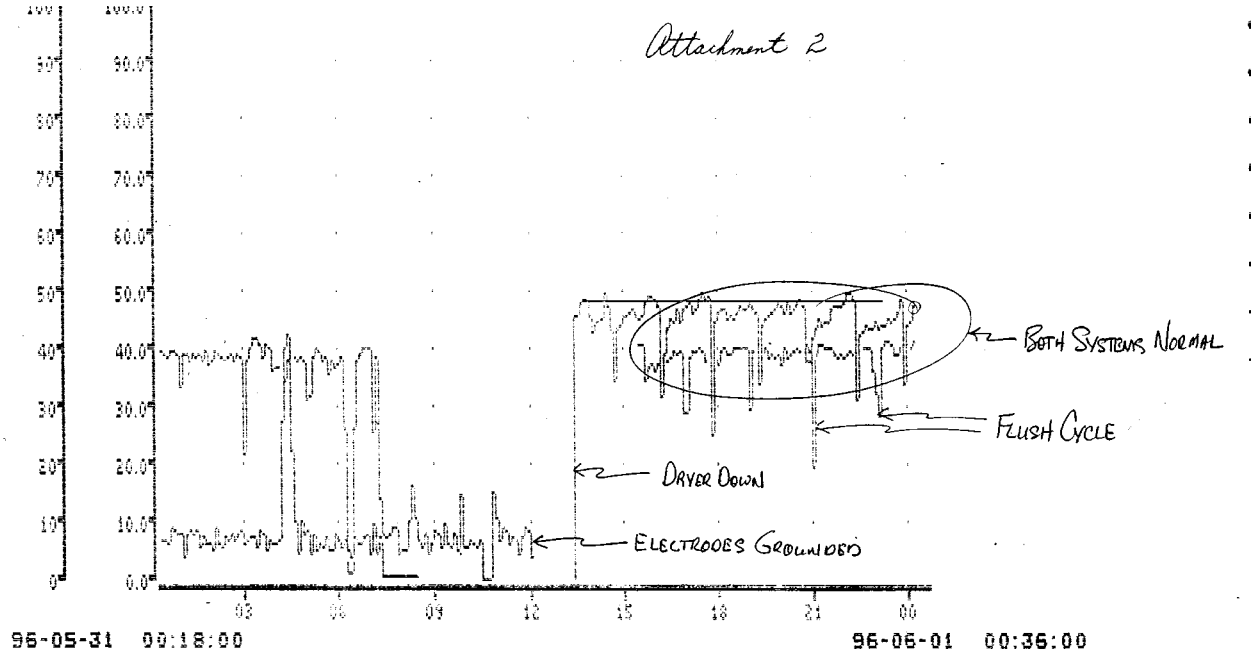

Figure A.9-1. WESP voltage levels.

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A.9b WET ELECTROSTATIC PRECIPITATORS (WESP) FOR PM CONTROL OF VENEER DRYERS – FACILITY P

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EXAMPLE COMPLIANCE ASSURANCE MONITORING
WET ELECTROSTATIC PRECIPITATORS (WESP) FOR PM CONTROL – FACILITY P

I. Background

A. Emissions Unit

Description:	Steam-heated dryers used in plywood manufacturing
Identification:	Veneer Dryers 1-6 (EU2)
APCD ID:	WESP 1, WESP 2
Facility:	Facility P Anytown, USA

B. Applicable Regulation and Emission Limit

Regulation No.:	Permit, State Regulation
Emission limits: Particulate Matter (PM):	0.3 lb/1,000 ft^2 (MSF) dried (3/8-inch thickness basis)
Monitoring Requirements:	Monitor WESP secondary voltage, quench inlet temperature, and WESP outlet temperature.
C. Control Technology	Wet electrostatic precipitator

II. Monitoring Approach

The key elements of the monitoring approach are presented in Table A.9b-1. The selected indicators of performance are: WESP secondary voltage, quench inlet temperature, and WESP outlet temperature. The selected indicator ranges are based on hourly average values.

TABLE A.9b-1. MONITORING APPROACH

	Indicator No. 1	Indicator No. 2	Indicator No. 3
I. Indicator	WESP secondary voltage.	Quench inlet temperature.	WESP outlet temperature.
Measurement Approach	The WESP secondary voltage is monitored using a voltmeter.	The gas temperature is measured with a thermocouple at the quench inlet.	The gas temperature is measured with a thermocouple at the WESP outlet.
II. Indicator Range	An excursion is defined as an hourly average voltage less than 35 kV. Excursions trigger an investigation, corrective action, and a reporting requirement.	An excursion is defined as an hourly average quench inlet temperature >375˚F. Excursions trigger an investigation, corrective action, and a reporting requirement.	An excursion is defined as an hourly average outlet temperature >175˚F. Excursions trigger an investigation, corrective action, and a reporting requirement.
III. Performance Criteria A. Data Representativeness	The monitoring system consists of a voltmeter that is part of the WESP instrumentation (TR controller). The minimum accuracy of the voltmeter is ±0.5 kV.	The monitoring system consists of a thermocouple located in the quench inlet ductwork. The minimum accuracy of the thermocouple is ±2.2˚C (±4˚F) or 0.75 percent of the measured temperature in ˚C, whichever is greater.	The monitoring system consists of a thermocouple located in the WESP outlet ductwork. The minimum accuracy of the thermocouple is ±2.2˚C (±4˚F) or 0.75 percent of the measured temperature in ˚C, whichever is greater.
B. Verification of Operational Status	NA	NA	NA
C. QA/QC Practices and Criteria	Voltmeter zero check during scheduled maintenance performed every 3 weeks.	Thermocouples calibrated annually by comparison against an instrument of known accuracy. The acceptance criteria is ±4˚F.	Thermocouples calibrated annually by comparison against an instrument of known accuracy. The acceptance criteria is ±4˚F.
D. Monitoring Frequency	The voltage on each WESP is monitored continuously (one data point per minute).	The quench inlet temperature is monitored continuously (one data point per minute).	The WESP outlet temperature is monitored continuously (one data point per minute).
Data Collection Procedure	Data are recorded on the continuous parameter monitoring system (CPMS) computer.	Data are recorded on the CPMS computer.	Data are recorded on the CPMS computer.
Averaging Period	Hourly block average.	Hourly block average.	Hourly block average.

MONITORING APPROACH JUSTIFICATION

I. Background

The pollutant-specific emissions units (PSEU) are the two WESPs that control six veneer dryers. The dryers are longitudinal, steam-heated dryers manufactured by Coe and Moore and are used in the manufacture of plywood. Veneer is introduced into the dryer either manually or using automated veneer sheet feeders. The dried veneer sheets pass through a moisture detector as they exit the dryer where any sheets not meeting moisture specifications are marked and sorted for redrying. Dry veneer sheets are coated with mixed glue and formed into panels.

Two WESPs, also referred to as E-tubes, remove particulate matter from the dryer exhaust. WESP No. 1 serves dryers Nos. 1, 5, and 6 and WESP No. 2 serves dryers Nos. 2, 3, and 4.

II. Rationale for Selection of Performance Indicators

A WESP is designed to operate at a relatively constant voltage. A significant decrease in voltage is indicative of a change in operating conditions that could lead to an increase in emissions. Low voltage can indicate electrical shorts or poor contacts that require maintenance or repair of electrical components. However, the regular flush cycles the WESPs undergo to remove the particulate from the collection surfaces may also cause drops in voltage of short duration. These brief voltage drops are part of the normal operation of the WESP.

Monitoring gas stream temperature can provide useful information about the performance of a WESP. Quench inlet temperature primarily is an indication that the inlet gas stream is not so hot that a fire may develop in the duct work or WESP. In addition, the gas stream needs to be cooled in order for some of the pollutants to condense. The WESP outlet temperature indicates that the gas stream has been sufficiently saturated to provide for efficient particle removal, and that the water spray prior to the WESP inlet is functioning. High outlet temperatures could be the result of plugged nozzles, malfunctioning pumps, or broken or plugged piping.

III. Rationale for Selection of Indicator Ranges

The selected indicator ranges are given below:

Secondary voltage:	$\geq$35 kV
Quench inlet temperature:	$\leq$375°F
Stack outlet temperature:	$\leq$175°F

An excursion is defined as (1) an hourly average voltage less than 35 kV; (2) an hourly average quench inlet temperature greater than 375˚F; or (3) an hourly average WESP outlet temperature greater than 175˚F. When an excursion occurs, corrective action will be initiated beginning with an evaluation of the occurrence to determine the action required to correct the situation. All excursions will be documented and reported. An hourly average was chosen to account for the intermittent flush cycles the WESPs undergo that cause the voltage to drop temporarily.

The indicator level for the WESP voltage was selected based upon the level maintained during normal operation. Typical operating voltages range from 35 to 55 kV. During the most recent performance test, the voltage ranged from 35 to 54 kV and the PM emissions were below allowable levels. An indicator level at the low end of the normal operating range was selected (35 kV). During a malfunction (such as an electrical short), the WESP voltage levels are appreciably lower than normal operational levels. The voltage also drops for a short period during the normal flush cycles that are performed every few hours to clean the tube surface where particulate is collected. Figure A.9b-1 displays the hourly average WESP secondary voltage during October 1997 for WESP No. 1.

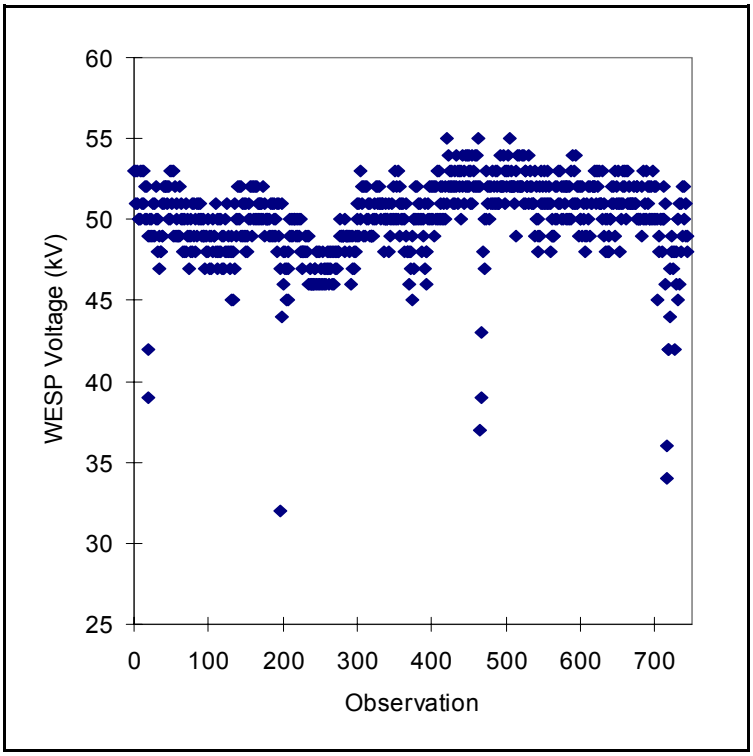

Figure A.9b-1. October 1997 hourly average secondary voltage (WESP No. 1).

The indicator levels for the quench inlet and WESP outlet gas temperatures also were selected based on levels maintained during normal operation. High temperatures may indicate a fire in the dryer or ductwork or a lack of water flow to the WESP. Temperature action levels were selected that are slightly higher than normal operating temperatures. If the water flow to the WESP is lost, the WESP outlet temperature will begin to approach the inlet temperature, which is much higher than 175˚F. Figures A.9b-2 and A.9b-3 display the hourly average quench inlet and WESP outlet temperature during October 1997 for WESP No. 1.

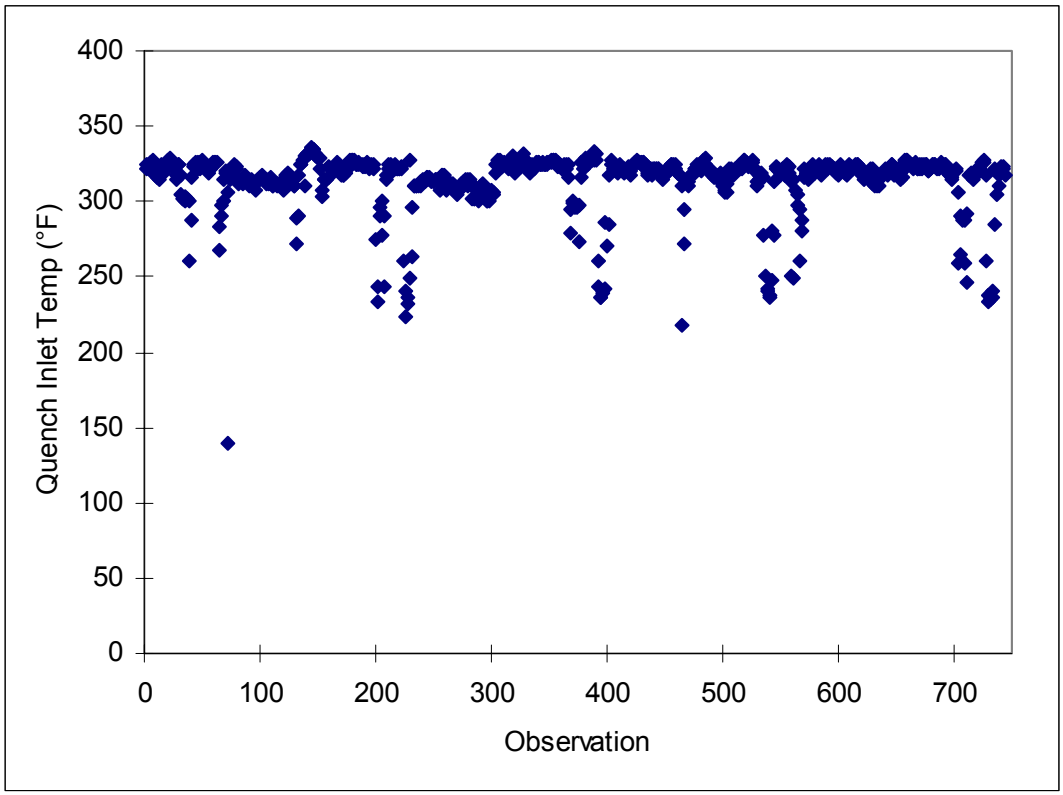

Figure A.9b-2. October 1997 Hourly Average Quench Inlet Temperature (WESP No. 1)

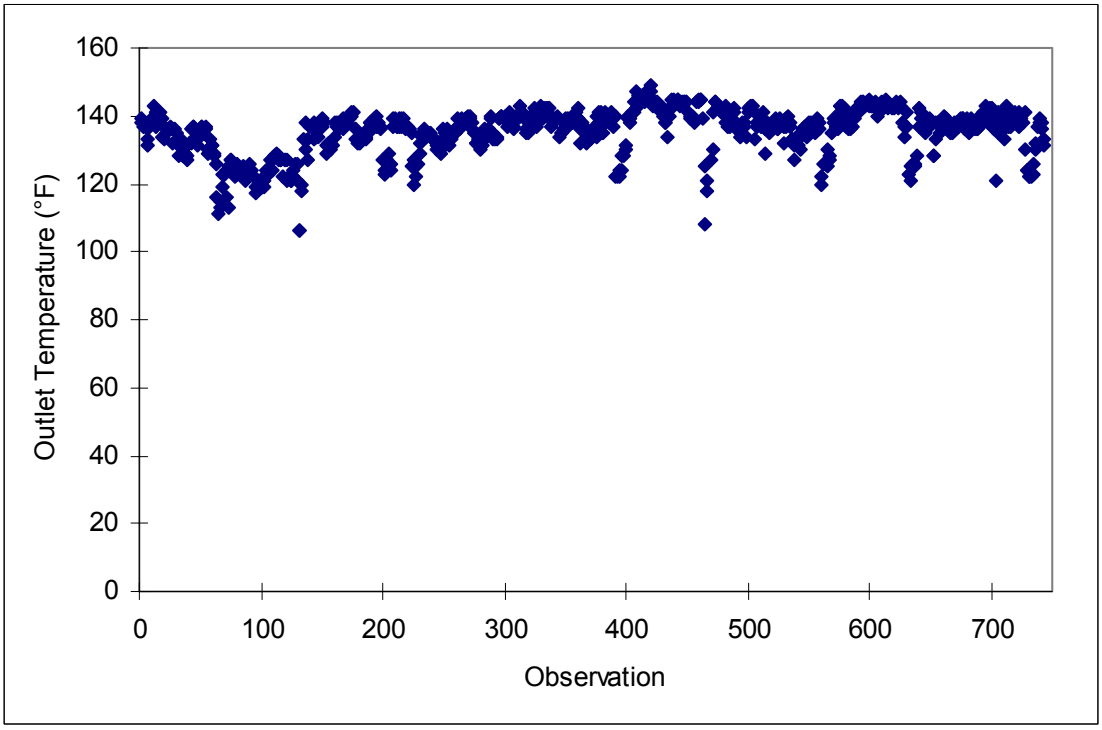

Figure A.9b-3. October 1997 Hourly Average WESP Outlet Temperature (WESP No. 1)

Indicator data for December 1995 to January 1996 and for October 1997 through December 1997 were reviewed. These data included hourly average WESP secondary voltage, quench inlet temperature, and WESP outlet temperature measurements. The maximum hourly average quench inlet temperature for WESP No. 1 was 336˚F, while the maximum for WESP No. 2 was 352˚F. The maximum hourly average stack outlet temperature for WESP No. 1 was 151˚F, while the maximum stack outlet temperature for WESP No. 2 was 178˚F. The average monthly voltages ranged from 47 to 51 kV for WESP No. 1 and from 40 to 46 kV for WESP No. 2.

Data obtained during the most recent performance test (October 1996) confirmed the unit was in compliance. During this test, the average measured PM emissions were 0.19 lb/MSF dried for WESP No. 1 and 0.21 lb/MSF dried for WESP No. 2. The measured particulate emissions were below the emission limitation of 0.3 lb/MSF dried (3/8-inch thickness basis). The WESP operating parameters during the performance test are summarized in Table A.9b-2.

TABLE A.9b-2. WESP OPERATING PARAMETERS DURING THE MOST RECENT PERFORMANCE TEST

WESP No.	Run	Production, ft^2/hr	Particulate, lb/MSF dried (3/8-inch basis)	WESP voltage, kV	Quench inlet T (˚F)	WESP outlet, T (˚F)
1	1	22,760	0.24	54	317	134
	2	23,419	0.17	54	318	134
	3	23,075	0.17	--	--	--
	Average	23,085	0.19	54	318	134
2	1	23,899	0.24	35	328	147
	2	32,238	0.17	38	332	143
	3	26,897	0.20	40	331	147
	Average	27,678	0.21	38	330	146