Appendix A – Description of E-Calc Software

E-Calc is Minnich and Scotto's proprietary, Windows-based emission-calculation software developed specifically for use with Kassay Field Services' open-path FTIR spectrometer. Created originally to help municipal solid waste landfill owners comply with mandated emission reporting and permitting requirements for methane and other greenhouse gases, e-Calc generates 15-minute-averaged, emission-rate "snapshots," in real time, for any type of leaking source. Based on the area-source emission technique (modified to include non-buoyant, point sources), the software combines AERMOD – U.S. EPA's Guideline air dispersion model for regulatory application – with coincident on-site meteorological data, path-integrated concentration (PIC) data, and other information to calculate these emission-rate snapshots.

Figure 1 illustrates the e-Calc measurement system. Most input data is entered into the software program from directly measured data. Pre-identified source locations, together with FTIR beam-path coordinates, are entered into a simple data input screen.

Figure 1. E-Calc Measurement System

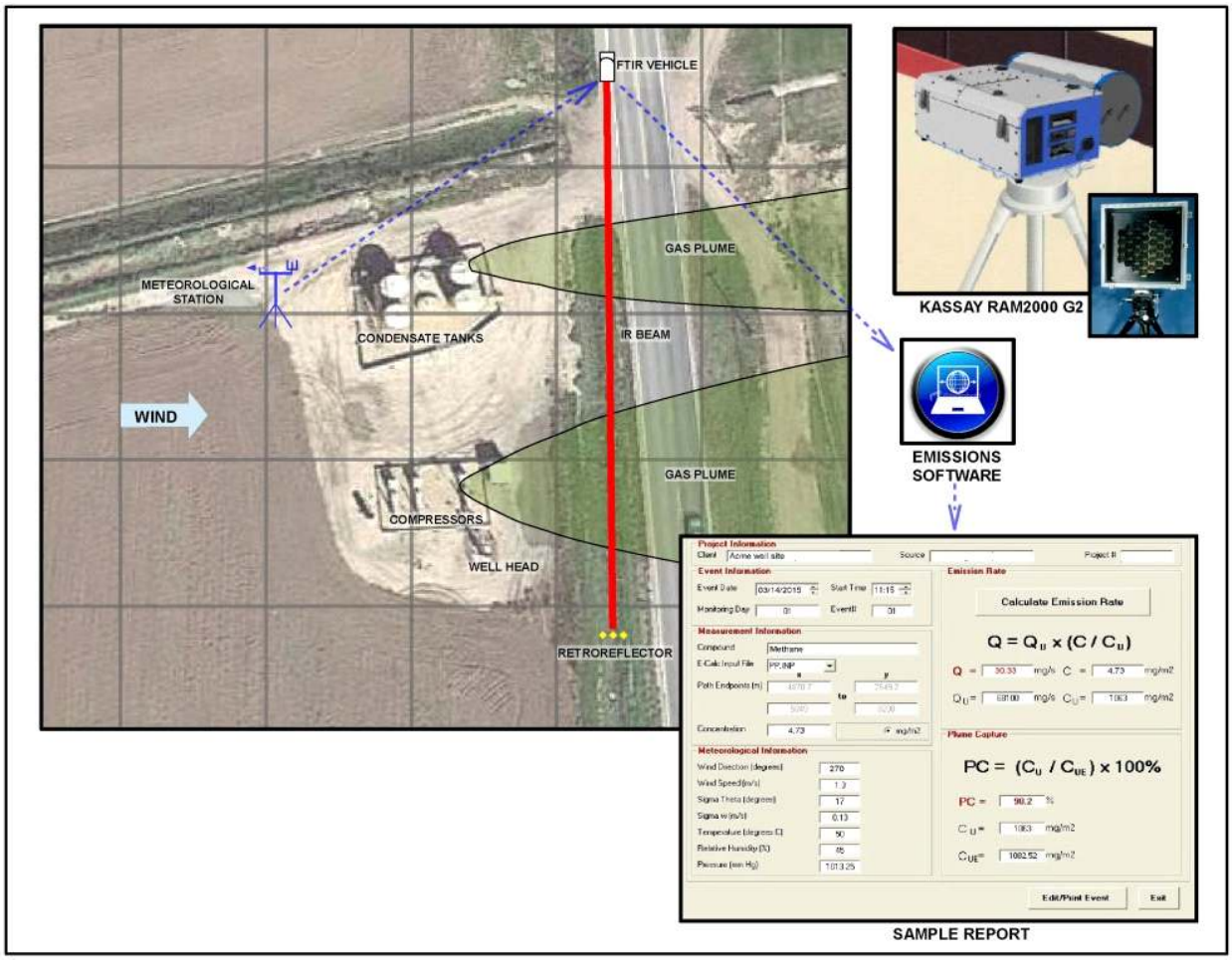


Figure 2 depicts the functional logic for e-Calc. Certain simplifying modifications will be employed in order to facilitate the measurement of many sources in a rapid manner. These include the imaging camera to determine leak location and relative source strength, which will not be used for this project.

E-Calc employs the U.S. EPA regulatory version of AERMOD in order to maintain its legal status as a Guideline model. The AERMOD output file includes all input data, a model set-up summary, and unity-modeling results.

Figure 3 presents a sample e-Calc monitoring event report for another project. Set-up menus are employed for entering requisite emission-characterization and monitoring configuration data. A separate input screen is utilized for entry of event-specific data leading to the generation of individual, hard-copy reports for each monitoring event.

Two or more sequential, 15-minute monitoring events will be performed at each source.

Figure 2. E-Calc2 Functional Logic

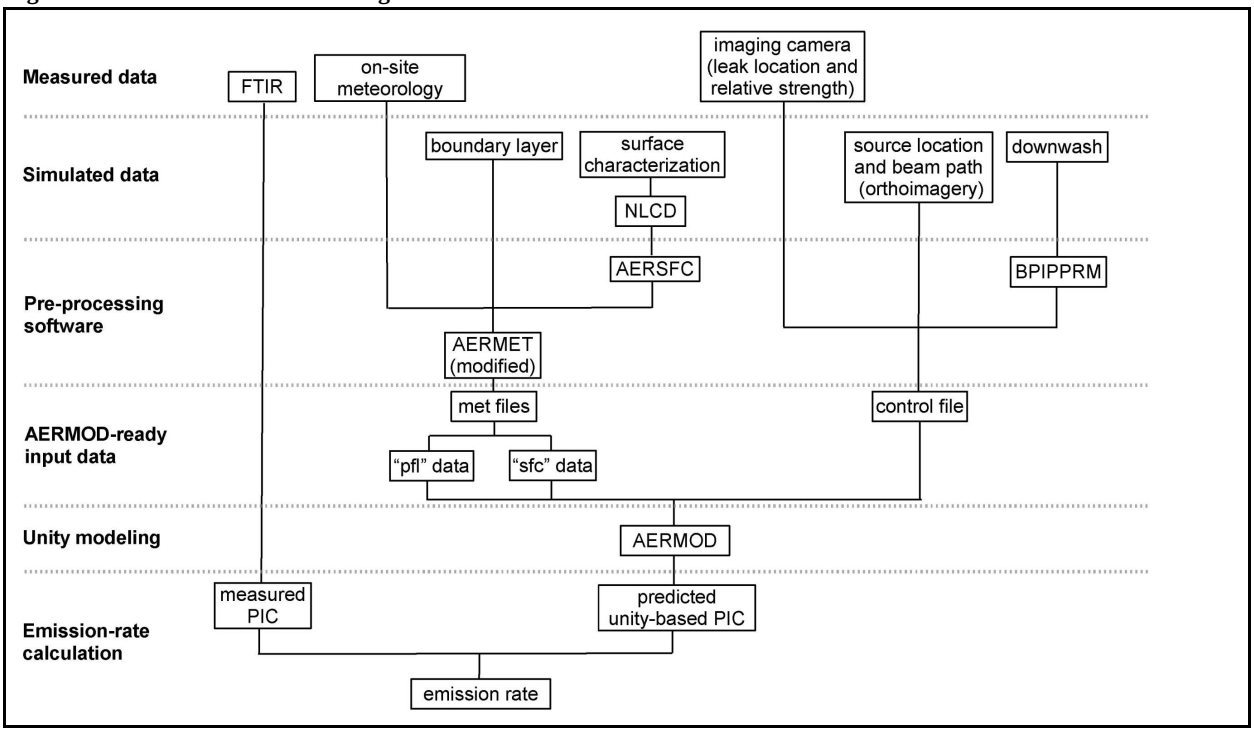
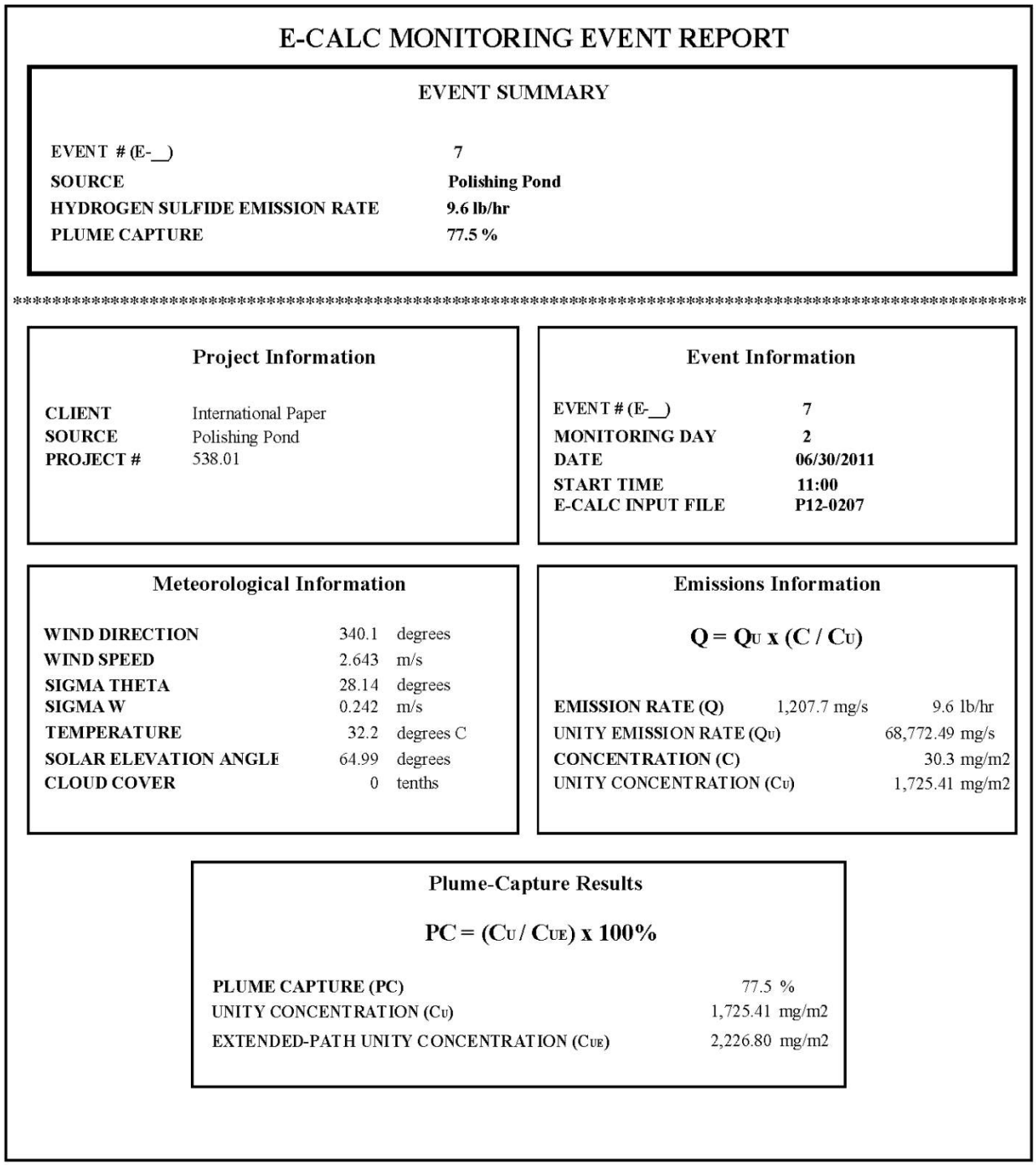


Figure 3. Sample E-Calc Monitoring Event Report



E-CALC MONITORING EVENT REPORT

EVENT SUMMARY

EVENT # (E-__)	7
SOURCE	**Polishing Pond**
HYDROGEN SULFIDE EMISSION RATE	**9.6 lb/hr**
PLUME CAPTURE	**77.5 %**

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Project Information

CLIENT	International Paper
SOURCE	Polishing Pond
PROJECT #	538.01

Event Information

EVENT # (E-__)	**7**
MONITORING DAY	**2**
DATE	**06/30/2011**
START TIME	**11:00**
E-CALC INPUT FILE	**P12-0207**

Meteorological Information

WIND DIRECTION	340.1	degrees
WIND SPEED	2.643	m/s
SIGMA THETA	28.14	degrees
SIGMA W	0.242	m/s
TEMPERATURE	32.2	degrees C
SOLAR ELEVATION ANGLE	64.99	degrees
CLOUD COVER	0	tenths

Emissions Information

$$Q = Q_U \times (C / C_U)$$

EMISSION RATE (Q)	1,207.7 mg/s	9.6 lb/hr
UNITY EMISSION RATE (Q_U)		68,772.49 mg/s
CONCENTRATION (C)		30.3 mg/m2
UNITY CONCENTRATION (C_U)		1,725.41 mg/m2

Plume-Capture Results

$$PC = (C_U / C_{UE}) \times 100\%$$

PLUME CAPTURE (PC)	77.5 %
UNITY CONCENTRATION (C_U)	1,725.41 mg/m2
EXTENDED-PATH UNITY CONCENTRATION (C_{UE})	2,226.80 mg/m2

Emission rates of each target compound is calculated in accordance with the area-source technique, in which the following relationship holds:

$$\mathbf{C_M / Q_A = C_U / Q_U}$$

where:

C_M	=	measured path-integrated concentration (attribution) (mg/m^2)
Q_A	=	actual emission rate (mg/s)
C_U	=	predicted unity-based path-integrated concentration along the measurement path (mg/m^2)
Q_U	=	unity-based emission rate (mg/s)

This equation describes the inherent relationship between: (a) the unity-based dispersion modeling; and (b) the actual emission rate and downwind measurements. The cornerstone of the area-source technique, this ratio states that the measured path-integrated concentration is to the actual emission rate as the unity-based, path-integrated (modeled) concentration is to *its* unity-based emission rate. The only unknown term in this equation is the actual emission rate (Q_A).

The FTIR generates the measured path-integrated concentration (C_M). AERMOD is configured to predict every meter along the FTIR beam path; these predictions get summed to derive the predicted unity-based path-integrated concentration (C_U). The unity-based emission rate (Q_U) is straightforward, unless there are multiple leaks of varying strength; in such cases, multiples of unity will be automatically assigned based on best professional judgement.