

## PureChoice Background

PureChoice is an information technology company that has established a new benchmark for indoor air quality monitoring. The company has developed a revolutionary, breakthrough technology that continuously monitors, measures, stores and reports critical indoor air quality (IAQ) information to customers through the Internet.

PureChoice was founded in 1992 to provide customers with the technology and equipment that delivered clean air and water. When the U.S. Environmental Protection Agency and other federal agencies sounded the alarm about the dangers of exposure to indoor air pollutants, PureChoice focused its vitality on documenting air quality information in commercial buildings, schools, hospitals and other public places.

PureChoice was recently awarded the 2003 ASHRAE Innovation Award for indoor air quality technology and has been featured in many outstanding industry publications, including *ASHRAE Journal*, *Engineered Systems*, *ACHR News* and *American Schools & Universities*. The company has also been featured on PBS's Business and Technology Network on Gen. Alexander Haig's "World Business Review – On Location" and on "Environmental Journal."

The company features sound, experienced, progressive, professional leadership combined with creativity and innovation -- constantly improving and seeking more effective and efficient technology solutions. PureChoice prides itself in providing the best service to its customers and network of strategic partners.

Yorkland Controls is a proud strategic partner of PureChoice.

## The IAQ Solution

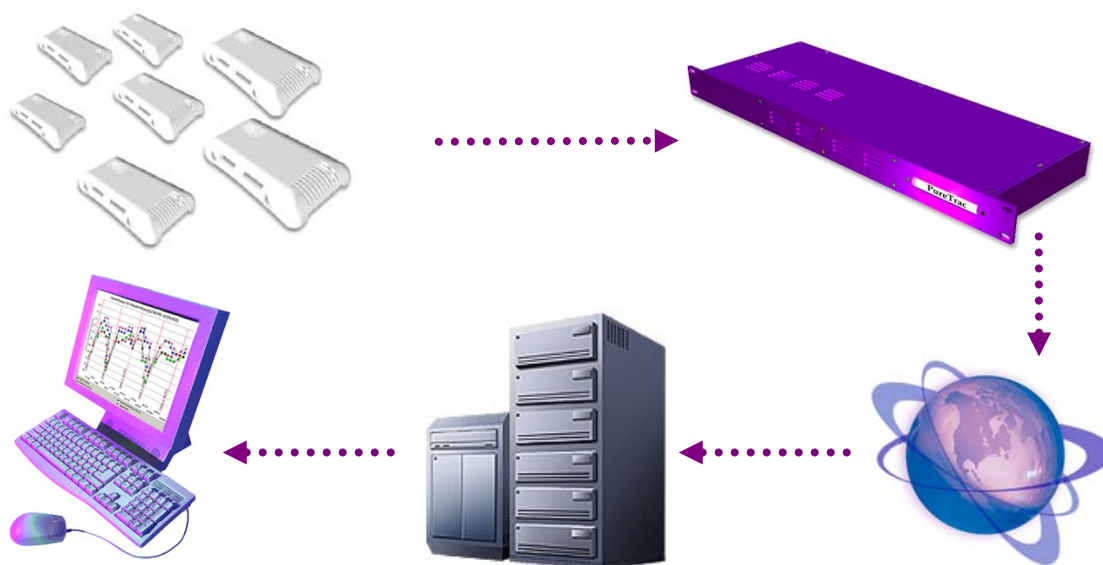
The PureTrac<sup>®</sup> Air Monitoring System is a proactive approach towards indoor air quality in your facility and is an important component of any ventilation strategy and IAQ management plan.

PureTrac is the industry leader in its cost-effective design and operation, application of new technologies, ease of use and high degree of customer satisfaction. PureTrac uses Nose<sup>®</sup> Monitors, self-contained sensor arrays that monitor temperature, humidity, carbon dioxide, carbon monoxide, and odors and gases (VOCs).

Noses use LonTalk<sup>®</sup> protocol for all communication and data transmission, and the Neuron<sup>®</sup> microprocessor developed by Echelon<sup>®</sup> Corporation. Each Nose has a unique identity and position within the data collecting system, allowing multiple Noses to be connected on a single communication line, in any topology.

## How PureTrac works

IAQ information is communicated as a standard network variable type (SNVT) and updated every few seconds, depending on the particular IAQ parameter. This information is retrieved from a customer site through a secure communications device connected via a persistent Internet connection, identified with a dedicated IP address and then transferred into a secure database at PureChoice's facility. Redundant data collection, storage, customer access systems and websites ensure data integrity and continuity.

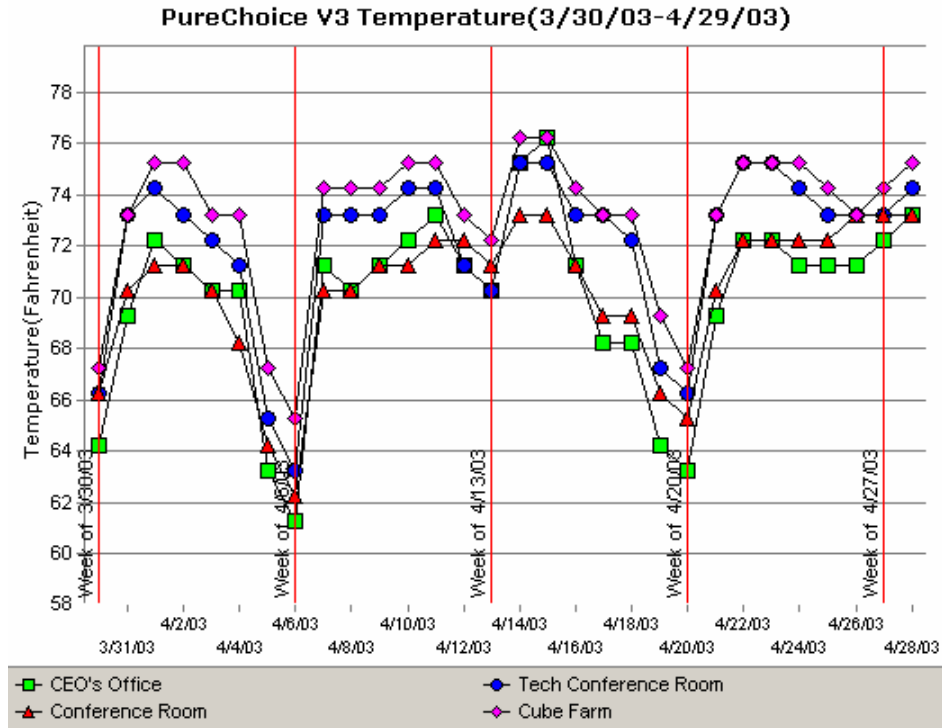


Using a secure username and password, customers can access data from their facility through the PureChoice's website and can view average data for all five parameters for Nose monitors in their facility. Averages are updated every five minutes and displayed in charts and tables. Instantaneous readings can be viewed in real time through a graphical interface that is updated automatically as new readings are received.

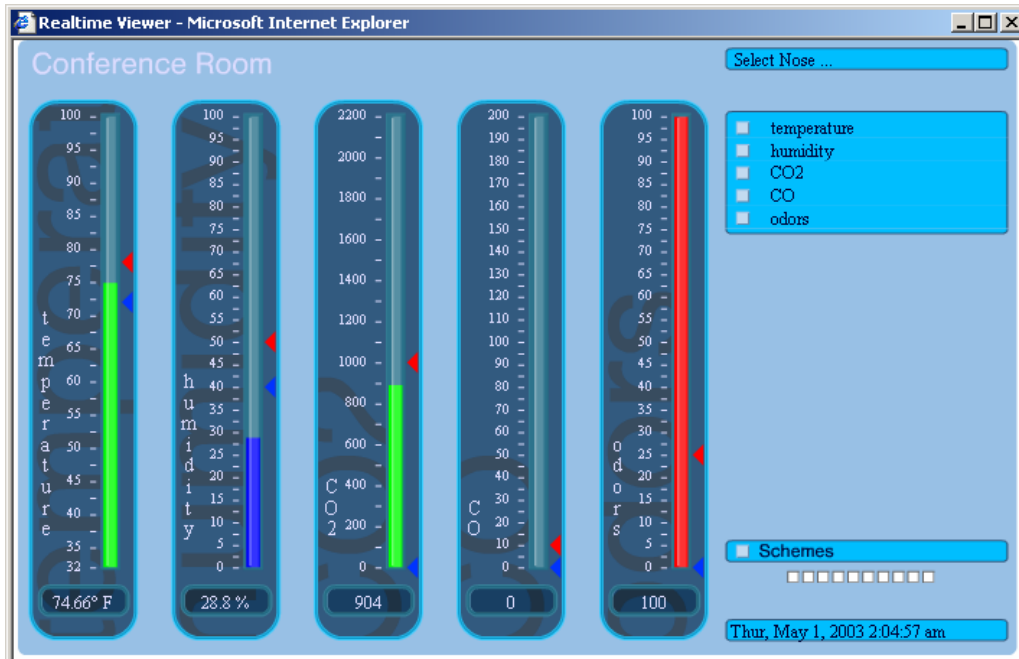
Real-time data collection allows instantaneous comparisons to alert limits. If IAQ readings exceed predetermined specifications, customers are notified that alert conditions have occurred, via e-mail or pager, along with the applicable IAQ reading, time and location. Alerts can be sent for high and low temperature, high and low humidity, and high CO, CO2 and odors and gases. Up to 13 months of continuous data is available online. Historical readings (more than 13 months old) are archived and available to customers as a hard copy or online. Communications and data transfers with customers are encrypted to ensure privacy and data integrity.

# Data formats

## Historical Information



## Real-Time View



## Summary

- PureTrac samples air continuously, instead of “moment-in-time” grab samples, providing detailed trend and “event” information that is essential in managing facilities.
- Real-time monitoring to know what’s occurring in the facility at any given point in time.
- Enhancement to current energy management system or practices.
- Notification of exception when a reading goes outside of pre-set threshold levels for each parameter (via e-mail).
- PureTrac is Internet-based, allowing clients to view data from remote locations and ability to collaborate with multiple users viewing the data at the same time – saving expert’s time and travel.
- Archives data for trending, troubleshooting and/or liability purposes.
- Provides “third-party” data integrity for documentation and verification purposes.
- Weekly summary reports are available via e-mail.

## The Nose

The Nose’s temperature and humidity sensors are contained in their own sub-chamber to isolate thermal interference that could be caused by the remainder of the circuitry. Patented software and hardware maintains precise



temperature control of both the carbon monoxide and odors and gases sensors to ensure minimal sensor drift. Microprocessors control the operation of all sensors, including thermal regulation, initial setup and calibration, conversion to engineering units, digital messaging and data transfer. All calibration and trimming are handled by digital communication with remote workstations, so the calibration

environment is not disturbed. In addition, all other circuitry, microprocessor, memory and power conversion circuits were assembled on this same board.

PureChoice selected the highest quality sensors available, with respect to the target price of the PureTrac system. Sensors have been manufactured in America, Great Britain and Finland, resulting in very demanding circuit design, since each sensor imposes different power, signal and communication protocol requirements.

## Sensor specifics

- **Temperature** measurement is made with a high-precision, "1-wire" digital thermometer. The sensor measures temperatures with a  $\pm 1.0^\circ$  C basic accuracy over the range of  $- 10^\circ$  C to  $+85^\circ$  C. PureChoice individually calibrates each Nose monitor prior to shipment to the customer's facility.
- The **humidity sensors** are based on the principle of variable thin film capacitance. A thin polymer film absorbs or exudes water vapor as the relative humidity of the ambient air rises or drops. The dielectric properties, and therefore the capacitance, of the polymer film depend on the amount of water contained in it. The Nose converts the capacitance changes to voltage and ultimately into a digital reading of percent humidity. PureChoice individually calibrates each Nose in a precision temperature and humidity controlled environmental chamber.
- **Carbon dioxide** is measured with a microprocessor-controlled module that emits and senses non-dispersive infrared radiation to determine CO<sub>2</sub> concentrations. A dedicated ASIC reads and processes the electrical signal produced by an optical source and a corresponding detector. Both are built into a small, gold-plated aluminum optical bench. Both communication and conversion into parts per million of CO<sub>2</sub> are controlled through digital communications.
- **Carbon monoxide** sensing is accomplished with a mixed-metal oxide semiconductor sensor, providing enhanced performance and stability.
  - Unlike more common tin-oxide sensors, these advanced mixed-metal sensors do not require catalysts, do not suffer from aging and are less susceptible to interference from relative humidity.
  - The semi-conducting oxide substrate is operated at temperatures above ambient and an imbedded platinum heater allows for temperature control.
  - Heater balance circuits using the printed platinum pattern as both a heater and an RTD and, along with microprocessor control, precisely maintain heater temperatures to assure accurate gas concentration readings.
  - Each individual sensor is calibrated with carbon monoxide mixed with zero air using GPT calibration techniques.

- Outlet gas concentrations are continuously monitored using NIST traceable carbon monoxide instrumentation.
- **Odors and gases** sensing is accomplished with a mixed-metal oxide semiconductor sensor, similar to that used in the CO sensor.
  - The sensors are made with ceramic fabrication process that allows the microstructure of the sensors to be precisely controlled.
  - The sensors provide long operational life. For the PureTrac application, they are expected to last three-to-five years. Each odors and gases sensor includes a platinum heater/RTD, and the Nose controls substrate temperature using the same approach as used for the CO sensor.
  - Each sensor is individually adjusted to the same range of response (0-100 percent) using GPT calibration techniques with NIST traceable concentrations of isobutylene or toluene.

## **Noteworthy PureChoice Clients**

3M Corporation

Caterpillar

General Electric

Dallas Independent School District

Pfizer, Inc.

Bank of America

Gustavus Adolphus College

Echelon, Inc.

Duluth (Minnesota) School District

St. Cloud (Minnesota) School District

Rogers (Arkansas) School District

XO Communications

Emory University (Georgia)


The Block Institute (Brooklyn, NY)

City of Chicago

United Hospital (St. Paul)

# IAQ Reporting

PureTrac Index  
Building Performance Indicator  
Greendale Elementary School  
December 2004

Location	Temperature				Humidity				Carbon Dioxide				Carbon Monoxide				Total											
	Low	High	Average	In Range %	Nose Points	Low	High	Average	In Range %	Nose Points	Low	High	Average	In Range %	Nose Points	Low		High	Average	In Range %	Nose Points							
<b>PureTrac Index</b>																	<b>73%</b>											
<b>29.4</b>																	<b>Building Performance Indicator</b>											
Room 238	58	78	66	56	1062	8	31	19	19	769	373	781	455	100	0	0	0	0	0	0	1831							
Room 138	58	78	66	58	1062	8	31	19	19	569	373	781	455	100	0	0	0	0	0	0	1631							
Conference Room	59	72	68	79	509	8	32	16	3	780	376	779	481	100	0	0	0	0	0	0	1389							
Office	59	72	68	79	509	8	32	16	3	780	376	779	481	100	0	0	0	0	0	0	1289							
Room 215	69	77	73	73	48	7	28	15	1	879	377	822	465	100	0	0	0	0	0	0	1027							
Room 231	63	72	68	90	72	6	29	16	2	811	386	1010	483	100	0	0	0	0	0	0	983							
Room 115	69	77	73	73	48	7	28	15	1	879	377	822	465	100	0	0	0	0	0	0	927							
Room 131	63	72	68	90	72	6	29	16	2	811	386	1010	483	100	0	0	0	0	0	0	883							
Room 142	69	75	72	100	0	7	29	16	3	800	379	1436	522	95	48	0	0	0	0	0	848							
Teacher's lounge	67	72	69	100	0	9	31	17	5	675	385	936	491	100	0	0	0	0	0	0	775							
Room242	69	75	72	100	0	7	29	16	3	800	379	1436	522	95	48	0	0	0	0	0	748							
Gymnasium	63	74	69	94	71	8	41	20	19	486	375	1110	481	100	2	0	0	0	0	0	719							
Room 147	67	70	69	100	0	8	32	17	8	699	379	1178	501	98	13	0	0	0	0	0	712							
Jr High Office 108	67	72	69	100	0	9	31	17	5	675	385	936	491	100	0	0	0	0	0	0	76							
Media Center	66	73	70	99	6	9	29	18	5	667	390	729	457	100	0	0	0	0	0	0	673							
Room 247	67	70	69	100	0	8	32	17	8	699	379	1178	501	98	13	0	0	0	0	0	612							
Cafeteria	63	74	69	94	71	8	41	20	19	486	375	1110	481	100	2	0	0	0	0	0	559							
																												
<b>Operating Strategy</b>	7 a.m. - 5 p.m.	M-F			Weekday																							
	5 p.m. - 7 a.m.	M-Th			Week Night																							
	5 p.m. F - 7 a.m. M	Weekend			Weekend																							
<b>Parameters</b>	<b>Temp</b>	WD	N	WE	67-75	65-75	65-75	<b>RH</b>	WD	N	WE	30-60	25-65	25-65	<b>CO2</b>	WD	N	WE	0-1000	0-1400	0-1400	<b>CO</b>	WD	N	WE	0-10	0-30	0-30

2/3/2005

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