City of Columbus Application Story

RTP 2200 Hybrid Control System in the application of incinerator control

Introduction

The solid waste incinerator at the Southerly Wastewater Treatment Plant, located just south of the City of Columbus, Ohio, was previously operated using a circa 1970's vintage control system. Beyond its useful life and subject to Y2K issues, management decided to replace the system. Requirements included a simplified configuration and programming environment, minimal time to install and commission, and an open architecture non-obsolescent design that was easy to operate and maintain. The goal was to acquire a high-performance, accurate, and stable control system that would help the city to reduce costs associated with operating the incinerators. Over twenty PLC and DCS vendors competed in the bid process. After careful evaluation, the project was awarded to the Coleman Instrument Company of Cincinnati, Ohio in October 1999. Installation of the new system began in December and completed during the first week of February 2000.

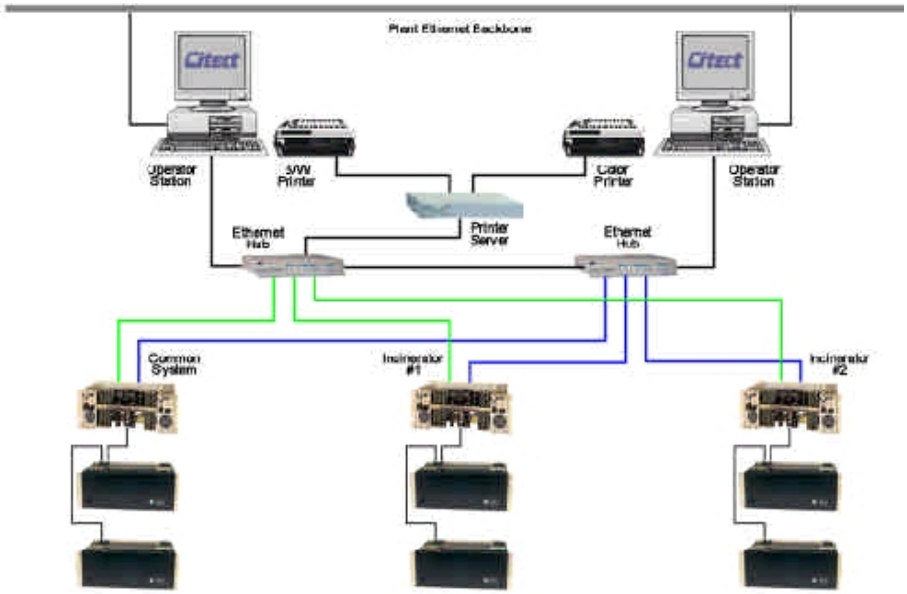

Figure 1 City of Columbus incinerator control system architecture

System Architecture

The new incinerator control system includes the latest generation RTP 2200 HCS (Hybrid Control System), which combines the advantages of both the PLC and DCS, and the operator interface is based on Citect (CiTechnologies) HMI/MMI software. The incinerator control system monitors, displays, records process data, and automatically controls the process. Three RTP 2200 HCS nodes are used: one node operates as the "Common System" that provides monitoring and control functions, such as the conveyors and scales, which are shared between the two incinerators. Functions that are unique to or independent of each incinerator, such as furnace rakes, airflow rates, temperatures and pressures, are under the control of their respective RTP 2200 node.

As illustrated in figure 1, each node includes an RTP 2200 HCS with two I/O expansion chassis. As a redundant unit, the RTP 2200 HCS uses dual controllers, power supplies, backplanes, and network interfaces. With a bus switch card and multi-level watchdog timers, the RTP 2200 HCS provides virtually

zero downtime utilizing bumpless transfer and non-intrusive reinitialization.

The expansion chassis interface to the redundant controller via the bus switch card where the analog and digital I/O cards are located. This dual controller and standard I/O configuration is indicative of the flexibility supported by the RTP 2200, which allows the optimum amount of redundancy to be selected for the intended application.

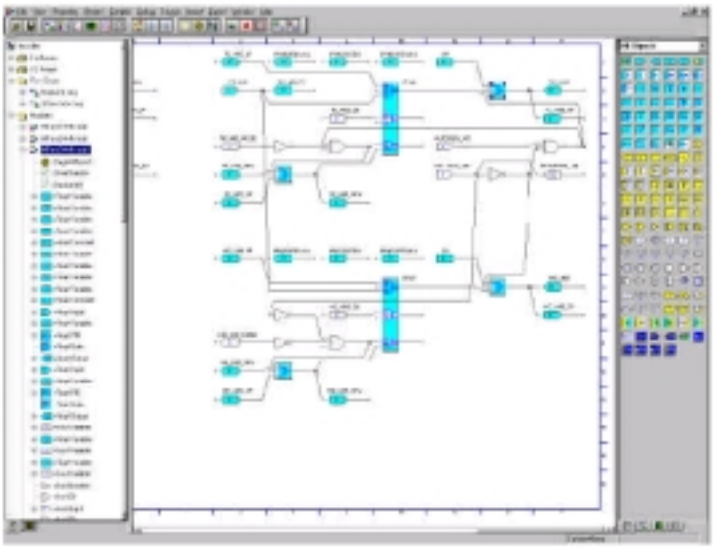

Figure 2 NetArrays object oriented logic display

To support high-reliability network communications for peer-to-peer traffic and with the HMI workstations, each RTP 2200 node utilizes two Ethernet links: either of which operates as the primary or secondary interface. The use of dual Ethernet hubs enhances the network architecture and adds to overall system reliability. Should a disruption of communications occur on the primary segment, the affected RTP 2200 node(s) will automatically switch to its secondary controller/network.

Two operator stations, running Citect MMI/HMI software interface with the RTP 2200 based control system via the network. Configured for monitoring, process control, alarming, trending, and report generation the workstations provide an intuitive, easy-to-use environment by system operators and process engineers alike. Configuration of the system, including both the hardware and application software, is performed by using RTP NetArrays graphical configurator (see figure 2). NetArrays includes over 120 objects, including floating-point PIDs and ladder logic all in a drag-and-drop, point-and- click environment.

The I/O cards configured in the system include:

Analog input cards	19
Analog output cards	9
Digital input cards	18
Digital output cards	15
Total I/O points	**752**

Common System Functions

Monitoring, control, and trending functions for the common system are point-and-click selectable from the system's main menu (refer to figures 3, 4, and 5). Graphical displays depict the system status and provide operator control of the process. With the common system, display information includes:

- conveyor tons per hour
- main burner fuel rates
- air and water flow rates
- fluid bed pressures.

Alarm status indicators are included along with the numerous on/off controls for the conveyor, grinder, skimmer, mixer, fuel, pump, and blower motors.

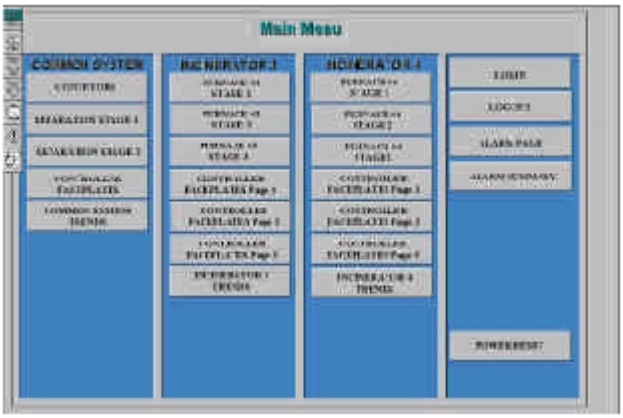

Figure 3 System main menu

Figure 4 Common system faceplates

Context sensitive areas provide an easy means to adjust setpoints, and a seperate faceplate summary display allows operators to monitor controller output and adjust setpoints for the digester water, heat exchanger, hot water return, and the skimming temperatures.

Figure 5 Common system conveyors/scales operator screen

Incinerator System Functions

Each incinerator has similar graphical displays (see figure 6) that are unique to monitoring and control of the furnaces, such as:

- ash handling control
- scrubber monitoring, control, and alarming
- heat recovery unit monitoring
- furnace monitoring, control, and alarming

Comprehensive trending displays are accessible for both the common system and for each incinerator. Common system temperature trends include:

- digester water
- heat exchanger
- hot water return
- skimming incinerator

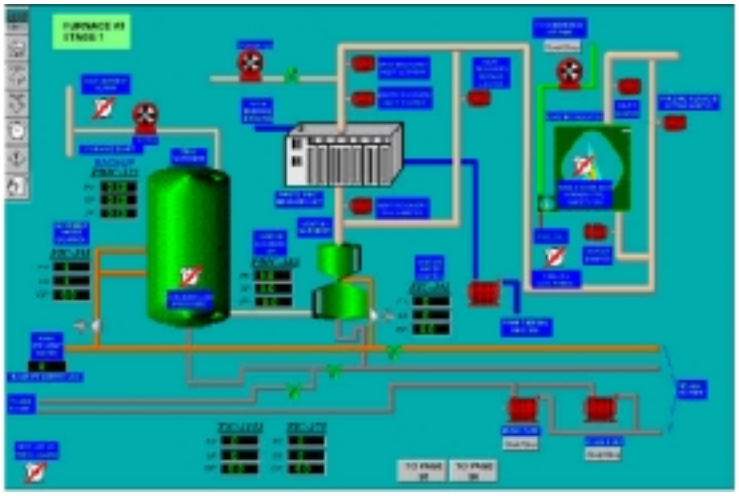

Figure 6 Common system conveyors/scales operator screen

Independent trending displays are also provided for each incinerator (see figure 7), which include:

- hearth temperatures
- fume incinerator temperature
- effluent water and flow rates
- furnace draft pressure
- combustion air
- exhaust gases oxygen content

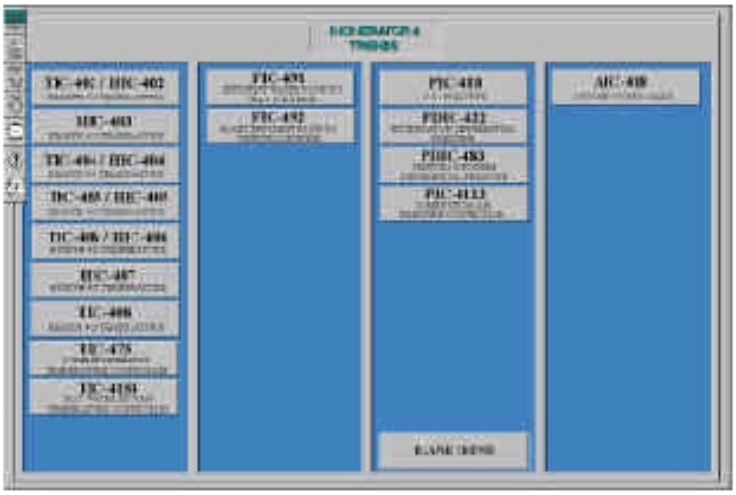

Figure 7 Incinerator trend menu

Summary

Upon commissioning of the new control system, the engineers quickly took advantage of the system's trending capabilities to optimize the incinerator processes. Not only are the incinerators now easier to operate, but tuning of the processes has resulted in a significant reduction of stack emissions. Fuel oil consumption has also been significantly reduced, resulting in considerable cost-savings for the City of Columbus.