ISA100Wireless Compliance Institute

Arkema User Test of the ISA100.11a Standard

September 2009

About the ISA100 Wireless Compliance Institute
Comprised of industry leaders from major manufacturing and automation control system users and suppliers, the ISA100 Wireless Compliance Institute (WCI) was formed to decrease the time, costs, and risks of developing and deploying standards-based, industrial wireless devices and systems. WCI has established a collaborative industry-based program among users, suppliers, and other stakeholders that conducts independent testing and certification of wireless devices and systems; provides education, tools, and technical support to users and suppliers; accelerates adoption of the ISA100 standards; and assures interoperability. For more information about the ISA100 Wireless Compliance Institute, visit www.isa.org/isa100compliant.

Within days of approval of the ISA100.11a standard by the ISA Standards and Practices Board, the ISA100 Wireless Compliance Institute installed a multi-vendor User Test of the technology at an Arkema plant in Crosby, Texas. This User Test demonstrates interoperability among multiple vendor devices.

Arkema is a €5.6B diversified global chemicals manufacturer that produces vinyl products, industrial chemicals, and performance products. Worldwide, Arkema has 80 industrial sites in more than 40 countries and six research and development centers.

Arkema's site in Crosby Texas produces liquid organic peroxides that are used primarily to produce plastic resins, polystyrene, polyethylene, polypropylene, PVC and polyester reinforced fiberglass, and acrylic resins. Many consumer products that we use every day, ranging from automobiles and food packaging to health and cleaning products, begin as organic peroxides.

Arkema identified a need to collect and integrate data from across their Crosby TX plant into their control room to improve plant and employee safety and efficiency. The Crosby plant was built in stages *beginning in the late 1960s, and has three different generations of technology. They need data from all* of these systems in one control room. ISA100.11a wireless is seen as a practical method of retrofitting sensors plant-wide into a diverse range of applications and presenting the data centrally.

Numerous applications for ISA100.11a were identified in a comprehensive review of the site, including temperature, pressure, contact closure, valve positioning, gas detection, corrosion detection, and others. Most of the sensing opportunities are outdoors, where cabling for sensors can be prohibitively expensive. Arkema Crosby enthusiastically embraced the vision of a single coherent architecture that is scalable to cover all of these applications, plus many more, with high reliability across the site.

Four applications were identified for an initial User Test.

- ***500,000 Gallon Water Tank:*** A firewater safety tank previously relied on a simple mechanical sight gauge that "fails full". A pressure sensor has been desired for some time, but the cost of wiring to that location has been prohibitive. It is extremely important to ensure that this firewater tank is full at all times.
- ***Cold Storage:*** The site includes numerous cold storage warehouses operating at temperatures below 0˚F. If these warehouses exceed the required temperature, product can potentially decompose and ultimately catch fire. Temperature is currently being reported to the control room by wire, with an audible remote alarm to indicate if a door is left open. A centrally reported door sensor was considered a good application for wireless. Wireless temperature and door sensors were added to three of the warehouses, providing central reporting of exception conditions. This cluster of six transmitters provides Arkema with a realistic demonstration of ISA100.11a sensor meshing capabilities.
- ***Wireless Adaptor:*** There is a wired level sensor on a waste water tank. The values are fed into a satellite control room close to the tank, but not the central control room. To provide central visibility to this information, an ISA100.11a adaptor connects in series to the 4-20 mA analog output of this sensor, reporting the result wirelessly through the ISA100.11a system to the

central control room. This serves as a proof-of-concept for the general notion of using ISA100.11a to provide central visibility to existing sensors scattered across the plant.

- ***Gas Sensor:*** The site includes many gas sensing opportunities. As a proof of concept, a single wireless gas sensor was installed alongside an existing wired sensor. Following a successful pilot, wireless gas sensing can be expanded throughout the site when fully certified wireless product is available.

The system was designed to cover the entire site. Wireless coverage is envisioned over an area comprising more than 50 acres, with wireless sensors installed as needed throughout the operation, even in the early stages of use. The entire site is covered by two backbone connections, shown schematically in Figure 1.

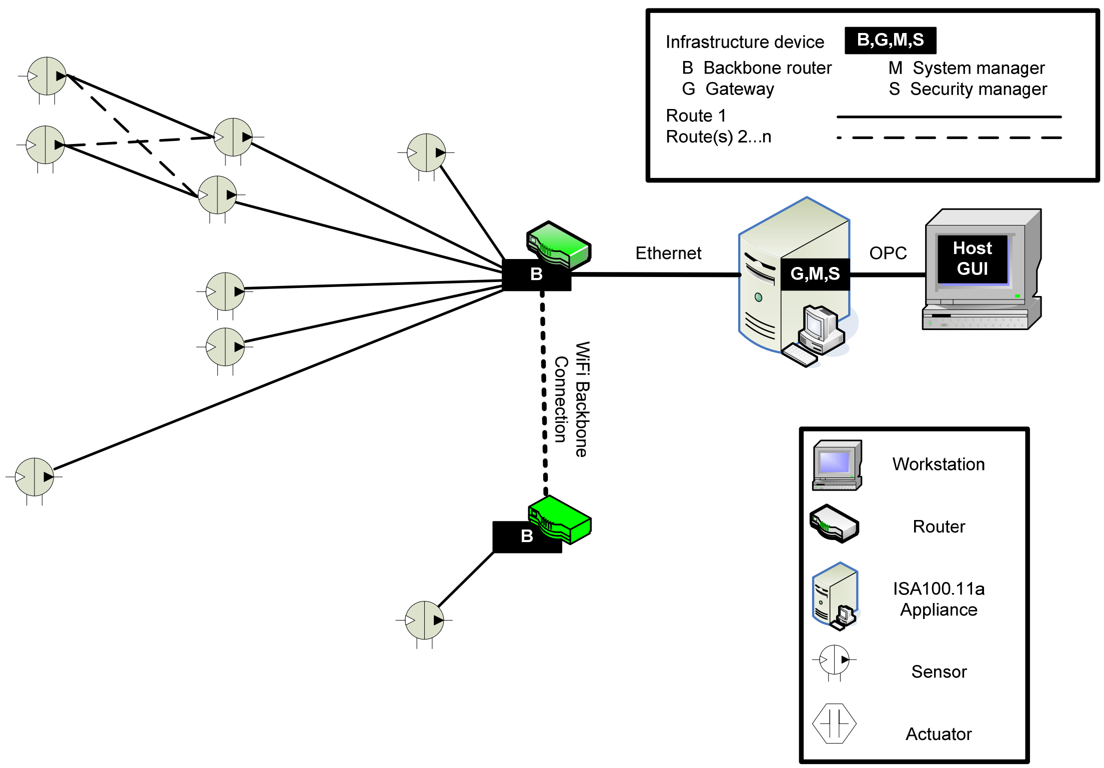

Figure 1 – Schematic of Arkema ISA100.11a system

An infrastructure was installed including two ISA100.11a backbone routers. The backbone routers act as ISA100.11a wireless access points covering the site. A WiFi connection between the backbone routers simplifies the installation, so that the remote backbone router does not need a wired connection back to the host.

The User Test topology is intended to demonstrate that a small number of backbone connections can cover extensive areas outdoors. An optimal system at this site would include an additional backbone router, and in fact one was provided. This third backbone router was held back as a spare. Now that it is apparent that the first two backbone routers are running reliably, the third device will be installed in a position to provide redundant, network level mesh coverage across the site. In the final configuration, with a third backbone router, it is expected that most if not all applications envisioned by the users across the site will be serviced by direct backbone connections. Exceptions will be handled by the sensor mesh.

In the initial configuration, seven of the nine transmitters were able to establish strong connections directly to the backbone. The remaining two transmitters are remotely located and need to connect by sensor meshing through other transmitters.

The ISA100.11a sensor mesh provides redundancy and also extends coverage to the edges of the facility. In an initial stage of system deployment, where there are relatively few devices for meshing, it is necessary to consider the placement of remote transmitters with some care. In this installation, six of the transmitters are located in a cluster providing ample opportunity for meshing as needed. The remaining three transmitters are in locations that have near line of sight to one of the backbone routers.

All deployed transmitters at Arkema have routing capability, so as more transmitters are added the number of possible mesh connections will increase exponentially.

Table 1 provides a list of transmitters currently installed at the Arkema site.

Application	Transmitter Type	Count	Range	Reporting Rate
Water Tank 500,000 gallon	Differential Presssure	1	0 – 400 in H_2O	30 s
Waste Water Tank	Analog Input	1	4 – 20 mA	1 s
Cold Storage	Temperature	3	-20 to 140 deg F	10 s
Cold Storage	Discrete input	3	Open/closed	10 s
Gas Monitoring	Sensor type and location confidential	1	0-30 ppm	30 s

Table 1 – Transmitters at Arkema

All transmitters installed at Arkema have been tested for ISA100.11a compliance using a non-commercial version of the Wireless Compliance Institute's Device Interoperability Test Kit (ITK), which is scheduled for commercial release in early 2010. This hardware/software tool uses XML scripts to emulate the operation of an ISA100.11a system manager in a transparent and vendor-independent manner.

Additional transmitters from Access Wireless Solutions will be installed during October 2009. These transmitters will act as 4-20 mA adaptors to existing wired sensors at Arkema.

Table 2 provides a list of suppliers who participated in the Arkema User Test. All transmitters were tested for ISA100.11a compliance, and approved for use at Arkema.

Supplier	Role/Components
Wilson-Mohr	Site specific project management System installation Wireless system configuration/integration Host system configuration/integration Arkema liaison
Nivis	System manager OPC server System integration
Honeywell	Host system Backbone routers Temperature transmitter Discrete input transmitter Analog input transmitter
Yokogawa	Water tank pressure transmitter
Gastronics	Gas sensor transmitter

Table 2 – Suppliers at Arkema

Figure 2 (next page) shows the system superimposed on a satellite view of the site.

To demonstrate the concept of plant-wide coverage from two access points, the initial transmitters are installed toward the periphery of the operation. The backbone routers were placed based on a visual inspection of the site, without a radio survey of any kind. Radio ranges of 100-200 meters are being achieved as expected. The infrastructure components are intended to cover the entire facility, with a third backbone router planned to the south of the other two. This will provide full coverage of the entire site, with many areas of interest having two direct backbone connections. The meshing capabilities in the ISA100.11a standard will provide redundancy in locations where only one direct connection is available, and network access in the few locations where a direct connection is unavailable.

The system has been operating at Arkema since 19 September 2009, ten days after the ISA100.11a standard was ratified. The parallel development of the standard, stacks, transmitters, and compliance tools made it possible to install a working, interoperable, multi-vendor system achieving clear user benefits in the real world in record time.

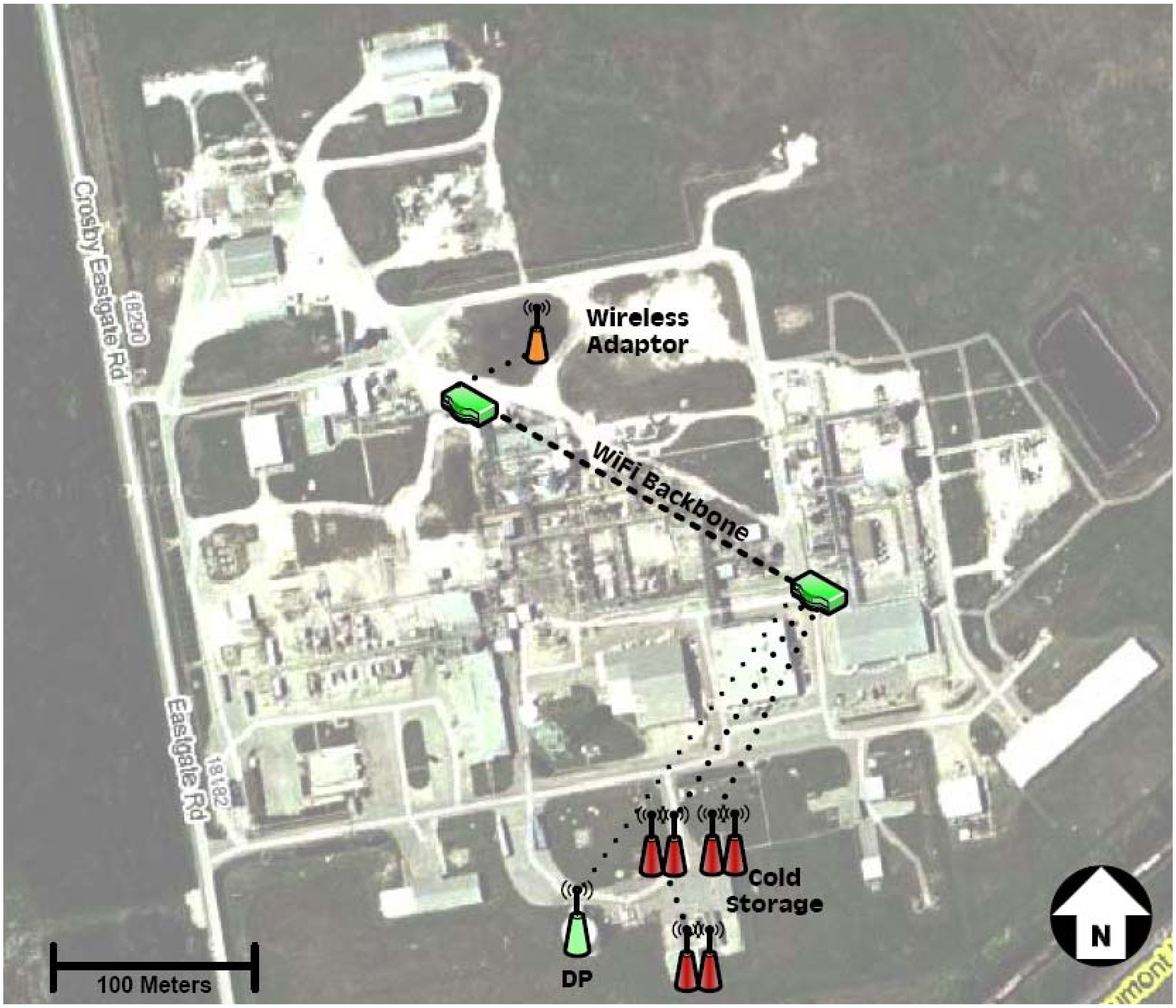

Figure 2 – Aerial View. Location of gas sensor is confidential.