Designing NFPA 820 Compliant Monitoring Systems for Wastewater Pumping Stations

NFPA 820 Overview
NFPA 820 Fire Protection in Wastewater Treatment and Collection Facilities
- First edition in 1990 was a recommended practice.
- Since 1995, each revised edition is now a “standard”.
- Most recent edition (2012) is over 60 pages long, includes 10 Chapters & Annexes.
- Authors' Observations: Many facilities are only partially compliant with NFPA 820; specifically, the monitoring system is often NON-COMPLIANT.

Classifying Areas as Electrically Hazardous
Following chapters give guidance in classifying electrically hazardous areas, and reducing the classification by ventilating:
- Chapter 4: Collection Systems
- Chapter 5: Liquid Stream Treatment Processes
- Chapter 6: Solids Treatment Processes

There are potential “surprise” classifications that can cause substantial & expensive re-design involving facility layouts, control panel location, specifying explosion-proof equipment, specifying intrinsically safe control circuits, seal conduit, etc.

- Become familiar with the standard. Try not to be “surprised”: Examples include:
  - In the Southeast, there are often no Primary Clarifiers upstream of Aeration Basins. Such Aeration Basins are classified. (surprise!)
  - Depending on the unit process, process engineers might consider certain sludges as innocuous. But related sludge basins or facilities may indeed be classified. (surprise!)
- For a structure to be passively unclassified, it must have at least 50% open space. (A 3-sided structure with one open side is not inherently unclassified.) (surprise!)

Using Ventilation to Declassify Areas (or Reduce the Classification)
Common practice is to provide ventilation to either unclassify or reduce the classification of areas. Allows use of more generic products; for example, a “regular” motor rather than an explosion-proof motor.

**Tip:** NFPA 820 requires that the ventilation air flow be monitored; monitoring just the On/Off status of a fan is NOT acceptable; some sort of true flow monitoring device is required – these range from simple (paddle switches) to complex (thermal dispersion).

Ventilation must be monitored by a specialized supervised signaling system as per NFPA 820.

Combustible Gas Detection (CGD)
NFPA 820 requires certain areas to be monitored for combustible gas. But many users opine that CGD units are problematic; several installation types; namely,

- CGD unit located in an easy-access classified area, such as a room; only requires simple integral sampling system.
- CGD unit mounted remotely from a classified area; for example, wetwell. Requires a sampling system; including pump, tubing and moisture traps (moisture a real problem, and can render the CGD unit ineffective.)
- CGD unit mounted integral in a hard-to-access classified area; for example, wetwell. Some units are flanged mounted inside the wetwell. Difficult to calibrate.
- CGD must also be monitored by a specialized supervised signaling system as per NFPA 820/ NFPA 72.

Supervised Signaling Circuits – What are they?
NFPA 820 requires monitoring certain conditions and alarms. Furthermore, the monitoring system must be a supervised signaling circuit as per NFPA 72, National Fire Alarm & Signaling Code.

- NFPA 72 is a 350-page standard that deals with fire alarm systems and puts forth many requirements of the supervised signaling circuits. Some requirements:
  - The entire system (panels and remote components) must have two sources of power. Thus the main panel is often furnished with a battery backup.
  - Each signal circuit must be monitored for its integrity. This is more complex than the typical NO or NC circuits that water & wastewater facilities typically have. This requires (unusual for us) end-of-line dropping resistors to be installed at the tail end of each signal circuit.

Supervised Signaling Circuits – Some Practical Issues
Supervised signal circuits are designed for fire alarm applications, which are often quite large. NFPA 820 water & wastewater applications are often smaller, but some suitable systems are available.

The fire alarm vendors describe supervised signaling circuit using a much different dialect than ours. Initially, from dialect alone, it is difficult to adopt these systems to NFPA water and wastewater applications. Some typical terms include:

- Initiating device circuits.
- Standard notification appliances.
- End-of-line resistors

But, after reviewing catalogue information & discussions with vendors, such circuits can be incorporated into a typical water & wastewater design that is NFPA 820 compliant.

Typical Example, Wastewater Lift Stations
Two wastewater lift stations have been designed & commissioned with supervised signal circuits that are NFPA 820 compliant. A third is in the bid phase right now. It too is NFPA 820 compliant, but differs a bit from the other two in that it uses a more sophisticated supervised signaling network.