Back to Basics: Operating in Manual Mode

Thoughts and Ideas to Ensure Continuity-of-Operation When a SCADA System Fails

A FlaWARN Webinar

24-Aug-2022

UF | TREEO Center
UNIVERSITY of FLORIDA

August-2022

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SCADA vs "The Old Days"

- Personally, I "grew up" in the drinking water and wastewater treatment industry before the internet.
- We had no cell phones, no world-wide-web, no iPads, no Face-Time.
  - This was all fantasy, something seen on "The Jetsons"
- My first exposure to computer operation at a WWTP was in 1984
  - The computer took up several large rooms

SCADA vs “The Old Days”

Photo courtesy of: pingdom.com/blog/retro-delight-gallery-of-early-computers-1940s-1960s

SCADA vs “The Old Days”

- While left alone, unsupervised in the computer control room, I pressed an “F” key, and got into trouble…
- Afterwards, the computer guy (IT person) wrote a series of SOPs designed to prevent this from happening again,
- And I received training…

Question: Did My Incompetence Reveal a Vulnerability?

A: Yes, yes it did.

- What could've been done differently?
  - Short term solutions?
  - Long term solutions?

A Compilation of Suggestions and Recommendations

I reached out to several subject matter experts on this topic and condensed them into the following slides.

Their contact information is provided at the end of this presentation.

Suggestions and Recommendations, page 1 of 12

1. Ensure ALL Operators and Trainees on shift are familiar with the treatment plant, it's processes and vital process equipment.
   - Have monthly plant walk throughs with new or younger employees, monthly skills test.

2. All operators and trainees are trained and tested on proper sampling locations and what field tests should be run and how often
   - Part of above monthly skills test

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3. For ground storage tanks (GST), elevated water storage tanks, flow equalization (EQ) basins, ensure there is a way of manually reading or measuring the basin water levels.
   - Pressure gauges, staff gauges, tape measure, measuring stick, etc.
   - For PSI gauges, provide a conversion chart for PSI to feet of head.
   - Train staff how to do the math when they can't find the conversion chart. 2.31 ft per 1 PSI, or 0.433 PSI per each foot of water level.

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4. All critical utility infrastructure that are connected to SCADA should be identified and listed.
   - This may have been done through the AWIA Risk & Resilience Assessment.

5. Is the SCADA system connected to the internet? If yes, is it a constant connect, or only connected as-needed/emergency connect?
   - Is there a way, or SOP, to safely disconnect if needed?

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6. Is the SCADA system connected to the Utility intranet (i.e. city's enterprise network)?
   - This could allow a way for an intruder to enter the city's confidential systems such as HR, payroll, billing, etc.

7. For each critical unit process, notation should be made as to which connections are monitor-only (i.e. pressure, level, pH, etc.) versus controlling connections (i.e. valve actuator, motor VFD controller, etc.)

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8. Make sure the “hand” part of the H-O-A switch does not rely on the PLC to function; it should go directly to a relay for pump/motor operation.

9. Keep a digital multi-meter by a VFD. During a SCADA PLC failure, you can maintain pressure with the VFD by having a digital readout.
   - Ensure only qualified personnel make connections in panels

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10. For critical unit process equipment, ensure there is some type of redundant meter or display for the motor/pump system that might also send signals to the SCADA system.

11. Ensure there is local automation in place for each critical unit process as backup (i.e. float switches, H-O-A switches, high and/or low-level alarm indicators, etc.)
    - Be sure to test these circuits at least semi annually

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12. SOPs, SOPs, SOPs! Can't repeat this enough!
    a. For each critical unit process, ensure there is an SOP written and current!
    b. Written by the Plant Lead/Chief Operator, at a reading level simplified enough so anyone on staff can follow it!
    c. Think of a new hire, still becoming used to the plant, on shift by themselves.
    d. Take pictures, insert labels, identify key items
    e. Start from most critical to lesser critical
    f. Include needed safety PPE if manually handling or mixing chemicals

Suggestions and Recommendations, page 8 of 12

13. SOPs, SOPs, SOPs continued
    g. Keep all SOPs in multiple locations (i.e. at main control/SCADA op's desk, near each critical unit process, etc.)
    h. Drill/test the operations staff on SOPs regularly to check their competency. Make it part of the yearly evals if needed.

14. Develop a complete SCADA-to Manual Mode SOP that covers the entire system
    - The individual component listed above can be incorporated

Suggestions and Recommendations, page 9 of 12

15. Ensure all SOPs are kept current. Updates are needed when new equipment is installed or built, or when treatment procedures change.
    - This could be part of the Lead/Chief Operator yearly evals.

16. If the facility already has an FDEP approved Operating Protocol for reuse/reclaimed water, this can be incorporated as well.

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17. If the utility has been operating on SCADA for a long time, operators may be complacent or simply do not know what manual operation truly is.
    - For purposes of training, start slow and work your way up.
    - Avoid full SCADA shut-down drills to begin with.
    - Try limited scenario table-top drills, ask “what-ifs?”
    - As difficult as it may sound, include some of us “old-timers” in the drill and allow them to show the newbies how to operate in manual mode.

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18. When the plant is functioning properly, and producing high quality water, record as many settings as you can.
    - Flow rates, well pumps running, chemical feed pump flow rates or %, PLC driven valve actuator settings (% open), VFD Hz, valve condition (open/closed), etc.
    - Record these values for various time-of-day flow rates or water demand conditions
    - Keep these records printed on paper and readily available at multiple locations or given to all essential personnel

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19. Have spare parts on hand and accessible for SCADA and PLC problems. This should include spare PLC's and PLC programming available.
20. Maintain current contact information for all SCADA and PLC vendors and reps, and emergency contact info.
21. Lastly – keep your emergency response plans (ERPs) updated!
    - Update all mutual aid contact info now, today, and don't be afraid to ask for help from a neighboring utility!

Think it Can't Happen? Think Again…

"A Tale of Two Utilities"

August-2022

“A Tale of Two Utilities” Success at the Town of X-Ray

The Town of X-ray’s Water Treatment Plant had lightning strike their auto switch gear equipment, severely damaging it and the SCADA control system.

- The newest and youngest Class C Operator was alone on-shift.
- He was able to maintain water pressure and all chemical feeds because he followed SOPs kept at the facility without any problems.
- He commented on how easy it was to follow the instructions.

“A Tale of Two Utilities”
A bad day at Zulu City

Zulu City operates a large WWTP using oxidation ditches and creates reclaimed water for public access reuse.

- During the 3-11 shift, at about 5pm, the SCADA system’s motherboard failed.
- The three control room monitors ‘froze’ on the last screen image showing proper operation.
- The lack of any control input to the PLC caused the PLC to go dormant, therefore all operating equipment stopped running.

“A Tale of Two Utilities” Zulu City, continued

- The plant’s video camera surveillance system showed the plant operator did drive the vehicle around the plant, but no routine walk-through rounds were made.
- The 11pm – 7am operator also failed to make routine, walk-through rounds.
- The SCADA screen showed all was normal, however the time and date never updated.
- A Trainee arriving at the plant at 6am asked the plant operator why the facility smelled so bad and was so quiet, which eventually sounded the alarm.

“A Tale of Two Utilities” Zulu City, epilogue

- The two plant operators were placed on administrative leave, pending investigations.
- It took over three days for the plant to recover and produce reuse quality water again.
- The replacement motherboard was sent and installed by I&C Techs. A spare motherboard was also purchased.

References & Contact Info

I wish to thank the following experts for their assistance and guidance for this presentation:

Mr. Fred Toone, Solutions Consultant

- Data Flow Systems
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References & Contact Info

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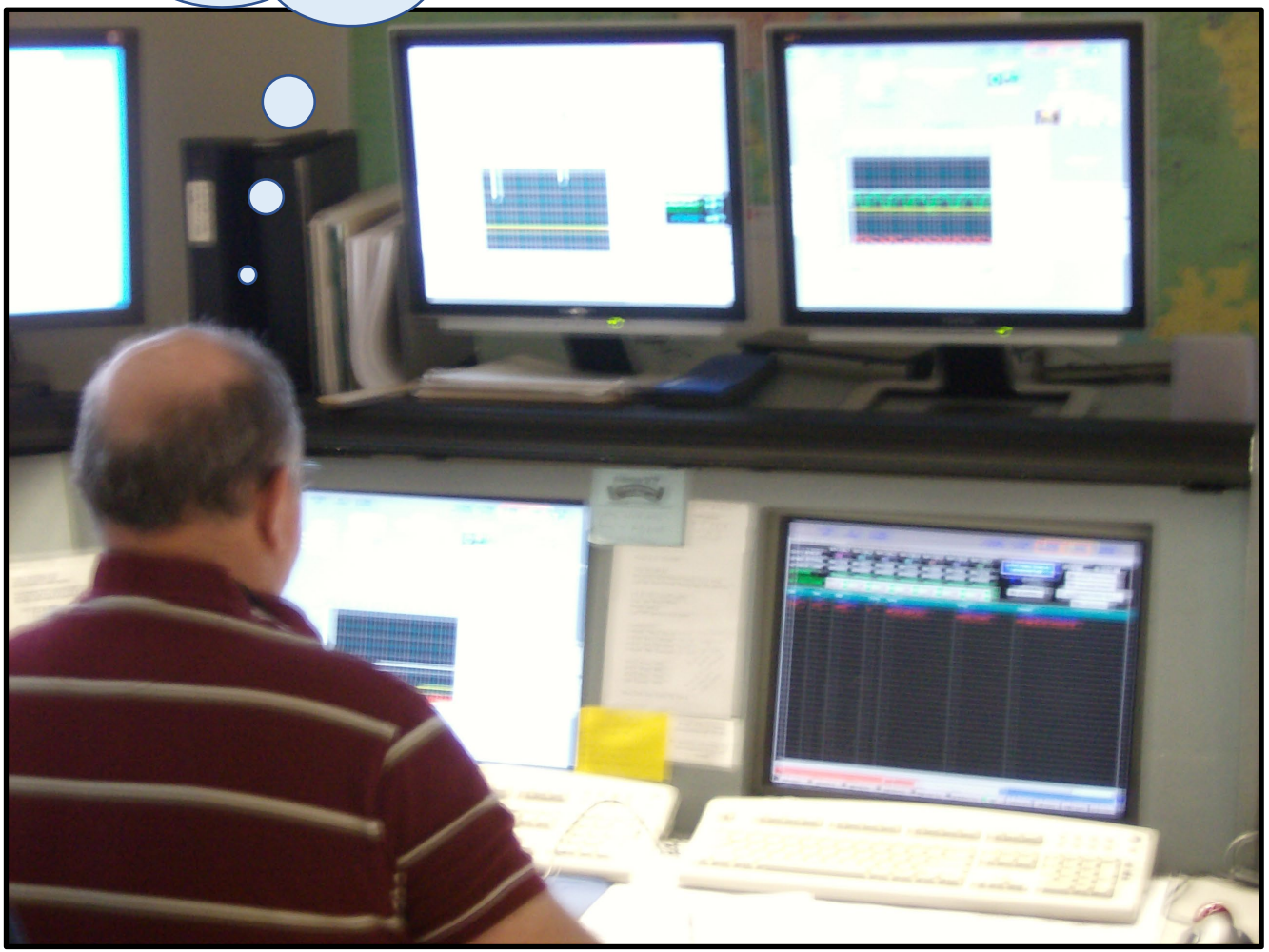
Special Thanks!

To the Managers and Supervisors of Zulu City and Town of X-Ray for sharing their stories!

If you wish to contact them directly, send me an email and I will pass it along to them. They will contact you at their discretion.

Q&A



Thank You For Attending!

- I hope this information was useful to you and your utility!

- Contact me at:
  - 352-294-3881
  - rtrygar@treeo.ufl.edu

- Enjoy the rest of your day!