Creating and Using Effective Standard Operating Procedures

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Environmental Finance Center
Syracuse University

Great Lakes Environmental Infrastructure Center
Environmental Finance Center for EPA Region 5

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Today's presenter:

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- Certified WT, WD, WWT Operator
- Trainer and Technical Assistance Provider
- Experience in operations and utility management

Michigan.org: Scenic places in the upper peninsula

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SOPs

Poll #1:

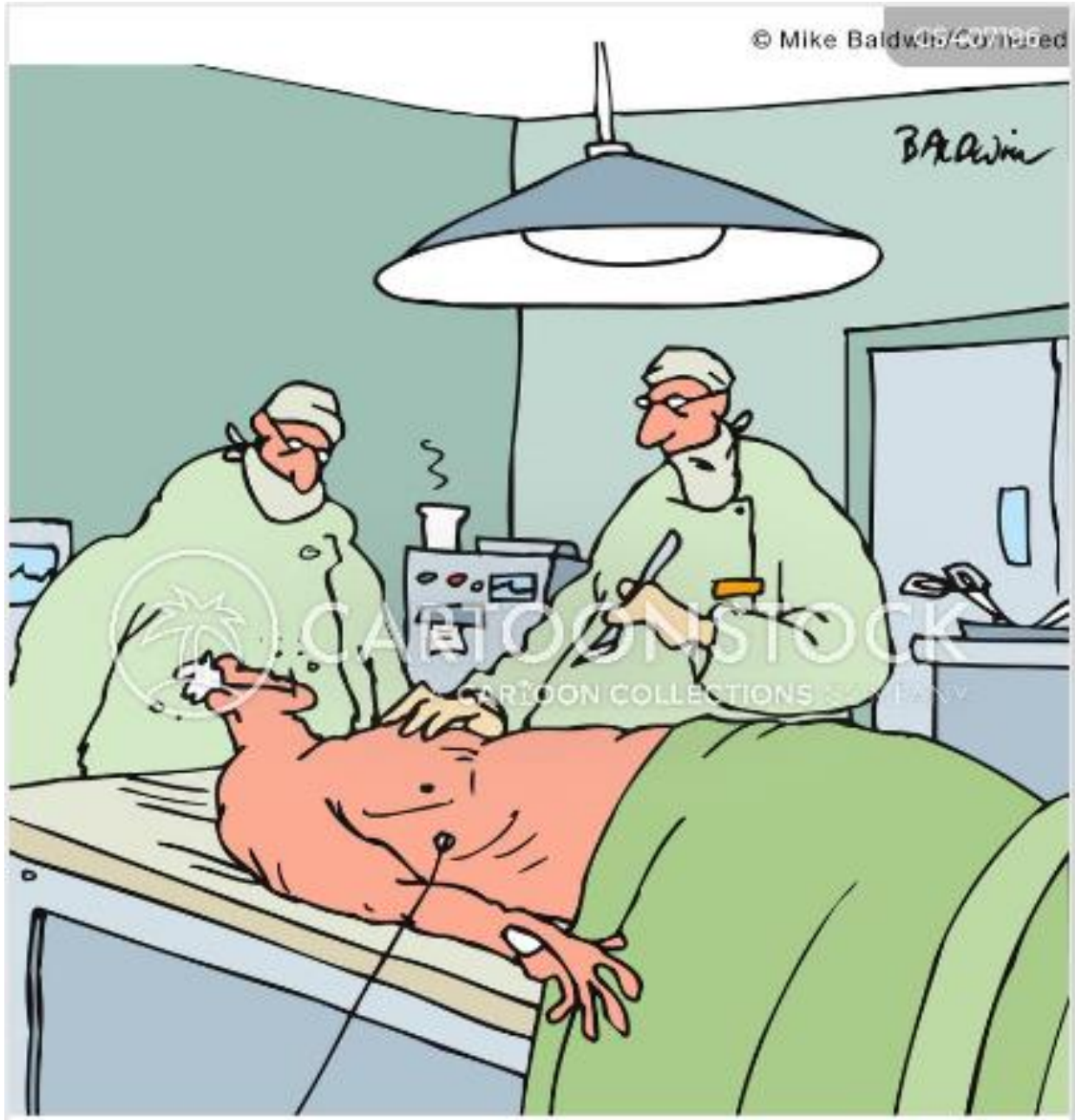
Does your utility currently have and use any Standard Operating Procedures??

a) We have SOPs but are not actively using them.

b) Yes, we have SOP's and use them faithfully.

c) No we do not have written SOPs but we do use standard procedures

d) No we do not have written SOPs or use any standard procedures



"Yes, the cutting open part is necessary. It's standard operating procedure."

Creating and Using Effective Standard Operating Procedures

Gregory Pearson, Water and Wastewater Systems Trainer

Standard Operating Procedures (SOPs)

An SOP is a step-by-step guide for completing a task

- Standardizes task procedure so it is done the same way each time
- Develop SOPs for every critical activity
- Can be tied to industry standards.
- Can be used for training and as part of the O&M manual.

Standard operating procedure (SOP)	[nam
SOP title:	
Location code:	Equipment number:
Description of area of service:	
Safety equipment required:	
Drawings and manual location:	

Standard Operating Procedures (SOPs)

When is an SOP needed?

Think about the consequences of failing to do a task correctly to determine if an SOP is needed.

1. *Compliance*
2. *Safety*
3. *Outage*
4. *Cost*

Standard operating procedure (SOP)	[nam
SOP title:	
Location code:	Equipment number:
Description of area of service:	
Safety equipment required:	
Drawings and manual location:	

What is the difference between work instructions and an SOP?

Provides Details about

- **Who** carries out and is responsible for tasks
- **What**: the task that needs to be accomplished and how it will be confirmed to have been done successfully
- **When** the task is performed
- **Where**: the location(s) where the task is performed and of resources
- **How** the task is to be performed

SOP Bloopers and Out-takes!

Ever so often, the reversed turbine pump operation scenario occurs . . .

1. An overly confident installer is certain that the 3-phase wiring to a turbine pump is hooked up correctly.

2. The installer decides to skip the SOP step to “bump” the starter to confirm the direction of shaft rotation.

3. The pump is fully turned on rotating backwards leading to the impellers unscrewing and being driven into the casings of the bowls causing extensive damage to impellers, casings, bearings, and shaft.

4. Within a matter of 1 or 2 seconds the pump’s breaker switch trips due to excessive amperage draw, but extensive damage has already been done.

SOP Bloopers and Out-takes 2

Skipping an important step!

1. A well pump 480-volt starter needs to be replaced. The operator has the part on hand and the job requires just a couple of screws and electrical connections, however the lockout, tagout kit is left back at the utility shop.
2. An operator concludes that the lock and tag-out procedures listed in the SOP aren't needed for this simple task and simply turns off the pump HOA switch and begins working.
3. While busy assembling the unit, another operator comes to the pump switch and seeing that the HOA switch is off, flips it back to auto.

SOP Suggested Format

Administrative

Title Page: *Use a standard naming procedure and clearly identify the task. Optional file number and date of creation.*

Administrative Page: *Document control page to track revisions. Also can list approval information and employee acknowledgements.*

SOP Contents

1. **Definitions:** *Define any acronyms or terms used in SOP.*
2. **Responsibilities:** *List responsibilities of key personnel.*
3. **Scope/Purpose**: *Describe what the SOP is intended to cover*
4. **Health and Safety:** *List hazards, worksite setup, training, and PPE*
5. **Procedures**: *List the required tools and step by step procedures.*
6. **Data Recording***: Data collection from the procedure.*
7. **References***: Standards*

Poll # 2

Consider this (hopefully unlikely) scenario as if it were occurring at your utility right now at this moment.

Your utility has two operators and one manager. One of the operators has been working for only two weeks, mostly shadowing the senior operator. The manager is on vacation and today the senior operator called in sick.

At around 11 am there is a power surge that knocks out power to one half of the town where the main well and disinfection system is located.

What would the new operator need to do (at this very moment) to find the information to get the well and disinfection system back on-line?

The operator would need to - - -

a) go the bookshelf where the O&M manual contains detailed SOPs specifically for generator start-up.

b) Log into an online digital resource created by the utility where the operator can find detailed start up information as well as a video about generator start-up.

c) Actually, our onboarding process has operators review the SOP and practice generator start-up multiple times during the first two weeks of employment.

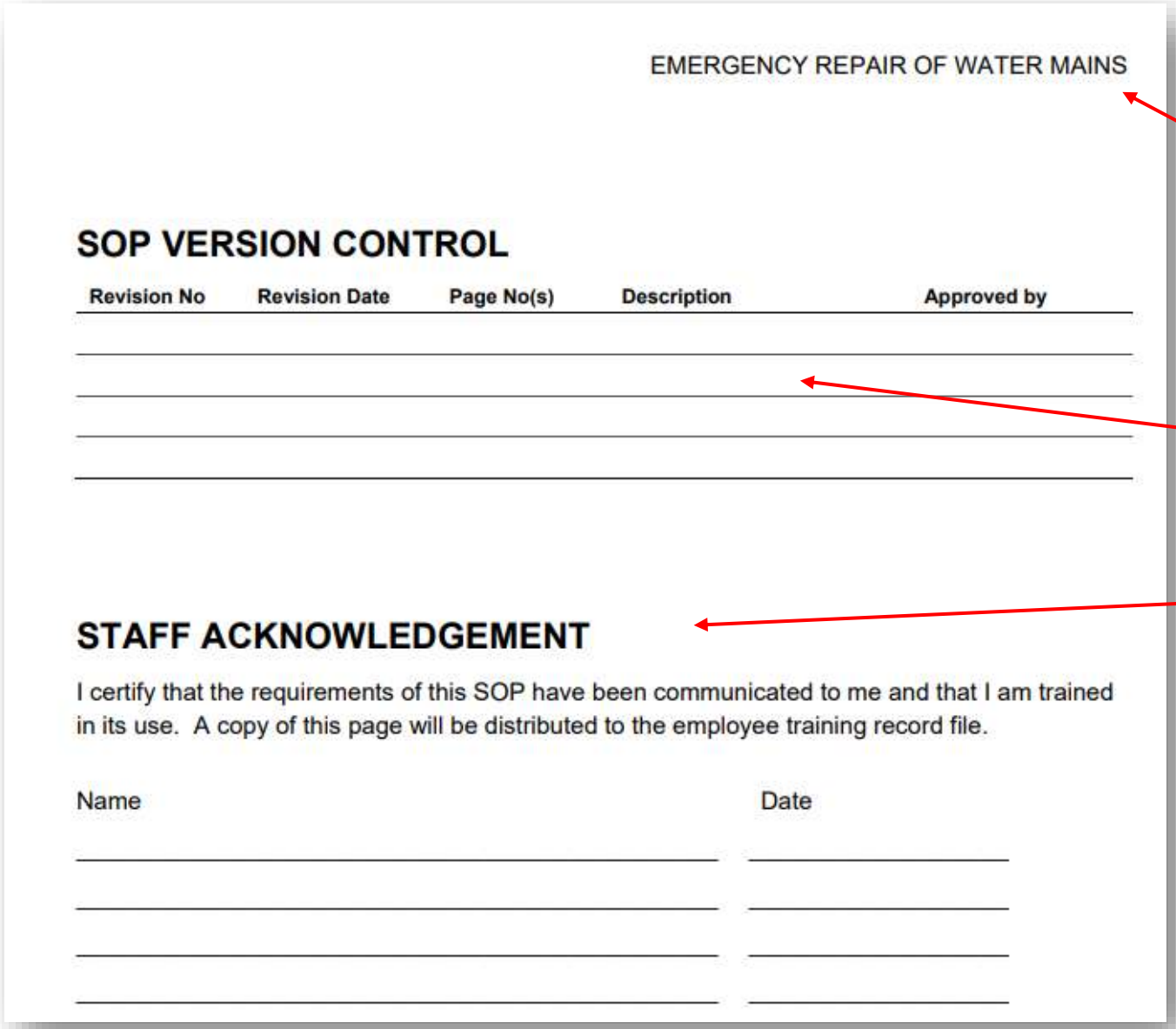
d) Go to the wellhouse where the generator is also located. Instructions have been written out for generator start-up and placed on the wall.

e) The operator would have to try to contact the vacationing manager or sick senior operator and have them walk through the procedure

Title Page

- Title clearly indicates what the SOP is about.
- SOP is numbered and dated.
- Includes information about current version.

Document Control



EMERGENCY REPAIR OF WATER MAINS

SOP VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Approved by

STAFF ACKNOWLEDGEMENT

I certify that the requirements of this SOP have been communicated to me and that I am trained in its use. A copy of this page will be distributed to the employee training record file.

Name	Date

- Header identifies the SOP topic throughout the document.
- Provides a section to document revisions.
- SOP is used to train staff.

Definitions

1 DEFINITIONS AND ACRONYMS

AWWA	American Water Works Association
EAM	enterprise asset management
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
mg/L	milligram per liter

Responsibilities

2 KEY PERSONNEL AND RESPONSIBILITIES

- Water Distribution Foreman:
  - Oversee main repair and disinfection
  - Determine and implement any follow-up activities
  - Document the break, including the type, repair conditions and activities, process used for disinfection and all sampling results, in the enterprise asset management (EAM) system
- Water Distribution Operator (2-4):
  - Conduct repairs and field disinfection process
  - Collect and analyze samples for disinfectant residual and document results
  - Collect bacteriological samples and deliver to the water quality laboratory for analysis
- Laboratory Technician:
  - Analyze bacteriological samples and report results to Water Distribution Foreman

Forman oversees and documents the repair in the EAM system.

Operators conduct repair and collect samples.

Lab techs analyze sample and report to Forman.

Scope and purpose

3 SCOPE/PURPOSE

The purpose of this SOP is to outline the procedures for repairing a main break, including any necessary flushing, disinfection and water quality testing to be conducted before a main is placed back into service. The procedures presented herein are based on the *Water Research Foundation Report #4307 – Effective Microbial Control Strategies for Main Breaks and Depressurization* (2014) and should be used in conjunction with AWWA Standard C651 – Disinfecting Water Mains. As not all breaks can be repaired in the same manner, crews should use their best judgment when implementing the procedures below.

Outlines main break repair procedures according to a particular standard.

Health and Safety

4. HEALTH AND SAFETY: This section describes hazards associated with main break repair, worksite design, required training, and PPE.

- **Hazards** – provides detailed descriptions of each type of expected hazard and worksite design factors.
  - Traffic Hazards
  - Heavy Construction/Mechanized Equipment Hazards
  - Trenching and Confined Space Hazards
  - Hazardous Chemicals
- **Worksite design factors -** signage, cones, flashers, lighting, shoring, etc.
- **Training requirements** – ability to recognize and respond to potential hazards.
- **PPE** – hard hats, safety glasses, work gloves, etc.

5. Procedures

Equipment Required: Provides a complete detailed list of safety equipment, repair equipment, fill materials, system maps, etc.

Step by Step procedures based on AWWA Standard C651-15 which divides main repair steps by type of break.

Main Break Type	Type 1	Type 2	Type 3	Type 4
Description				
Description	Controlled pipe repair without depressurization	Controlled pipe repair with depressurization after shutdown	Uncontrolled pipe break with possible water contamination or loss of sanitary conditions during repair	Uncontrolled pipe break with a likelihood of water contamination or loss of sanitary conditions during repair
Pressure Conditions	Positive pressure maintained during break and repair	Pressure maintained during break and excavation, followed by controlled shutdown for repair	Loss of pressure at break site / possible local depressurization (less than 20 psi) adjacent to the break (e.g., severe erosion requires pressure to be reduced prior to exposing the pipe)	Loss of pressure at break site / widespread depressurization (less than 20 psi) in the system (e.g., pipe blowout and loss of pressure prior to shutdown)

List and describe step by step procedures sequentially using an outline form.

Use clear active language:
*"**Evaluate** the site for safety and **set up** appropriate traffic control measures"*

Clearly indicate any decision points:
*"**If needed**, disinfect the pipe in accordance with the described method outlined in AWWA Standard C651"*

6. Data Recording & Management

Following a main break, enter all necessary information into the EAM system."

- Date and Time
- Apparent Cause
- Type of Break
- Pipe Data, etc.

- Indicates how data will be stored.
- Lists the type of data to be collected.

References

7 REFERENCES

AWWA. (2015). *C651-14 Disinfecting Water Mains.* AWWA

AWWA. (2011). *C652-11 Disinfection of Water Storage Facilities.* AWWA

Kirmeyer, G. J., Thomure, T. M., Rahman, R., Marie, J. L., LeChevallier, M. W., Yang, J., … & Schneider, O. (2014). Effective Microbial Control Strategies for Main Breaks and Depressurization. Denver, CO: Water Research Foundation.

- List of standards being used in the procedure.
- Reference materials used to develop SOP

Benefits of SOPs

- Onboarding and continuing education
- Useful for cross-training
- Develop an O&M manual
- Capture the knowledge of experienced employees

Checklist
Writing Standard Operating Procedures

- [ ] Identify a process. Example: *Scale Checks and Calibrations*
- [ ] Create a *flowchart* of the process.
- [ ] *Perform* or *watch* the process. Modify the flowchart as needed.
- [ ] Convert the flowchart into *written steps*.
- [ ] Think about why the process is necessary. This is the *Purpose*.
- [ ] Assign *ownership*. Who is responsible for the process?
- [ ] Write down all *tools* and *materials* needed for the process.
- [ ] Research the *frequency* of the process. Example: Weekly
- [ ] Make note of any *safety* and *health warning*.
- [ ] Include a section to track *updates* and *reviews* to the SOP.
- [ ] If needed add *definitions*, *references*, *pictures*, or *diagrams*.
- [ ] *Test* the procedure. Pretend you are a *new employee*!
- [ ] Have someone other than yourself (a manager preferably) *approve* the procedure.

SOP Tips for long-term successful implementation

- Make the SOP digital as well as printed
- Encourage employees to make suggestions to improve operation and maintenance procedures
- Involve staff in SOP development
- Provide training using SOPs
- Budget time for employees to enter data and update procedures when needed.

Poll #3:

A current SOP requires that all operators must employ all arc-flash personal protective equipment when opening any electrical panel.

Some of the panels however for the SCADA system are low voltage (24 volts) and operators are getting frustrated because the PPE is interfering with their ability to make adjustments and take readings.

In your opinion, what do you feel is the biggest concern here?

a) Operators could start ignoring other SOPs
b) Feedback from operators is not being considered.
c) The SOP instructions should be more flexible.
d) The SOP is fine the way it is – you never know when there could be an arc flash. The problem is with the operators' unwillingness to use it.
e) The purpose of the SOP is unclear.

Testing an SOP

- If possible have different people perform the task based on the instructions – engineers, vendors, experienced employees, new employees, and especially someone who knows nothing about the task.
- Note any areas of misunderstanding and edit the SOP to make it more clear
- Also have persons perform the task at different locations or in different settings if applicable

Exercise to Develop SOP Step-by-step procedures.

1. Have each of your staff members create step by step instructions for a simple task with 6 steps or less.
2. Ask them to use clear, active language.
3. Have them name the SOP with a clear title.
4. Have the employees trade their SOP with another person and see if they could complete the task using the instructions.