Optimizing Utility Operation Through the Use of AWWA Utility Management Standards

G-100 Treatment Plant Optimization

D. Gerard Yates
Water Quality & Treatment Dept. Manager
Central Utah Water Conservancy District
Recent Water Treatment in the News

- Michigan Governor Apologizes for Flint Water Crisis
- “President Obama and senior White House advisor Valerie Jarrett met with Flint Mayor Karen Weaver”
- “You’re paying for poison. I’m paying for water that’s a toxic waste”
- “Improperly treated water from the Flint River allowed lead to leach from the pipes, officials said”
- “Adding that an anti-corrosion agent would have cost about $100 a day, and experts say 90% of the problems with Flint’s water would have been avoided”
- (Lead & Copper), Legionella, HAB (cyanotoxins), EDC’s, DBPs, & Spill Events...
Why Should I Put in the Extra Effort?

• I Do Not Want To Make The News

• Producing Exceptionally a Reliable Supply of High Quality Water in a Cost Effective Manner – Will Never Be “Newsworthy” and That’s OK
G-100?

• It is a broad based, comprehensive evaluation and optimization tool based on industry standards and best management practices (Specific to Water Treatment)

• It provides confidence that I am not missing something important

• I don’t have to “re-invent” it
Rationale

• To gain a better understanding of the AWWA Utility Management Standard for Water Treatment Plant Operation and Management – also known as the G-100 Standard

• To consistently produce high-quality water by following best management practices
Learning Objectives

• As a result of this workshop…
  – You will understand the purpose and function of the G100 Standard
  – You will understand how to employ an optimization strategy to identify opportunities for improvement
  – You will know how to implement and incorporate the elements of the standard into everyday operations
Agenda

• Overview of AWWA G100 Standard
• Description of how CUWCD used the G100 standard and guide book as a comprehensive optimization tool
• Review content of worksheets in the Operational Guide
AWWA G100 Standard & Operational Guide

- 2005 – AWWA approved and published the G100 Standard
- In 2011, AWWA produced (under Technical and Educational Council) the G100 Guidebook
The Guide was written as a guidance tool for the implementation of water treatment plant operation and management best practices as set forth in the ANSI/AWWA Standard G100.
Key Points of the Standard

• **4 Major Categories:**
  1. Regulatory Compliance Requirements
  2. Operational Management Practices
  3. Plant-real property Management and Maintenance
  4. Water Quality Management

• Establish measurable goals, implement a monitoring system to measure performance of goals, employ an optimization strategy to identify opportunities for improvement, and maintain consistent operation that satisfies the goals under all conditions
Program Introduction

• AWWA Intermountain Section’s Utility Quality Management Committee
• “Train the Trainer” sessions on source water, treatment, & distribution standards
• Promotion of G-series standards and guidebooks, self-assessments, and peer reviews
• “OK – We should do this”
Utility Perspective – Background

Central Utah Water Conservancy District
We collect and store snow melt
Collection through mountain diversion dams
Mountain Storage Reservoirs
Another Storage Reservoir (Stillwater)
Large conveyance pipelines

(This pipeline was drilled 8 miles through a mountain)
Upper Provo River
Deer Creek Reservoir
Lower Provo River
River Diversion Dam to Treatment Plants
Ashley Valley Plant
20 MGD - Conventional

Duchesne Valley Plant
10 MGD – Direct w Ozone
3 Treatment Plants with Unique Challenges

- Same Operational Goals
- Different Sizes (100 MGD, 20 MGD, 10 MGD)
- Difference Source Water
- Different Chemicals
- Conventional & Direct Filtration
- Free Chlorine
- Ozone (2 plants)
- Deep Bed Filters
- Different Underdrains
- Different Solids Handling
- Different Finished Water Quality Challenges
- Different Personalities and Skills
We are doing quite well – but are we missing something important?
Utah Valley Water Treatment Plant
Water Quality Improvements 1996 - Date

US EPA regulatory limit = 0.3 NTU
Plant Max Goal = 0.10 NTU
“There’s always room for improvement!
It’s a small room with no windows and no
distraction. And we already moved your things.”
Some Good Business Reasons For Change

- We’re doing well but are we missing something?
- O&M guided by industry “best practices”
- Develop (train) our water professionals with confidence in their ability to do the job well
- Incorporate A Comprehensive System Wide Optimization Program
- Utilize A Comprehensive Asset Management Program
- Provides For Effective Succession Planning
- Provides For Improved Customer Satisfaction
Plant Optimization Using the AWWA G100 Utility Management Standard and Guide
Guide Book Section 7: Audit Checklist

• Compliance With Regulatory Requirements?
  – Are we meeting all the applicable regulations and are we striving to perform better than minimal required?

• Operational Management Practices
  • Are all plant personnel involved in the accomplishment of the utility’s programs?  (oops!)
## Regulatory Compliance / Mission Goals / Financial Planning

<table>
<thead>
<tr>
<th>Checklist Question</th>
<th>Yes/No</th>
<th>Discussion / Comments</th>
<th>Documentation / Examples</th>
<th>Percent Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.1 - Compliance with Regulatory Requirements</strong></td>
<td></td>
<td>In addition to meeting all federal and state regulations the UVWTP has an excellent -10 rating on the Utah IPS Report indicating a very high level of compliance. (Customer DBPs??)</td>
<td>2010 IPS Rule Summary</td>
<td>100%</td>
</tr>
<tr>
<td>Does the plant meet all Federal, State and Local regulations?</td>
<td></td>
<td>The UVWTP communicates their compliance to its customer agencies through the Consumer Confidence Report.</td>
<td>CCR</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Laboratory Director maintains a database of all regulatory and nonregulatory testing. This is reviewed annually as well as when individual results are received.</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td><strong>4.2 Operational Management Practices</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.21- Business Practices</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mission Statement / Optimization Goals / Review</td>
<td></td>
<td>In order to keep goals in the forefront of the operators minds, the goals are posted in the operations room. These goals are reinforced with training as well as monetary rewards annually.</td>
<td>CUWCD Mission Statement</td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UVWTP Goals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Turbidity Goals and History</td>
<td></td>
</tr>
<tr>
<td><strong>4.2.1.1 - Budget and Financial Management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Financial Planning</td>
<td></td>
<td>CUWCD has an annual budget cycle. The UVWTP manager meets with plant personnel and compiles the budget. The budget is then reviewed by the Water Quality / Treatment Manager before final approval is given by the Board of Directors.</td>
<td>Annual Budget Example</td>
<td>100%</td>
</tr>
</tbody>
</table>
It’s OK To Answer “No”

Total THMs

43.2

28.3

4/29/2013

4/29/2014

mg/L
### Safety Procedures

Safety is a one of the District's core values and has always been at the forefront of employees' minds. Safety is addressed by having weekly safety messages. In the 33 years that the UVWTP has been in operation there has not been a lost time accident. The plant is in complete compliance with OSHA and Risk Management Requirements. All visitors and contractors are trained in those safety items pertinent to their visit.

#### 4.2.12 Customer Inquiry Tracking and Response

Because UVWTP is wholesaler, we do not deal directly to public inquiries. We are in contact with our customer agencies on a continuous basis and they relay trends or complaints that may or may not be related to the water produced at the plant. We offer free bacteriological and esthetic testing to these agencies upon their request. One of the most common reasons for customer complaints would be the aesthetic (taste/odor). It is the goal of the plant to maintain aesthetic to a high level and address them with all tools available at the plant as they are detected. The plant conducts flavor and taste profiling on a 4 hour basis as well as testing for the threshold odor number (TON) on a daily basis.

*Every four hours the operator conducts a taste and odor flavor profile and records their finding on the operations log. Any rating lower than "excellent" is then characterized with an accompanying odor description, i.e., "earthy / musty. When the rating of..."

### Redundancy

All critical equipment at the plant has redundancy even down to the electrical transformers. In addition preventative and predictive maintenance is performed on equipment regularly to ensure reliability. Spare parts are stocked for critical pieces of equipment to address single points of failure.

*Maintenance Records, Spare Parts, Action*
4.2.2.1 Production Limits

Written policy for plant production limits for each unit process, sets process objectives, and demonstrates meeting objectives.

Unit Filter Run Volumes
(First 12 Days in May)

- 2013: 4,525 Gallons/ft²
- 2014: 25,025 Gallons/ft²
Did I Say “Comprehensive”? 

- Compliance  
- Business Practices  
- Budget & Financial  
- Plant CIP  
- Energy Management  
- Plant Production/Supply  
- Production Capacity  
- Plant Cleanliness  
- Operating Permits  
- Plant Management  
- Training Program  
- Quality Assurance  
- SOP’s  
- Chemical QA  
- Calibration  
- Emergency Preparedness  
- Security Planning  
- Customer Care…….
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<td>□ Yes □ No</td>
<td>Minimum design standards are followed to ensure water quality and all projects are reviewed by engineers in the E&amp;C department as well as the Engineering Manager of WD. During construction, pipes are protected from outside contaminants, and then flushed and disinfected prior to activation.</td>
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<td>4.2.11.1 Policies and procedures. Utilities shall have a formal, standardized design procedure that provides for comprehensive review of all construction projects to reduce the potential for water quality degradation during and following installation of the project.</td>
<td></td>
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<td>4.2.11.2 Records. Utilities shall prepare as-built drawings of all installed facilities and shall maintain records associated with inspection, design, and construction of all new and retrofitted facilities.</td>
<td>□ Yes □ No</td>
<td>As-builts are required for any facilities installed by outside contractors. The WD also makes use of Grid maps, valve cards and the GIS (which in most cases is built from the as-builts).</td>
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<td>4.2.12 Energy management.</td>
<td>□ Yes □ No</td>
<td>The E&amp;C Dept’s Basis of Design SOI requires evaluation of energy use in new projects.</td>
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<td>4.2.12.1 Energy management program. The utility shall have a program to review and optimize energy usage. The program shall have the following elements: 1. A review of energy usage, identification of energy use trends and cost or usage tracking versus time. 2. Consideration of energy costs in its evaluation of new distribution system facilities.</td>
<td></td>
<td>HWTP follows SOI HO.2001.35 Power Management Load Control when filling tanks to ensure they are using off-peak energy rates. And they are looking into strengthening their program of which pumps to run when to get the most efficient performance. This program is not in place yet, but they are working on the details.</td>
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<td>4.3.1 Treated water storage facilities.</td>
<td>□ Yes □ No</td>
<td>Levels for storage facilities are based on fire flows required and are laid out in SOIs for each reservoir. Alarms on SCADA are set for low levels.</td>
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<td>4.3.1.1 Storage capacity. The utility shall establish minimum operating levels in storage facilities based on pressure in the distribution system, fire flow requirements, emergency storage requirements, and other site-specific conditions.</td>
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New Manager Experience

• G-100 is a self assessment tool to evaluate how we are doing and what we are missing

• Helped us identify areas of concern that we did not even know were areas of concern

• Helped us identify and address missing pieces: *Chemical QC, operational goals, importance of SOP’s, comprehensive training program, customer care program, inspection frequency program, system failure training*.....
Continued: New Manager Experience

• At first we started the audit with the attitude of checking the boxes “yes” – then we decided it was OK to recognize that we have some work to do

• I thought we were doing well – but now I know “how well” we are doing using industry standards

• We now have real goals for improvement

• We have confidence that we are not missing something important

• This has been a real team builder

• And I sleep a lot better at night
“We took our time – we had fun- we worked together as a team – we’re still improving – and it’s great!”
## Worksheet Review

*Taken from G100 Standard Operational Guide*

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Operational Goals and Objectives (Example)

1. Has the plant established goals for water quality and plant efficiency?
2. Are these goals monitored and what actions are taken if they are not met?
3. Does the utility have performance goals to protect the public health and enhance customer satisfaction?
4. Do the goals exceed the regulatory requirements, yet are realistic and achievable?
5. Does the utility produce water that always meets or exceeds regulatory requirements in terms of quality and demand?
Standard Operating Procedures (Example)

1. Does the utility have standard operating procedures for all the critical operations and maintenance activities?
2. Does the utility routinely review and update these procedures by getting feedback from all of the stakeholders?
3. Do these procedures get updated in a timely manner?
4. Do the standard operating procedures incorporate manufacturers’ recommendations and best management practices?
5. Review SOPs and the process for implementing and updating these procedures.
Unattended Operation Guide

If Unattended Operation is Permitted, the Operation Must Include The Following Additional Controls:

1. Control Limits (set response time)
2. Alarm Notification (notification protocol / multiple alarms where appropriate)
3. Backup Notification (system failure alternative)
4. Default Settings (system failure = fail safe default)
5. Notification System Validation
Unattended Operation (Rationale)

Some plants especially at smaller utilities are unattended with regular visits from a certified operator...

Regardless of the size of the plant and the length of time it is left unattended, all unattended plants must have an electronic system that monitors settings on plant equipment and flow, as well as an automated evaluation protocol and an alarm system that notifies operators of major problems or a plant shutdown. This sort of operational protocol is programmed into a SCADA system that can check control limits, determine when an alarm condition is reached, and initiate an alarm call-out.
5.1 Operation: SOP Example G100 Operational Guide

1. Ensure poke point for the Auto-Hand position on SCADA.
2. Ensure pumps are showing available on SCADA.
3. Press poke point on SCADA of desired pump, and press the start command.
4. After pump has started, adjust manual-speed control on SCADA to the desired percentage.
5. Monitor motor windings, bearing temperatures, pump vibration, amps, total dynamic head, and pump submergence.
6. Check for unusual noises and excessive heat coming from the pump.

_Shut down Instructions_
1. Ensure poke point for the Auto-Hand is in the Hand position of SCADA.
2. Ensure pumps are showing available on SCADA.
3. Press poke point on SCADA of desired pump, and press the stop command.

In the event of a power loss, place pumps in the off position on SCADA until power is restored. Inform instrumentation of problem and investigate problem. Take corrective action, clear alarms, and start desired pump.....
Summary (Standards = Optimization Tool)

- Utilizing Best Practices will Foster Sustainability
- Start with a Guided Self Evaluation (cost effective)
- Optimization Prevents Shocks/Upsets
- Meet Present Needs w/o Compromising the Ability for Future Change
- Minimize Critical Knowledge Loss
- Ability to Train & Retain Qualified Employees
- Tool to Identify & Mitigate Risk
- Program to Educate Stakeholders – True /Value of Water
- Enhance Customer Confidence
- Vehicle to Move from Laggards to Leaders
Recommendations: Why the Peer Review Process?

- Even the coach needs a coach
- Peer reviewers are not enforcing a rule
- Identifying and implementing operational improvements is a good thing
- We can utilize in-house or outside reviewers
- A neutral review is a valuable resource
- Can also help recognize and celebrate success
- **Beware** of enemies of progress (fatalism, protectionism, and tradition)
Questions?

Central Utah Water Conservancy District
E-mail: Gerard@cuwcd.com
River Diversion Dam to Treatment Plants
Saturday Morning 10:00 am
Savage Brothers truck rolls ¾ mile above Olmsted Diversion Dam
Most of the oil in one tank spills – An estimated 1000 gallons flows into the Provo River
Most of the oil entered the river through this storm drain

Photos (Wednesday 12/02/2015)
Oil solidifies and floats down river towards the Olmstead Diversion Dam.
Oil Floating towards Olmsted Diversion where CUWCD staff had closed the intake – raised the water level - and deployed the containment boom
Training Pays
Emergency Response Coordination Pays Off

Central Utah Water Conservancy District
“Providing Safe Reliable Drinking Water Through Provo Canyon and Provo River”

Emergency Paging Service For All Provo Canyon Water Related Emergencies.
(801) 431-0814
The Plan

- Protect life
- Contain the spill
- Protect water facilities
- Communicate to stakeholders
- Coordinate efforts
- Repair Damage
- Timely Clean Up Spill
- Water Quality Testing
- Restore flow

The Challenge

- Protect life
- Contain the spill
- Protect water facilities
- Communicate to stakeholders
- Coordinate efforts
- Repair Damage
- Timely Clean Up Spill
- Water Quality Testing
- Restore flow
The Cleanup
Clean up and Testing
Friday December 4th

Substantial Clean-up Completed

Testing Results: All Non-detect

Flows Restored to Area Treatment Plants

95 CFS X 6 days = lost water supply for 4,000 people for entire year

Note: The containment booms will remain in place through the winter to collect any remaining oil

EPA: “I respond to many spill events and I provide a lot of training. This spill event will now be used in all future training as the standard for how to prepare and respond” (Joyel R. Dhieux)
Questions?

Central Utah Water Conservancy District
E-mail: Gerard@cuwcd.com