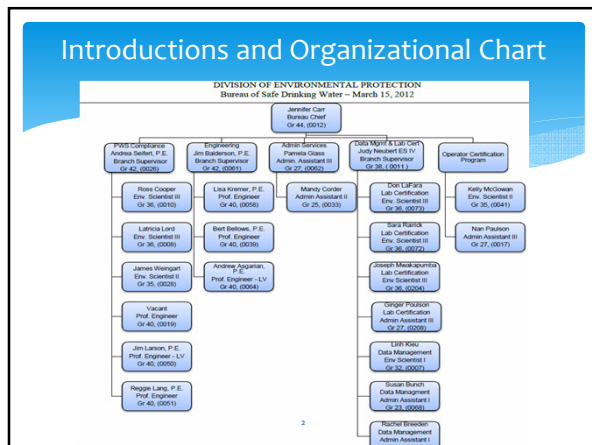


Important Changes in Chlorine Monitoring Compliance

Bureau of Safe Drinking Water
Presented by:
Don LaFara, Reggie Lang, Latricia Lord & Andrea Seifert



Housekeeping Notes

- * Please sign in.
- * CEU's will not be issued if you do not:
 - * Sign in,
 - * Remain the entire time, and
 - * Participate in the training activities.
- * Restroom Facilities
- * Feel free to follow along with your Colorimeter.

Presentation Overview

- * Method 4500-Cl G (30 minutes)
 - * Who does this impact? Why Now?
 - * Regulation Review
 - * Procedural Review
 - * Common EPA Approved and Unapproved Units
- * Standard Operating Procedure (30 minutes)
 - * Utilizing Secondary Gel Standards
 - * Performing an Initial Demonstration of Capability (IDC)
 - * Routine Calibration Verification Standard
 - * Reporting Results to BSDW
- * Hands-On Exercise (1 hour)
- * Ensuring Compliance (30 minutes)
 - * Take back to your water system
 - * Sanitary Survey and BSDW Checklist
 - * Completing the Quarterly Chlorine Residual Report

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Keep This in Mind From Source to Tap

Method 4500-Cl G Who does this impact? Why Now?

- * Who does this impact?
 - * Systems Utilizing DPD Colorimetric Test Kits for Compliance Monitoring
 - * Maximum Residual Disinfectant Level for Chlorine and Chloramines
 - * Community & Non-Transient Non-Community
 - * Chlorinated or Chloraminated Water Systems
 - * Treatment for Pathogens & Take Grab Samples
 - * All Public Water Systems
- * Why Now?
 - * Recent review and comments from EPA on our primacy package for the Stage 1 DBP Rule.
 - * Provide process to ensure that field data obtained for compliance is equivalent to certified lab data.

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Method 4500-Cl G
Regulation Review

Distribution

- * Stage 1 Disinfectant/Disinfection Byproducts Rule
 - * Monitoring Requirement
 - * NAC 445A.4525, 40 CFR §141.132(c)
 - * Chlorine and Chloramines
 - * Requires chlorine residual monitoring at same time and place as Coliform monitoring (Routine and Repeat).
 - * Surface Water Treatment Rules
 - * Monitoring Requirement
 - * NAC 445A.527, 40 CFR §141.72

Method 4500-Cl G
Regulation Review

Distribution

- * Stage 1 Disinfectant/Disinfection Byproducts Rule
 - * Analytical Requirement
 - * NAC 445A.458 (4)-Conduct of Analysis → 40 CFR 141.131 (c)
 - * (2) If approved by the State, systems may also measure residual disinfectant concentrations for chlorine, chloramines, and chlorine dioxide by using DPD colorimetric test kits.
 - * Chlorine and Chloramine-4500-Cl G
 - * Chlorine Dioxide-4500 ClO₂ D
 - * (3) A party approved by EPA or the State must measure residual disinfectant concentration.
 - * Free chlorine or total chlorine may be measured for demonstrating compliance with the chlorine MRDL and combined chlorine, or total chlorine may be measured for demonstrating compliance with the chloramine MRDL.

Method 4500-Cl G
Regulation Review

Distribution

- * Surface Water Treatment Rule
 - * Analytical Requirement
 - * NAC 445A.527-Requirements for Monitoring → 40 CFR 141.74(a)(2)
 - * If approved by the State, residual disinfectant concentrations for free chlorine and combined chlorine also may be measured by using DPD colorimetric test kits.
 - * In addition States may approve the use of the ITS free chlorine test strip for the determination of free chlorine. Use of the test strips is described in Method D99-003, "Free Chlorine Species (HOCl and OCl⁻) by Test Strip," Revision 3.0, November 21, 2003, available from Industrial Test Systems, Inc.

Method 4500-Cl G Regulation Review

TREATMENT

- * Surface Water Treatment Rule
- * Monitoring Requirement- Procedure applies for Grab Samples
 - * NAC 445A.527 → 40 CFR §141.74
 - * Requires chlorine residual monitoring to determine contact time and Entry Point to the Distribution System Monitoring
 - * If continuous monitoring fails, grab sampling every 4 hours can be used to determine compliance

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Method 4500-Cl G Regulation Review

TREATMENT

- * Ground Water Rule
- * Monitoring Requirement- Procedure applies for Grab Samples
 - * NAC 445A.4525 → §141.403(b)(3)(i)
 - * (A) Population >3300
 - * Must continuously monitor
 - * The ground water system must maintain the State-determined residual disinfectant concentration every day the ground water system serves water from the ground water source to the public.
 - * If there is a failure in the continuous monitoring equipment, the ground water system must conduct grab sampling every four hours until the continuous monitoring equipment is returned to service.
 - * Must resume continuous residual disinfectant monitoring within 14 days.

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Method 4500-Cl G Regulation Review

TREATMENT

- * Ground Water Rule
- * Monitoring Requirement-Procedure applies for Grab Samples
 - * NAC 445A.4525 → §141.403(b)(3)(i)
 - * (B) Population ≤ 3300
 - * Must take a daily grab sample during the hour of peak flow or at another time specified by the State.
 - * If any daily grab sample measurement falls below the State-determined residual disinfectant concentration, the ground water system must take follow-up samples every four hours until the residual disinfectant concentration is restored to the State-determined level.
 - * Alternatively, may monitor continuously and meet the requirements of paragraph (b)(3)(i)(A) of this section.

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Method 4500-Cl G Regulation Review

TREATMENT

- * Surface Water Treatment Rule and Ground Water Rule
 - * Analytical Requirement
 - * NAC 445A.4525, 445A.458, 445A.527 → 40 CFR 141.74 (a)
 - * NAC 445A.4525 → 40 CFR 141.403 → 40 CFR 141.74 (a)
 - * (2) Public water systems must measure residual disinfectant concentrations with one of the analytical methods in the table or
 - * If approved by the State, residual disinfectant concentrations for free chlorine and combined chlorine also may be measured by using [DPD colorimetric test kits](#).
 - * In addition States may approve the use of the ITS free chlorine test strip for the determination of free chlorine. Use of the test strips is described in Method D99-003, "Free Chlorine Species (HOCl and OCl⁻) by Test Strip," Revision 3.0, November 21, 2003, available from Industrial Test Systems, Inc.

Method 4500-Cl G Regulation Review

- * NAC 445A.458 Conduct of analysis.
 - * 1. Except as otherwise provided in this section, each analysis required by NAC 445A.4525 to 445A.457, inclusive, must be performed by a laboratory certified pursuant to NAC 445A.542 to 445A.54296, inclusive.
 - * 2. Turbidity measurements may be made by a laboratory certified pursuant to NAC 445A.542 to 445A.54296, inclusive, or by public water system personnel utilizing an instrument capable of meeting the requirements of 40 C.F.R. § 141.74(a)(1), as adopted by reference pursuant to NAC 445A.4525.
 - * 3. Chlorine residual measurements to comply with 40 C.F.R. §§ 141.72 and 141.74, as adopted by reference in NAC 445A.4525, must be made by public water system personnel utilizing an instrument and methods capable of meeting the requirements of 40 C.F.R. § 141.74(a)(2), as adopted by reference in NAC 445A.4525.

Method 4500-Cl G Regulation Review

- * NAC 445A.458 Conduct of analysis.
 - * 4. Chlorine, chloramines or chlorine dioxide residual measurements to comply with the maximum residual disinfectant level must be made by public water system personnel using an instrument and methods capable of meeting the requirements of 40 C.F.R. § 141.131(c), as adopted by reference in NAC 445A.4525.
 - * 5. Temperature and pH measurements must be made by the public water system utilizing an instrument and methods capable of meeting the requirements of 40 C.F.R. § 141.23(k)(1), as adopted by reference in NAC 445A.4525.
 - * 6. Public water systems may direct the laboratory which analyzes water samples to submit the results of the sample to the Division or the appropriate district board of health.

Method 4500-Cl G Regulation Review

Analytical Methods—40 CFR 141.131 (c) Table

Methodology	SM (19th or 20th ed)	SM Online ²	ASTM method	Residual Measured		
				Free Cl ₂	Combined Cl ₂	Total Cl ₂
Amperometric Titration	4500-Cl D	4500-Cl D-00	D 1253-86 (96), 03	x	x	x
Low Level Amperometric Titration	4500-Cl E	4500-Cl E-00				x
DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F-00		x	x	x
DPD Colorimetric	4500-Cl G	4500-Cl G-00		x	x	
Synergaldazine (FACTS)	4500-Cl H	4500-Cl H-00	¹⁶	x		

Method 4500-Cl G Procedural Review

* Why is this important?

- * Chlorine Residual results must be obtained in a manner consistent with Laboratory Methods.
- * Holding Time for Chlorine is immediately (15 minutes).
- * Field Colorimeters developed to comply with Method 4500-Cl G are acceptable for compliance reporting.
- * Legal defensibility.

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Method 4500-Cl G Procedural Review

* What will I need to do differently?

- * Utilize EPA approved Colorimeter(s) that meets Method 4500-Cl G criteria.
 - * Wavelength must be 490-530 nm with light path > 1 cm (SM 4500-Cl G 2.a. 2)
- * Develop and implement a Standard Operating Procedure (SOP).
- * Perform an Initial Demonstration of Capability (IDC).
- * Utilize Secondary Standards to verify the calibration of your Colorimeter.
 - * These are NOT the Secondary IOC's sampled for triennially
- * Be prepared to defend your data!

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Method 4500-Cl G Procedural Review

- * Why do I need an SOP?
 - * Creates consistency when a process is performed
 - * Provides a format that is easy to follow
 - * Reduces the possibility of human error
 - * Provides guidelines for employees to follow
 - * Ensures data is Legally Defensible
- * BSDW created a Template that you can tailor to fit your system.

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Method 4500-Cl G Procedural Review

- * What are Secondary Standards? Why are they important?
 - * Secondary Standards are used to perform the IDC and to quickly check the accuracy of your colorimeter.
 - * Colorimeters are factory calibrated. The calibration can shift and should be verified with Secondary Standards each day a Chlorine Residual is obtained.
- * What is an Initial Demonstration of Capability?
 - * A procedure to confirm the operator can properly perform a particular method. Subsequently performed with any significant changes (new instrument, new operator, new standards, new/revised methods).
 - * We will walk you through performing an IDC as part of this training.

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Common EPA Approved Field Instruments



Hach Pocket
Colorimeter II



Hach DR890
Colorimeter



LaMotte 1200-CL
Colorimeter

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Non EPA Approved Units



Color Wheels

Non DPD Colorimeters

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Non EPA Approved Units

A portable, easy to use solution for field-measurement of Residual Chlorine

Features

No Reagents Required
The colorimetric method enables measurement to be carried out easily without the need for reagent treatment and management. This reduces operating costs compared to using DPD method for measurements. It also allows more stable measurements without the human errors associated with colorimetric measurements.

Waterproof Construction
Meter is constructed to IP 67 standards and can withstand complete immersion into water (1m for 30 minutes). Provides worry free operation in outdoor environments.

ISO Validation Functions
The instrument includes time functions and internal storage of 1000 measurement results. The electrode sensor stores model, serial number, calibration value, alignment coefficient in an internal memory chip. This data is automatically downloaded to the meter when the electrode is connected.

RS232 Output
Stored data can be printed using a separately available printer or data can be sent to other peripherals such as personal computers etc. for further statistical manipulation.

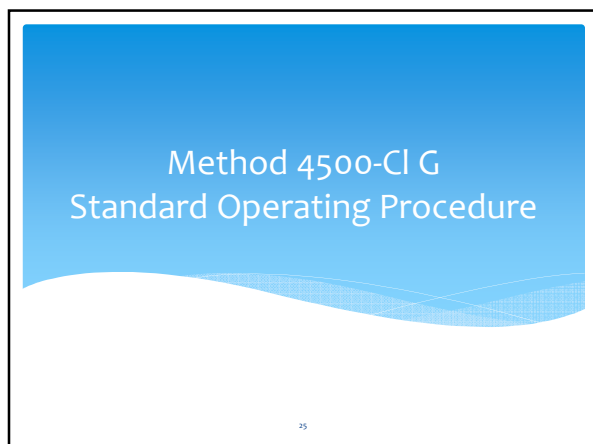
Continuous Measurement Option
Continuous measurement operation is possible (Model RC-31P-F only). A beads cleaning kit (C1200005) is available as standard accessory. The measurement mode must be changed to real time (continuous measurement not possible in auto-hold mode).

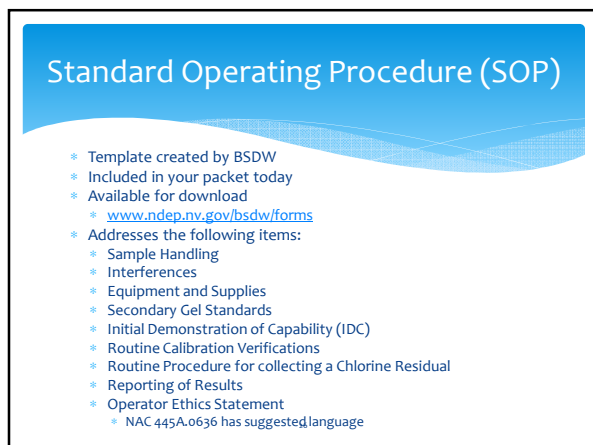
Container and Throw-in Sensor Type (Model RC-31P-F)
Measurement is performed after collecting sample in the container or by tossing the float type sensor into the water and commences after the ENTER/HOLD button is pressed. The use of a beads cleaning system allows continuous measurements to be performed. (Contact DKK-TOK with details of your application)



Questions?

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SOP Section 6- Definitions

- * Initial Demonstration of Capability (Section 6):
 - * Very simple procedure that shows each operator is capable of performing analysis.
 - * Also ensures the accuracy of your colorimeter.
 - * What does Relative Standard Deviation mean?
 - * Standard Deviation is simply a measure of how spread out the numbers are in a given set of data.
 - * What is % Recovery?

$$\frac{\text{Amount Obtained (recovered)}}{\text{Starting Amount}} \times 100 = \%R$$

OR:

 - * How much Stuff you ended up with / How much Stuff you started with x 100 = percent recovery of Stuff

SOP Section 6

- * Initial Demonstration of Capability (Section 6):
 - * Procedure for Performing
 - * Step by step instructions for excel spreadsheet
 - * Analyst and Witness should sign
 - * Witness Affiliation shows BSDW that the witness is knowledgeable in the procedure
 - * Keep this on file for review during a Sanitary Survey

SOP Section 7

- * Routine Calibration Verification Standards (Section 7):
 - * Perform prior to collecting a chlorine residual for compliance.
 - * Perform before leaving office or treatment plant for the day.
 - * Gel Standards are temperature sensitive
 - * Perform prior to sampling and again following the final sample analysis of the work day.
 - * More Defensible especially for systems collecting a large number of samples

SOP Section 7

- * Routine Calibration Verification Standards (Section 7):
 - * Ensures your Colorimeter is reading within range.
 - * Rule of thumb- Use standard that is $\frac{1}{2}$ the expected Cl₂ residual.
 - * Reading should be $\leq 15\%$ of Known Concentration.
 - * Notice trending towards $\geq 15\%$.

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SOP Section 8

- * Analytical Procedure (Section 8)
 - * This is what you all know how to do better than us!
 - * Be aware of minor details associated with:
 - * Low Range vs. High Range
 - * Free Chlorine vs. Total Chlorine
 - * Write these details into your SOP

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SOP Section 9

- * Recordkeeping (Section 9)
 - * Describe your internal procedure for Recordkeeping
 - * May include:
 - * Writing result on Chain of Custody
 - * Maintaining a Log of results and date analyzed
 - * Creating a Spreadsheet

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SOP Section 9

Reporting Results -Distribution System

- * Reporting Results (Section 9)
 - * Describe your internal procedure for Reporting Data
 - * Compliance Data
 - * Utilize "Disinfectant Residual Data Quarterly Report" Form
 - * Report values to BSDW by the 10th of the month following each quarter
 - * Operational Data
 - * Provide to supervisors and other staff
 - * Providing data to next shift operator
 - * Providing data to management



Microsoft Excel
97-2003 Worksheet

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SOP Section 9 cont.

Reporting Results - Surface Water Treatment Rule

- * Reporting Results (Section 9)
- * Monthly Report-Routine Monitoring (NAC 445A.527)
 - * Daily Chlorine Parameters
 - * Minimum chlorine residual at entry point to distribution system
 - * Minimum Contact Time
 - * Residual in distribution system cannot be undetectable in more than 5% of the monthly samples
- * As soon as possible-no later than next business day (NAC 445A.538)
 - * If your online chlorine analyzer fails
 - * Take Chlorine Residual Grab Samples every 4 hours, no more than 5 working days following equipment failure.
 - * Failure to meet minimum Contact Time

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SOP Section 9 cont.

Reporting Results - Ground Water Rule

- * Reporting Results (Section 9)
- * As soon as possible-no later than next business day
 - NAC 445A.4525 → 40 CFR 141.405(1)
 - * If water system fails to meet minimum chlorine residual for more than four hours.
- * Every 3 months NAC 445A.5405
 - * Sampling log verifying that treatment plant treating in accordance with the state regulations

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SOP Sections 10-12

- * Safety: DPD is Toxic. Refer to the MSDS.
- * References: Utilize your Owners Manual!
- * Ethics Statement: Referenced in NAC 445A.54278 and just good business practice.
- * Each operator should read the SOP and Sign and Date.
- * Keep these copies on file for review during a Sanitary Survey.

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Method 4500-Cl G
Hands-On Exercise

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Hands On Exercise

- * Small groups:
 - * Hach Pocket II Colorimeters
 - * Hach DR890 Colorimeter
 - * LaMotte 1200
- * Obtain Known Concentrations
- * Perform an Initial Demonstration of Capability (IDC)
- * Perform a Routine Calibration Verification Standard (CVS)

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Ensuring Compliance

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Ensuring Compliance

- * Take this back to your water system and implement a procedure, conduct Initial Demonstration of Capabilities, train your other operators.
- * Feedback from attendees
- * Questions



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Ensuring Compliance

- * What to expect on an Inspection
 - * Have SOP and completed IDC forms ready for your Sanitary Survey.

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Ensuring Compliance

- * You've spent a lot of time obtaining accurate and defensible results—Ensure you Report the Data Correctly
- * Distribution System-Maximum Residual Disinfectant Level
 - * Utilize Quarterly report form to report values to BSDW



Microsoft Excel
97-2003 Worksheet

- * Total Coliform Rule and Chlorine Residuals reported to our office go hand in hand.
 - * Collect a residual at each Total Coliform sample site.
 - * # of samples on this form must match samples taken for compliance with Total Coliform Rule.
 - * Report Chlorine Residuals for Routine & Repeats required under the Total Coliform Rule.

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Ensuring Compliance

- * Distribution System-Maximum Residual Disinfectant Level (Continued)
 - * Compliance is based on the Running Annual Average-4.0 mg/L
 - * Labs include individual residuals on reports as a courtesy
 - * These values may be transposed or omitted by the lab
 - * Example: 0.38 accidentally becomes 0.83.
 - * If omitted we don't always receive a copy of your Chain of Custody
 - * Results are due by the 10th of the month following each Quarter

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Ensuring Compliance

- * Surface Water Treatment & Ground Water Treatment
 - * Contact BSDW if not in compliance
 - * Note: After hours call line
 - * 888-331-6337 (Calling from within Nevada)
 - * 775-687-9485 (Calling from Anywhere)
 - * Submit monthly reports on time

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Ensuring Compliance

- * The presentation printouts contain
 - * Example SOP's
 - * Example IDC spreadsheet
 - * Disinfectant Residual Data Quarterly Report
- * www.ndep.nv.gov/bsdww/forms

BSDW Forms Page

- Attachment "A" Monitoring Schedule
- Consumer Confidence Reports (ccrlinker.com)
- Lead & Copper for LFLA [HTML](#)
- Waiver Renewal Form "B"
- Water Operator Reciprocity Application [HTML](#)
- Water Operator Renewal or Reinstatement Application [HTML](#)
- Water Operator Certification Application [HTML](#)
- Application for Approval of Course of Training for Continuing Education [HTML](#)
- Public Water System Address/Name Change Form
- Application for approval of water project [HTML](#)
- Public Water Systems (Forms) [HTML](#)
- Disinfection Byproducts (Forms) [HTML](#)
- Chlorine Residual Compliance Procedures SM4100 CLG [HTML](#)

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Questions?

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