



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-F208

Portable Spectrophotometer / Colorimeter (Field Use)

Standard Operating Procedure

SOP Number	SOP-F208
Revision	0.2
Author(s)	Marc Los Huertos
Date	2026-06-26
Organization	EA Program, Pomona College

FOR INTERNAL USE ONLY

This document is the property of the Environmental Analysis Program at Pomona College.
Unauthorized distribution is not permitted.

Table of contents

1 Purpose	1
2 Scope	2
3 Responsibilities	2
4 Definitions	2
5 Safety and Hazards	3
5.1 Required PPE	3
5.2 Emergency Procedures	3
6 Equipment and Materials	3
7 Procedure	3
7.1 Pre-Field Preparation	3
7.2 Field Setup	4
7.3 Blank and Calibration Check	4
7.4 Sample Analysis	4
7.5 Waste Management	4
8 Quality Control	5
9 References	5
10 Related SOPs	5
11 Training Record	5

1. Purpose

This SOP describes the field operation of the Hach DR900 portable colorimeter for on-site water quality analysis (Hach Company, 2024a, 2024b). The DR900 enables rapid, field-based measurement of nutrients, metals, and other parameters using Hach pre-packaged reagent kits. Field colorimetry provides same-day results when samples cannot be transported to the lab within required hold times and supports real-time decisions during stormwater events, spill response, or reconnaissance sampling (APHA et al., 2012).

This SOP focuses on field-specific procedures (transport, outdoor operation, field QC). For detailed method chemistry, reagent handling, the Method Registry, and laboratory use of the DR3900 and DR900, see [SOP-L303 Hach Colorimetric Analysis](#).

2. Scope

- **Applies to:** Field use of the Hach DR900 portable colorimeter at EA Program field sites for grab-sample analysis of nutrients (PO_4 , NO_3 , NH_3), metals (Fe, Mn, Cu), and general chemistry (hardness, chloride, silica, chlorine)
- **Does not apply to:** Laboratory bench-top analysis (see [SOP-L303](#)); field turbidity (see [SOP-F205](#)); in situ sonde measurements (see [SOP-F200](#))
- **Location:** All EA Program surface water, groundwater, and stormwater field sites

3. Responsibilities

Role	Responsibility
PI / Field Lead	Select analytes and approve field methods
Trained Personnel	Operate the DR900 per this SOP; record results
New Students independent field use	Complete training on both this SOP and SOP-L303 before

4. Definitions

- **Beer-Lambert law:** The linear relationship between the absorbance of a solution and the concentration of the absorbing analyte, expressed as $A = \epsilon cl$, where ϵ is the molar absorptivity, c is concentration, and l is path length; the physical basis of colorimetric analysis (APHA et al., 2012).
- **Blank (reagent blank / DI blank):** A deionized water sample carried through the complete analytical procedure; used to zero the instrument and establish the baseline absorbance of the reagent system; must read at or near zero before sample measurements begin.
- **Detection limit (MDL):** The minimum concentration reliably distinguishable from the blank; Hach method-specific MDLs are listed in the Method Registry in [SOP-L303](#) (Hach Company, 2024b).
- **Field duplicate:** A second independent measurement of the same sample, prepared through the full analytical procedure, to assess precision; RPD must be $< 20\%$ for concentrations above 5 times the detection limit.
- **Reaction time:** The incubation period specified in the Hach method protocol after reagent addition during which the color-forming reaction proceeds to completion; reading before reaction time has elapsed gives systematically low results (Hach Company, 2024a).
- **RPD (relative percent difference):** $|A - B| / ((A + B) / 2) \times 100$; used to assess duplicate precision.
- **Stored program:** A factory-programmed method on the DR900 that specifies wavelength, calibration curve, and units for a specific Hach reagent kit; accessed by program number on the instrument (Hach Company, 2024a).
- **Zeroing:** The process of inserting a DI water blank into the DR900 sample chamber and pressing Zero to set the baseline absorbance to zero for the selected program; required before reading samples.

5. Safety and Hazards

Hazards

- **Chemical:** Hach reagent powder pillows and liquid reagents may contain acids, oxidizers, or heavy metal indicators. Review the SDS for each kit before field use. Cadmium-containing reagents (older NitraVer 5 formulation) are hazardous waste.
- **Physical:** Glass sample vials can break during transport; pack in padded cases.
- **Biological:** Water samples may contain pathogens. Wear gloves.

5.1. Required PPE

- ☐ Nitrile gloves
- ☐ Safety glasses (required for all reagent handling)
- ☐ Closed-toed shoes or wading boots

5.2. Emergency Procedures

For reagent splashes to skin or eyes, flush with clean water for at least 15 minutes. Carry a squeeze bottle of DI water for emergency rinsing. Refer to [SOP-F001 Field Safety](#) and [SOP-L003 Hazardous Materials Handling](#).

6. Equipment and Materials

Item	Notes
Hach DR900 Portable Colorimeter	Charge before field day (Hach Company, 2024a)
Sample vials (10 mL, 25 mL, 1-inch round)	Matched to the methods being run
Hach reagent kits	Check expiration dates; select analytes per project
DI water (squeeze bottle, 500 mL)	For blanks, rinsing, and dilutions
Lint-free wipes (Kimwipes)	For cleaning vial exteriors
Silicone oil and applicator cloth	For 1-inch round vials
Timer	Phone timer or stopwatch for reaction times
Waste container (sealable)	For used reagent vials and waste solution
Padded carrying case	For protecting vials during transport
Field notebook	Per SOP-F003

7. Procedure

7.1. Pre-Field Preparation

1. Identify the analytes to be measured; pack the corresponding reagent kits and verify none are expired.

2. Pack at least 500 mL DI water and two extra clean sample vials per method.
3. Charge the DR900 battery and confirm stored programs for your methods are accessible (Hach Company, 2024a).
4. Print or photograph method procedure cards for each analyte (from the kit box or [SOP-L303](#) Method Registry).

7.2. Field Setup

1. Place the DR900 on a flat, stable surface **out of direct sunlight**. Direct sunlight on the sample chamber causes erroneous readings.
2. If no shade is available, shade the instrument with a jacket or tarp during each reading.
3. Turn on the DR900 and allow it to complete its self-check.
4. Select the stored program for your analyte.

7.3. Blank and Calibration Check

1. Fill a clean sample vial with DI water to the fill line.
2. Wipe the vial exterior with a lint-free cloth.
3. Insert the vial, close the lid, and press **Zero**.
4. The display should read 0.00 (within the method detection limit); if not, clean the vial and re-zero.
5. If a known mid-range standard is available, read it immediately after zeroing; the result must be within $\pm 10\%$ of the stated value. Record the result in the field notebook (Hach Company, 2024b).

7.4. Sample Analysis

Follow the method-specific procedure from the reagent kit or [SOP-L303](#) Method Registry:

1. Collect a grab sample per [SOP-F300](#).
2. Fill the sample vial to the fill line with sample.
3. Add the reagent per method instructions.
4. Cap, invert, and mix as directed. Start the timer for the required reaction time.
5. When the reaction time is complete, wipe the vial exterior (apply silicone oil for round vials).
6. Insert the vial into the DR900, close the lid (shield from sunlight), and press **Read**.
7. Record the result, analyte, Hach method number, sample ID, units, date, and time in the field notebook.
8. Rinse the vial three times with DI water before the next sample.

7.5. Waste Management

1. Collect all used reagent packets, vials, and waste solution in a sealable container.
2. Do not discard reagent waste in the field.
3. Return waste to the lab and dispose of per [SOP-L003](#).

8. Quality Control

- Zero the instrument with DI water before each batch of samples.
- Run one DI blank and one mid-range standard at the start of each field session; record results in the field notebook (Hach Company, 2024b).
- Analyze one field duplicate per 10 samples (minimum one per event); RPD must be < 20% for concentrations above $5 \times$ the detection limit.
- If the field blank reads above the MDL, investigate contamination (dirty vials, contaminated DI water) and re-run.
- Note ambient temperature; some Hach methods are temperature-sensitive. If the sample is outside the method-specified range (typically 20–25 °C), note the potential bias (Hach Company, 2024a).

9. References

- Hach Company (2024a)
- Hach Company (2024b)
- APHA et al. (2012)

APHA, AWWA, & WEF. (2012). *Standard methods for the examination of water and wastewater* (22nd ed., p. 1360). American Public Health Association.

Hach Company. (2024a). *DR900 portable colorimeter: Procedures manual*. <https://www.hach.com/dr900-portable-colorimeter/product?id=56440352476>

Hach Company. (2024b). *Water analysis guide* (7th ed.). <https://www.hach.com/wag>

10. Related SOPs

SOP	Title	Relationship
F001	Field Safety	Required prerequisite
F300	Surface Water Sampling	Sample collection procedures
L003	Hazardous Materials	Reagent waste disposal
L303	Hach Colorimetric Analysis	Full method registry and lab procedures

11. Training Record

Before using the DR900 in the field independently, personnel must:

1. Read this SOP and [SOP-L303](#) in full
2. Demonstrate a complete field analysis (zero, standard check, sample analysis, waste collection) under supervision
3. Be signed off by the PI or field lead