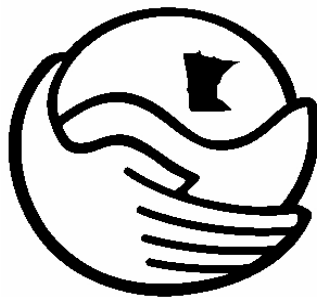


***Guide To***  
***DISCHARGE***  
***MONITORING***  
***REPORT FORMS***  
***(DMRs)***



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## **INTRODUCTION**

This manual has been developed for use in completing the Minnesota Pollution Control Agency (MPCA) Discharge Monitoring Report (DMR) preprinted form, as required by the National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit. The Supplemental Discharge Monitoring Report (Supplemental) is also required for dischargers of domestic wastewater.

In addition to the guidance contained in this document, the permittee must adhere to all monitoring and reporting requirements contained in the permit.

# SECTION I

## UNDERSTANDING THE FORM

### **MONITORING LOCATIONS**

The preprinted DMR form is a reflection of the monitoring locations, limits, and monitoring requirements of the current NPDES/SDS permit. Each discharge point and monitoring location will have a separate DMR form. In the upper left corner of the DMR form, under “Station Information,” the monitoring location will be identified. Examples of this are listed below.

1. A Facility has one discharge point. The Permittee is required to monitor both its influent and effluent. This facility will receive two forms for each monitoring period, one for influent monitoring and one for effluent monitoring. The preprinted DMRs will be labeled as follows:

**Station Information:**

SD-001

Surface Discharge, Effluent to Surface Water

**Station Information:**

WS-001

Waste Stream, Influent Waste

2. Another facility has one discharge point. The Permittee is required to monitor both its influent and effluent, and is required to do upstream and downstream surface water monitoring. This facility will receive four forms for each monitoring period. The preprinted DMRs will be labeled as follows:

**Station Information:**

SD-001

Surface Discharge, Effluent to Surface Water

**Station Information:**

SW-001

Surface Water, Stream/River/Ditch, Upstream

**Station Information:**

SW-002

Surface Water, Stream/River/Ditch, Downstream

**Station Information:**

WS-001

Waste Stream, Influent Waste

3. Another facility has three discharge points which require monitoring, and the Permittee is required to monitor its influent. In addition, the facility has four ground water monitoring wells. They will receive a total of eight forms for each monitoring period. The preprinted DMRs will be labeled as follows:

**Station Information:**

GW-001

Ground Water, Well, Upgradient

**Station Information:**

GW-002

Ground Water, Well, Downgradient

**Station Information:**

GW-003

Ground Water, Well, Downgradient

**Station Information:**

GW-004

Ground Water, Well, Downgradient

**Station Information:**

SD-001

Surface Discharge, Effluent to Surface Water

**Station Information:**

SD-002

Surface Discharge, Effluent to Surface Water

**Station Information:**

SD-003

Surface Discharge, Effluent to Surface Water

**Station Information:**

WS-001

Waste Stream, Influent Waste

## **MONITORING PERIODS**

If the monitoring is only required during certain months of the year (e.g., ground water monitoring required in April, July, and October), the Permittee will only receive DMR forms for the months the monitoring is required. If samples at a monitoring location only need to be taken seasonally, as in the case of most fecal coliform sampling, the parameter will only show up on the forms for the months monitoring is required.

## **HEADING INFORMATION**

The top portion of the form contains identification information such as the permittee name and address, permit number, station number (formerly referred to as the outfall number), and monitoring period. The station number may or may not relate to the number listed in the permit facility description, depending on when the permit was reissued. In order to match the correct form to the proper discharge location, look to the right of the station number box for a written description of the discharge location.

On the right hand side of the form, below the permittee name/address information, there may be a checkbox labeled either “No Discharge,” “No Flow,” or “No Material Generated.” The label will vary with the type of station and the type of facility producing the discharge. If marking the checkbox accurately reflects the facility activity for the monitoring period, and no sampling data is required, the permittee can check this box and submit the form with the proper signatures. No data will be expected in the blank white boxes in these instances. Examples of these situations are:

1. Controlled pond discharges that only occur a few months out of the year. The Permittee would check the “No Discharge” box.
2. Industrial facilities such as canning operations that only operate seasonally. The Permittee would check the “No Discharge” box.
3. A monitoring well is dry, and a sample could not be taken. The Permittee would check the “No Flow” box.
4. A facility that produces solids, followed by landspreading, that only operates three months out of the year. The Permittee would check the “No Material Generated” box.

## **SAMPLING INFORMATION**

The large section of the form printed in gray and white is where the sampling information should be inserted. Listed below are definitions of the terms used in this section.

**Parameter** - The constituent that is being sampled, such as Total Suspended Solids (TSS).

**Sample Value** - The actual value or calculation to be reported.

**Permit Requirement** - Prints the type of value to be reported, such as calendar month average, and the associated limit, if applicable.

**Report** - Means no limit applies but monitoring is required to be reported.

**Quantity** - The information contained in this column is usually a mass calculation of kilograms/day and/or total calculations for flow and precipitation.

**Quantity Units** - Specifies the reporting units required in the quantity boxes.

**Concentration** - The information contained in this column is usually a concentration calculation such as milligrams/liter (mg/L) or micrograms/liter (ug/L). Some values to be reported in this column are not true concentration values, such as flow in million gallons per day (mgd).

**Concentration Units** - Specifies the reporting units required in the concentration boxes.

**Frequency of Analysis** - The frequency of analysis required by the permit is printed in the gray box. If the actual frequency varies from that indicated in the permit, insert the actual frequency in the white box above the required frequency. If the actual frequency of sampling matches that required by the permit, put a checkmark in the white box.

**Sample Type** - The sample type required by the permit (grab, 4-hour composite, etc.) is printed in the gray box. If the actual sample type varies from that indicated in the permit, report the actual sample type in the white box above the required sample type. If the actual sample type matches that required by the permit, put a checkmark in the white box.

**NOTE:** The Quantity and Concentration headers that appear at the top of the form are for guidance only. The gray boxes indicate the actual value that is required by the permit for the associated column. In some cases measurements such as monthly totals are required in these columns, and the gray boxes will provide the correct information about the type of sample measurement to be entered in the blank white box above.

### **WHEN WILL YOU GET YOUR DMRs?**

Forms are generated for each facility once per year. In addition, if the permit is reissued or modified, or if a facility moves from interim to final limits, a new packet of forms will be sent out to reflect any changes that may have occurred. **When your facility switches to final limits, notify the MPCA in writing.** Continue to use the current packet of forms until a new packet is received; any additional samples that are required due to a new permit or new limits can be added in writing to blank spaces on the forms. If new forms are needed and are not received within three weeks of the date they are due, contact the MPCA at (800)657-3864.

The entire packet of forms should be reviewed each month (or quarter for those facilities that monitor quarterly) to ensure all forms due in a particular monitoring period are completed on time.

**Failure to submit data on the preprinted form and/or failure to complete the form in full are violations of the permit. Forms are due to the MPCA postmarked no later than the 21st day of the month following the end of the monitoring period.** Sample measurements must be typed or printed in the open white boxes with blue or black ink. Signatures of both the Principal Executive Officer or Authorized Agent **and** the Chief Operator are required unless a letter is on file at the MPCA authorizing the Operator to sign as the Authorized Agent.

### **COMPLETING THE DMR**

DMR forms will arrive sorted first by station information, and then by month or quarter within each station. Assemble all DMR forms for all stations with required monitoring in the current monitoring period. Enter the sample measurement values in the blank white boxes. **All empty white boxes must be filled.** The Permittee is not required to fill in boxes that have asterisks printed in them. **Only numeric values will be accepted.** All values below detection limits should be indicated with a less than sign (<) and the detection limit or reporting limit. Submit all forms even if there is no data to report; the checkbox labeled either “No Discharge,” “No Flow,” or “No Material Generated” should be used when applicable. If there is some other reason for missing data, note the information on the DMR and attach an explanation.

Make sure the numeric value entered in the blank white box coincides with the limit type (permit requirement) printed in the gray box directly below (calendar month average, calendar month total, etc.) The unit must be the same as the unit indicated in the gray box to the right of the measurement boxes. The frequency of analysis should be the same or more frequent than that indicated in the gray boxes. If it is the same, place a checkmark

in the blank white box to indicate this. If the frequency is anything other than the frequency noted in the gray box, note the frequency in the blank white box. The sample type should be the same as that indicated in the gray box; if it is the same, a checkmark can be used to indicate this. If any other sample type is used, indicate the actual sample type in the blank white box.

When a permit contains both an average and a maximum limit for a parameter, and sampling is required only once in the monitoring period, the **value must be placed in both the average and maximum boxes**. This occurs commonly with pH, and with some other parameters as well.

## **SUPPLEMENTAL REPORT FORMS**

The supplemental report forms are daily reporting forms which are required to be submitted along with the preprinted DMR form for all domestic facilities and for some industrial facilities as required by the permit. A domestic facility is one which treats “normal domestic strength waste,” such as municipal wastewater treatment facilities, mobile home parks, state parks, and schools. The form has space for daily sampling results, pond observations, and other operational information. An additional page of the supplemental form is available for those facilities that need additional room for monitoring requirements that are not standard to the first page of the supplemental, and for the facilities that have additional receiving water monitoring requirements. These forms are available to any facility operator for use. The Permittee may submit a computerized facsimile of the supplemental report form, providing all the information from the MPCA form is included in the computerized version.

## **STABILIZATION PONDS**

Stabilization pond facilities with a controlled discharge have the following unique reporting requirements.

1. **Record pond observations** such as pond depth, odors, dike condition, etc., on the back side of the supplemental form.
2. **Quarterly influent samples** will print on the preprinted forms for influent waste in the months of March, June, September, and December. The samples ***do not have to be taken in those months; they may be taken at any time during the quarter.*** The influent quarterly samples for pH, TSS, and CBOD may still be taken any of the three months in the calendar quarter, and must be reported on the **supplemental form** for the month during which the sample was taken. Quarterly influent sample results must also be reported on the **preprinted form** for the last month of each calendar quarter. Take the samples and report as follows:
  - Report quarterly samples taken in January, February, or March on the **March DMR**.
  - Report quarterly samples taken in April, May, or June on the **June DMR**.
  - Report quarterly samples taken in July, August, or September on the **September DMR**.
  - Report quarterly samples taken in October, November, or December on the **December DMR**.
1. **No discharge** should be reported by writing “No Discharge” on the front of the supplemental form, and by checking the “No discharge” box on the first page of the preprinted form containing the effluent sampling requirements.
2. **Influent flow** is monitored daily and must be reported monthly. Remember that influent samples are reported on the Waste Stream, Influent Waste station DMRs.
3. **For discharge events that occur in two consecutive months**, summarize only the discharge samples that occur in the month being reported. The required effluent monitoring should be reported in the month in which the samples were taken. If all of the required effluent samples were taken in one of the months, then



the month in which there were no effluent samples taken but a discharge occurred, a note should be written on the supplemental indicating that the required samples were reported in the previous month or will be reported on the next month's DMR.

An example of this would be if a discharge began the 27th day of the month and ended one or two days into the next month. Effluent samples could be taken at the required frequency of twice per week before the month ended. There would be no effluent samples to report in the new month, but there would still be flow reported from the discharge. A note should then be written on the supplemental stating that the required sampling was done during the previous month.

## SECTION II

### HOW TO CALCULATE SAMPLE VALUES

Discharge Monitoring Report (DMR) reporting requirements are printed in the gray boxes labeled “Permit Requirement” and are located to the right of the **PARAMETER** box on the preprinted DMR form. If the reporting requirements are not printed in the gray box, refer to your permit for the definitions of minimum, average or maximum. These definitions are also provided in this manual.

All sample measurements must be reported in the same units required in the permit. For example, if the permit requires a sample to be reported in micrograms per liter, do not report in any other unit, such as milligrams per liter. Also, flows must be reported in million gallons for total flows and million gallons per day (MGD) for average and maximum values. For example, a total flow of 1,560,000 gallons must be reported as 1.56, and an average flow of 35,000 must be reported as .035.

#### **QUANTITY (or LOADING)**

To report quantity (loading) values, use the white boxes under “Quantity” on the preprinted DMR. For example, if reporting a “calendar month average” Total Suspended Solids (TSS) in kilograms per day (kg/day), report the value in the white “sample value” box above the gray box labeled “CalMoAvg.”

Most quantity or loading values are expressed in kg/day. In some limited cases, the permit requires reporting pounds rather than kilograms. Be careful to verify that you are calculating the correct units as required in your permit on the DMRs. To calculate loading, use the following formula:

$$\text{Loading (in kilograms per day)} = \text{concentration (in mg/L)} \times \text{flow (in million gallons per day)} \times 3.78 \text{ kilograms per gallon}$$

**OR**

$$\text{Loading (in pounds per day)} = \text{concentration (in mg/L)} \times \text{flow (in million gallons per day)} \times 8.34 \text{ pounds per gallon.}$$

When more than one limit type is required to be reported for a single parameter (e.g., calendar month average and maximum calendar week average), be careful to verify that the limit type (permit requirement) printed in the gray box matches the value reported.

#### **CONCENTRATION**

To report concentration values, use the white boxes under “Concentration” on the preprinted DMR.

For example, if a calendar month average is required, that value must be reported in the white “sample value” box above the gray box labeled “CalMoAvg.” The sample measurement reported is the arithmetic mean of all the samples values measured during the monitoring period of one month in length.

## **MAXIMUM CALENDAR WEEK AVERAGE**

When a maximum calendar week average is required, that value must be reported in the corresponding white “sample measurement” box. For permits indicating a sampling frequency of once per week or less, this value will be the high sample for the monitoring period. When a sampling frequency of twice per week or more is required, the sample measurement reported is the highest weekly average of the sample values measured during each week of the monitoring period.

## **COMMON “PERMIT REQUIREMENTS” ON THE PREPRINTED DMR FORM**

Below are some of the common abbreviations used on the DMR. For other values, see the definitions in the permit.

CalMoAvg	Calendar Month Average
MxCaWkAvg	Maximum Calendar Week Average
MnCaMoAvg	Minimum Calendar Month Average
CalMoMin	Calendar Month Minimum
CalMoMax	Calendar Month Maximum
CalMoGeoMn	Calendar Month Geometric Mean
CalMoTot	Calendar Month Total
Single Val	Single Value
InstantMin	Instantaneous Minimum
InstantMax	Instantaneous Maximum
MeaIns	Instantaneous Measurement

## **PERCENT(%) REMOVAL**

To calculate the percent removal you need to use the following formula:

$$\text{Percent Removal ( \% )} = \frac{\text{Influent} - \text{Effluent}}{\text{Influent}} \times 100\%$$

where influent = the calendar month average of the influent concentration;  
and effluent = the calendar month average of the effluent concentration.

Influent and effluent concentrations are usually expressed in units of milligrams per liter (mg/L).

The average percent removal for the reporting period must be reported in the “concentration” column.

## **FECAL COLIFORM CALCULATIONS**

Results of fecal coliform bacteria sampling should be filled in on the preprinted DMR in the row labeled “COLIFORM, FECAL MPN...” If your permit requires only monthly monitoring, write the value in the blank white box in the proper row.

If you are required to sample more than once per month, report the calendar month geometric mean of the fecal coliform results. The calendar month geometric mean is calculated by multiplying the values of all the sample results obtained during the month (the number of samples = n), and taking the n<sup>th</sup> root of the product. This calculation can be performed with a scientific calculator that has an

$x\sqrt[y]{}$  function or a  $y^x$  key. To calculate a geometric mean take the n<sup>th</sup> root (x) of the product of multiplication of all the individual fecal coliform samples (y) taken during the month.

Below are sample problems for calculating the geometric mean.

### **Sample 1 - Calculating a geometric mean using a calculator with a $y^x$ button.**

Problem: Find the geometric mean of 450, 175, 0, <20

1. Convert all zeros to 1 and drop all < symbols: 450, 175, 1, 20  
[TNTC (too numerous to count) values are not acceptable, contact your lab for maximum values]
2. Multiply all of the numbers:  $450 \times 175 \times 1 \times 20 = 1,575,000$
3. Divide one by the number of values (n): There are four values; so  $1 \text{ divided by } 4 = 0.25$
4. Enter answer from step #2 into calculator - 1,575,000
5. Push button marked  $y^x$  or x.
6. Enter answer from step #3 into calculator: 0.25
7. Push '=' key: Answer is 35.43.

### **Sample 2 - Calculating a geometric mean using a calculator with a $x\sqrt[y]{}$ symbol.**

Four fecal coliform samples are take during the month (n = 4). Analytical results = 120, 300, 50, 160.

1. Multiply all sample results together:

$$120 \times 300 \times 50 \times 160 = 2.88^{08} \text{ ( or } 288,000,000)$$

2. Take the 4<sup>th</sup> root of  $2.88^{08}$

On the calculator, this is accomplished by:

- Calculator display shows  $2.88^{08}$
- Press the  $x\sqrt{y}$  function key
- Press 4
- Press =
- The geometric mean of the four values will be displayed in the view screen (= 130.27)

$$4\sqrt{288,000,000} = 130.27$$

3. The monthly geometric mean of the four sample results = 130 colonies/100 ml.

**Sample 3 - Calculating a geometric mean using a calculator with a  $x\sqrt{y}$  symbol.**

Ten fecal coliform samples are taken during the month (n = 10).  
Analytical results = 100, 540, 20, 20, 20,000, 20, 60, 100, 40, 30.

1. Multiply all the sample results together:

$$100 \times 540 \times 20 \times 20 \times 20,000 \times 20 \times 60 \times 100 \times 40 \times 30 = 6.2208^{19}$$

(or 62,208,000,000,000,000)

2. Take the 10<sup>th</sup> root of  $6.2208^{19}$

On the calculator this is accomplished by:

- Calculator display shows  $6.2208^{19}$
- Press the  $x\sqrt{y}$  function key
- Press 10
- Press =
- The geometric mean of the ten values will be displayed in the view screen (= 95.36)

$$10\sqrt{62,208,000,000,000,000} = 95.36$$

3. The geometric mean of the 10 sample results = 95 colonies/100mL.

## **FLOW**

Flow reporting is required in most permits. The following are typical flow reporting requirements:

1. Monthly or quarterly total flow values in million gallons (MG), reported in the quantity columns of the form, previously reported in the concentration section.
2. Calendar month or quarter average flow in million gallons per day (mgd), reported in the concentration columns of the form.

The gray boxes beneath the empty white boxes will indicate where the total, average, and maximum values need to be reported. Generally, for domestic (municipal) facilities, influent flow measurement is required, so the flow is reported on the pre-printed DMR for the WS, Influent Waste station. Some permits require reporting of effluent flow either instead of or in addition to influent flow monitoring. Influent flow is reported on the preprinted DMR for the WS, Influent Waste station, and effluent flow is reported on the preprinted DMR for the SD, Effluent to Surface Water station. Other station types such as Waste Stream or Land Application stations may also require flow measurements.

To properly record flow values, locate the correct form by checking the description information printed on the upper right portion of the form. When the correct form is located, locate the row labeled "Flow." The total flow value will usually be entered into the first empty white box. Verify this by reading the description in the gray box directly underneath it. **Always follow what is indicated by the gray box to decide which value should be entered in the white box above.**

If required, the average daily flow during the month should be reported as the arithmetic average of all the daily flow values recorded during the month. The highest daily flow value recorded during the month should be recorded in the monthly maximum box on the preprinted DMR.

### **MPCA NPDES NONDETECTABLE VALUE POLICY – August, 1999**

A letter was sent out in August, 1994, from the Minnesota Pollution Control Agency (MPCA), to all National Pollutant discharge Pollutant Elimination System (NPDES) permittees stating that nondetectable values should be reported as "nondetectable", which can also be abbreviated as "ND" or "BDL." This procedure is not consistent with the common reporting procedures in the laboratory community. "Nondetectable" also does not give enough information to the end user of the data.

**Therefore, MPCA NPDES permitting program is now requiring all nondetectable values to be reported with a less-than sign (<) followed by the laboratory's detection limit, typically referred to as the reporting limit (RL). For example, a nondetectable value with an RL of 2.0 mg/L should be reported as "< 2.0 mg/l."** The less-than sign and the RL will both be stored in the MPCA's computer system, allowing more information to be stored about the analytical value.

Listed below are directions for using nondetectable values for calculations in monthly Discharge Monitoring Reports (DMR)'s. If you have any questions about the DMR reporting or calculation procedures for nondetectable values, please contact Kim Sandroek at (651) 296-7387.

## 1) Averaging Nondetectable Concentrations

Until the Environmental Protection Agency's issues their own guidance on nondetectable values, MPCA is still recommending the following procedure for averaging nondetectable values for monthly averages:

- If one or more values are greater than the RL:

**Substitute zero for all nondetectable values in the average calculation. The one exception to this rule, is calculating geometric means for fecal coliform - drop the < sign and use the RL in the calculation to prevent a zero value. See Example 3 below for the procedure to calculate geometric means.**

- If all values are below the RL:

**Drop the < sign, use the RL to calculate the average, and add the < sign back on to the average value.**

### **Example 1 - Average Monthly Concentration Using One Nondetectable Concentration**

Value 1 = 5.0 mg/L, Value 2 = 4.0 mg/L, Value 3 = < 2.0 mg/L

**Monthly Average** =  $(5.0 + 4.0 + 0.0) / 3 = 9.0/3 = 3.0$  mg/L

### **Example 2 - Average Monthly Concentration Using all Nondetectable Concentrations**

Value 1 = <2.0 mg/L, Value 2 = < 2.0 mg/l, Value 3 = < 3.0 mg/L

**Monthly Average** =  $(2.0 + 2.0 + 3.0) / 3 = 7.0/3 = < 2.3$  mg/L

### **Example 3 - Geometric Mean for Fecal Coliform Using Two Nondetectable Concentrations**

Value 1 = < 4.0 col/100 ml, Value 2 = < 10 col/100 ml, Value 3 = 25 col/100 ml

Product of the 3 values =  $4 \times 10 \times 25 = 1000$  (then follow directions below for the calculator)

Enter 1000 in the calculator, push the  $y^x$  key, enter .333 (for the fraction 1/3), and push the = key. (If you want to know the mathematical formula for this calculator procedure, refer to the \* below).

**Monthly Geometric Mean** = 10 col/100 ml

Formula for Geometric Mean =  $(\text{Product of Values})^{1/n}$ , n = number of values  
=  $(1000)^{1/3} = 1000^{.333} = 10$  col/100 ml

## 2) Calculating Monthly Average or Daily Mass Loading with Nondetectable Concentrations

To calculate a mass loading with a nondetectable concentration, use the RL value in the calculation and then add a less-than sign to the value. Zero cannot be used in the place of the nondetectable concentration because that would result in a zero mass loading which isn't measurable. Here is an example:

### **Example 1 - Monthly Average or Daily Mass Loading with Nondetectable Concentration**

Monthly or Daily Avg Concentration = < 2.0 mg/l

Monthly or Daily Flow = 7 million gallons/day

**Monthly Avg/Daily Mass Loading** = 2 mg/l x 7 million gallons/day x 3.78 kg/gallon

= < 53 kg/day

If you calculate loadings on a daily basis and you average the daily loadings to obtain a monthly average loading, then use the procedure in Section No. 1 above - **Averaging Nondetectable Concentrations**.

## 3) Method Detection Limits (MDL)'s

The analytical reporting limit (RL) is typically two to ten times greater than the method detection limit (MDL). The MDL is calculated according to 40 CFR part 136, Appendix B. **All analytical methods used for NPDES reporting, with the exception of dissolved oxygen, pH, total suspended solids, all volatile solids, and fecal coliform, must have an MDL that is calculated by the laboratory running the method.** This does apply to total residual chlorine (TRC), which is currently not certified by the State of Minnesota Laboratory Certification program. Listed below are directions for calculating an MDL for an analytical method.

- Obtain an estimated MDL from the manufacturer of the equipment or method. See Table 1 for estimated MDL's for TRC methods.
- Obtain a commercially prepared standard or use your own wastewater effluent – the standard concentration or your effluent concentration must be one to five times the concentration of the estimated MDL. Standards can be purchased from commercial providers such as APG (1-800-272-4442) or Environmental Resource Associates (1-800-372-0122). You may have to dilute the commercial standards.
- Run the standard/effluent through the analytical method 7 times and calculate the standard deviation of the 7 concentrations. The standard deviation can be easily calculated on a scientific calculator – see Table 2 for directions. The MDL is then equal to the standard deviation multiplied by a statistical factor, called a Student's t value (see Table 3 for values).
- **The reporting limit (RL) can then be calculated by multiplying the MDL by a factor. The most common factors for calculating the RL range from 2 to 10. MPCA recommends that a factor of 2 be used when determining TRC RL's.**
- The ratio of the true value of the standard (or the mean value of the effluent replicates) to the calculated MDL should be between 1 and 10 – if not, the study will have to be repeated.



- Calculate the percent recovery: (Mean of the 7 replicates/sample true value) x 100. The percent recovery must be within 70 – 130% for the study to be valid. The percent recovery can only be done if a standard was purchased – the true value of an effluent sample is not known, therefore, the mean percent recovery cannot be calculated for effluent samples.

**Example MDL Calculation for a .15 mg/l standard:**

7 replicate concentrations = .15 mg/l, .10 mg/l, .12 mg/l, .15 mg/l, .12 mg/l, .15 mg/l, .14 mg/l

**Standard Deviation** = .020 mg/l, Student's t = 3.143 (for 7 replicates and 99% confidence level)

**MDL** = (standard deviation) x (Student's t for 7 replicates) = .020 mg/l x 3.143 = .063 mg/l.

**Reporting Limit** = .063 x 2 = .13 mg/l

**% Recovery** = (Mean/True Value) x 100 = .13/.15 x 100 = 89% (valid = between 70 – 130%)

**True Value/MDL** = .15/.063 = 2.4 (valid between 1 and 10)

**Table 1. Environmental Protection Agency Approved Methods and Estimated Method Detection Limits for Total Residual Chlorine**

Analytical Method	EPA	Standard Method	ASTM	Other Methods (including Hach)	Estimated Method Detection Limit
<b>Amperometric Direct Titration</b>	330.1	4500-Cl D	D1253-86 (92)		.01 mg/l
<b>Iodometric Direct Titration</b>	330.3	4500-Cl B			.1 mg/l
<b>Back Titration Ether End-Point Titration</b>	330.2	4500-Cl C			.01 - .1 mg/l
<b>DPD FAS Titration</b>	330.4	4500-Cl F			.05 mg/l
<b>Electrode</b>				Orion Electrode 97-70	.01 mg/l
<b>DPD Spectrophotometric</b>	330.5	4500-Cl G		Hach 8167 – using the following equipment:  Pocket Colorimeter, DR-700, DR-800, DR-2000, DR-2010, DR-3000, and DR-4000	.02 mg/l
<b>DPD Spectrophotometric</b>				Hach 8167 – using the DR-100	.1 mg/l

<b>DPD Spectrophotometric – Low Level</b>	330.5	4500-Cl G		Hach 8370 – can only be done using the following equipment:  DR 2010 and DR 4000	.002 mg/l

**Table 2. Calculating Means and Standard Deviations Using a Scientific Calculator**

- 1) Clear the calculator from any previous data entry by pushing the “CSR” key – refer to your calculator manual if a “CSR” key isn’t found.
- 2) Refer to your calculator manual for directions on entering the sample concentrations from the MDL study. On most calculators, there is a key with a “ $\Sigma$  +” symbol – this is the key you will use to enter your 7 concentrations.
- 3) Enter the first MDL study concentration and press the “ $\Sigma$  +” key – the calculator should display a number 1, referring to the one number that was entered.
- 4) Enter the second MDL study concentration and press the “ $\Sigma$  +” key – the calculator should display a number 2, referring to the two numbers that were entered.
- 5) Enter the next five concentrations – press the “ $\Sigma$  +” key after each number that is entered. When all 7 numbers have been entered, the calculator should display the number 7 – this will confirm that you entered all 7 concentrations.
- 6) Refer to your calculator manual to find the mean and standard deviation keys. The mean key (also referred to as the average) is typically spelled out as “mean” on the calculator, and the standard deviation key is typically shown as “ $\sigma_{n-1}$ ”.
- 7) Press the “mean” key and record this result as the mean.
- 8) Press the “ $\sigma_{n-1}$ ” key and record this result as the standard deviation.

**Condensed Directions:**

- 1) Clear any previous data entry in the calculator – hit the “CSR” key if it is listed on your calculator.
- 2) Enter each of the seven MDL study concentrations and press the “ $\Sigma$  +” key after each number.
- 3) The number 7 should be displayed on your calculator after the entry of the 7<sup>th</sup> concentration.
- 4) Press the “mean” key and record the result as the mean.
- 5) Press the “ $\sigma_{n-1}$ ” key and record the result as the standard deviation.

**Table 3. Student's t Values at a 99% Confidence Level**

<b>Number of Sample Results</b>	<b>Student's t Value at a 99% Confidence Level</b>
7	3.143
8	2.998
9	2.896
10	2.821
11	2.764
12	2.718

## **SECTION III**

### **RECEIVING WATER MONITORING AND GROUND WATER MONITORING**

#### **RECEIVING WATER MONITORING**

Receiving water monitoring is required by some permits. It is also called stream monitoring, ambient monitoring, upstream and/or downstream monitoring, or river monitoring. It is either listed on the monitoring requirements page(s) of the permit, or it may be contained in paragraph form in the permit after the monitoring and limits pages, sometimes labeled as “Special Requirements.”

You are required to sample and record all elements required in the permit, including date, time of day, and location sample was taken on the supplemental DMR form. This information should also be summarized and transferred to the corresponding gray and white “preprinted” DMR form.

Samples must be collected in accordance with the permit requirements, usually from mid-stream at mid-depth. Use the “No Flow” checkbox on the preprinted form when samples cannot be collected. Record the reason as a comment on the supplemental form (e.g., the stream is dry or frozen, conditions are unsafe for sampling, or sampling is not required due to conditions in the permit).

If sampling frequency is two times per month then samples must be taken at least two weeks apart. Temperature and pH measurements must be made immediately after samples are collected. Calibration and maintenance should be done periodically on any monitoring instruments used to ensure accuracy of measurements.

It is important that pH buffer solutions used to calibrate meters are fresh. pH buffer solutions should have expiration dates listed on bottle and should be used within three to six months after first opening. Buffers may not be used after the expiration date.

#### **GROUND WATER MONITORING**

If you are required to report the results of ground water sampling (such as ground water monitoring wells or piezometers), you should have a separate page(s) for each monitoring well in your packet of preprinted DMRs.

Select the corresponding DMR(s) for the appropriate month of sampling. The monitoring well number will be printed in the station information portion of the form. Fill in the blank boxes under the “concentration” column with the sample values from the corresponding lab sheets that were received from the laboratory that did the analysis. Also, fill in the blank “frequency of analysis” and “sample type” boxes with the appropriate information.

Water level information should be reported in the “maximum” blank under the “quantity” column.

If you were unable to collect a sample from the monitoring well during the sampling period, fill in the “maximum” blanks with the words “no sample.” You should also explain why the sample was not collected in the “comments” section of the Supplemental DMR.