

Thermal Rules Implementation What You Should Know



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2011 Government Affairs Seminar

Overview

- Basics of NR 102 and NR 106
- Intro to Limit Calculations
- Monitoring Requirements
- DC Evaluation
- Questions?



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Types of Standards (NR 102)

- Public health & welfare
 - 120° F
- Fish and aquatic life
 - Acute (lethality)
 - Sub-lethal
 - Spawning
 - Juvenile growth
 - Gametogenesis



Ambient Temperature (NR 102)

- Specific large rivers
- Northern and southern inland lakes
- Great Lakes waters
- Non-specific waters (default)



Who Needs to be Evaluated? (NR 106)

Does the point source have a WPDES permit?

Includes all WPDES permits even Municipal POTWs

Does the point source discharge heat or is there a heat gradient?

Does the point source discharge to a surface water to the state?

Is the point source a stormwater discharge?

If yes to each box, permit **must** be evaluated for thermal limits

No to any box above

Yes

No evaluation required

Rule Flexibility

- NR 102
 - Site-specific ambient temperature values
 - **Site-specific water quality criteria**
- NR 106
 - Annual, seasonal, or monthly limits
 - Alternative mixing zones
 - Limits derived from water quality models
 - Dissipative cooling (*for POTWs only*)
 - Compliance schedules
 - **Variances- 283.15, Stats. (3-yr duration)**
 - **Alternative Effluent Limits- equivalent of federal 316(a) demonstration (10-yr duration)**

Orange= Federal approval required

Flexibilities in Order of Cost/Likely Benefits/Ease

- Monthly low flows
- Site-specific ambient temperatures
- Mixing zone studies/modeling
- Real-time limits
- Site-specific criteria
- Variances as a last resort

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Does My Discharge Need Thermal Limits?

- Use $Q_s:Q_e$ ratio for preliminary evaluation
 - $Q_s:Q_e$ can be found in Appendix D of the Guidance Document

Flow Ratio and Limitations		
Warm Water	Cold Water	Effluent Temperature Limitation
$Q_s:Q_e \geq 20:1$	$Q_s:Q_e \geq 30:1$	120°F
$20:1 > Q_s:Q_e > 2:1$	$30:1 > Q_s:Q_e > 2.5:1$	120°F or sub-lethal WQBEL, whichever is lower
$Q_s:Q_e \leq 2:1$	$Q_s:Q_e \leq 2.5:1$	Sub-lethal and acute WQBELs

Stream Types for Criteria and Ambient Temperatures

- Cold water community
- Large warm water sport or forage fish community
- Small warm water sport or forage fish community
- Limited forage fish community
- Mississippi River
- Rock River
- Upper Wisconsin River
- Lower Wisconsin River
- Lower Fox River

What You Need to Calculate Limits

Stream Conditions

- **Stream flow (Qs) from USGS**
 - $Q_s = \frac{1}{4}$ of the 7-Q10
 - Annual, Monthly or Seasonal 7-Q10
- **Ambient Temperature**
 - NR 102
 - Site-Specific

Discharge Conditions

- **Effluent flow (Qe)**
 - **Municipal**
 - Annual design flow
 - **Industrial**
 - Annual average flow
 - Seasonal or other (case by case)
- **Effluent Temperature Data***

*If insufficient data, *limits subject to drop* may be included in permit

Calculating the Limits

- Equations found in NR 106

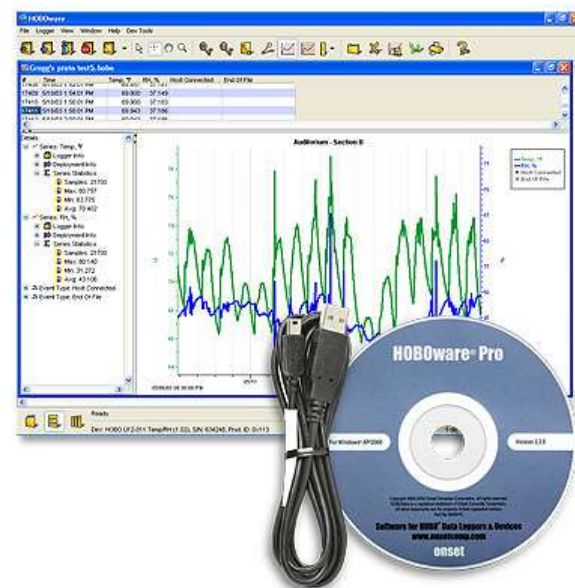
<http://dnr.wi.gov/org/water/wm/wqs/thermalrulesrevisions.htm>

Special Cases:

- LAL limit = 86 ° F daily max
- Effluent channel = 120 ° F daily max
- Wetland = case by case with 120 ° F cap

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How to Monitor?

- Only monitor when you are actively discharging during a 24-hour period
- Continuous method
 - Record data every 15 minutes or less
- Multiple grab sample method
 - Record data at 6 evenly spaced time intervals
 - Sampling interval can be modified via supporting data
- Collect data at discharge point or closest point to it within a facility

What to Record?

- Effluent temperature

- Daily maximum

- Highest record value during a 24-hour period

- Minimum effluent temperature requirements

- Low variability

- At least 1 operating day per week for 1 years

- Highly variable discharges

- At least 1 operating day per week for 2 years

- If insufficient data present, *limits subject to drop* will be included in permit

Temperature Logger System

- Set-up
- Deploy
 - Re-bar and zip ties??
- Download/Re-deploy



Data Logger Options



HOBO

- Operation range: -20 °C to 70 °C
- Battery life: ≈ 1 yr.
- User replaceable battery
- Cost: \$59 each



Water Temp Pro V2

- Operation range: -20 °C to 70 °C
- Battery life: ≈ 6 yrs.
- Factory replaceable battery
- Cost: \$123 each



TidbiT V2

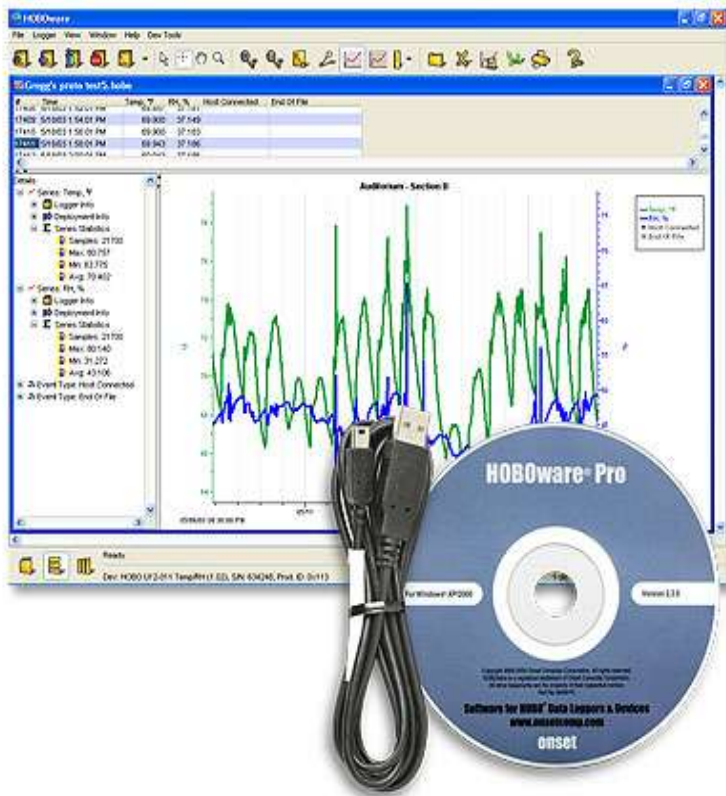
- Operation range: -20 °C to 70 °C
- Battery life: ≈ 5 yrs.
- Non-replaceable battery
- Cost: \$133 each

Waterproof Shuttle



- Communicate between pc and temp. logger via USB
- Download and reset logger in the field
- Can be used with multiple tidbits
- AA batteries
- Cost: \$230 each

HOBOWare Pro Software



- Required for temp. logger set-up and download.
- Used for graphing and data analysis.
- Easy export to excel.
- Cost: \$89

TOTAL COST FOR DATA LOGGER= \$378-\$452

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What is Dissipative Cooling?

- **Cooling effects associated with heat loss to the ambient water, the atmosphere and the surrounding environment (NR 106.59)**
 - Dispersion
 - Diffusion
 - Dilution
 - Heat Dissipation



Why Request Dissipative Cooling?

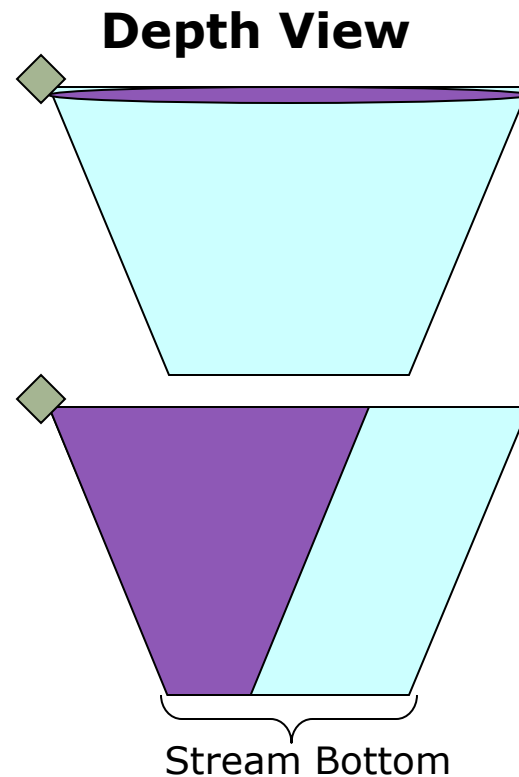
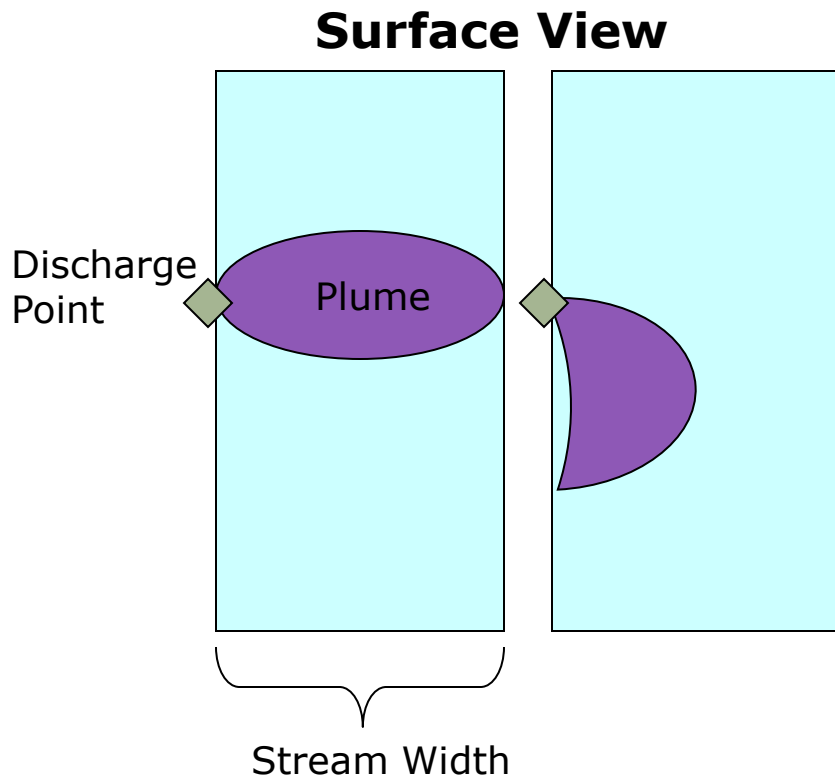
By successfully supporting DC, **weekly limits** are no longer included in permit

Facts to consider:

- Permittees are responsible to provide the Department with all relevant information
- Data collection may be required
- For POTWs only

Things to Look For → Plume Behavior

- Zone(s) of free passage
- Zone does not extend more than 25% of the cross-sectional area or more than 50% of the width of the receiving stream



Things to Look For → Rapid Heat Loss

- High exit velocity



- Ambient flow conditions



- Structures



- Loss to atmosphere?



Things to Look For → Other

■ Biota

- Endangered/threatened species absent
- *Difference in biotic communities in and outside of discharge*
- *No impediment of migration*

■ Multiple discharges present

■ Others?



No Data Available

- Some facilities may not have data available
- Recommendations
 - Perform temperature profile study
 - If needed, perform dye study
 - Provide visual evidence



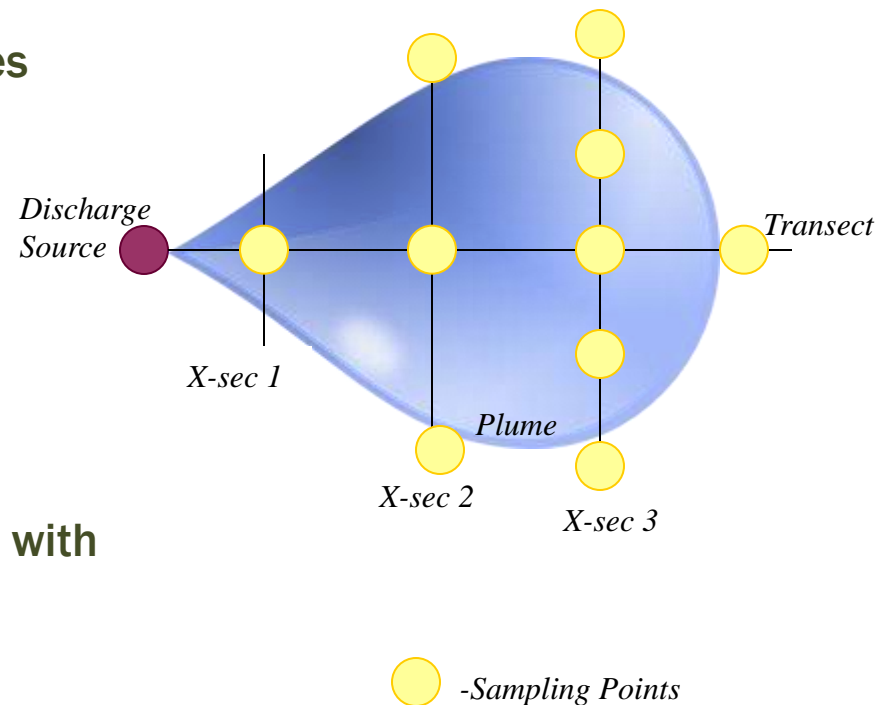
Thermal profile

■ Goal:

- Represent vertical and horizontal distribution of mixing zone
- Represent significant morphological changes
 - Depth
 - Stream flow/direction
 - Substrate
 - Emergent features
 - Others

■ Needed Elements:

- Ambient temperature reading upstream
- Surface temperature readings and readings with depth
- Depth at each sampling
- Distance between sample and discharge source
- Conductivity measurements



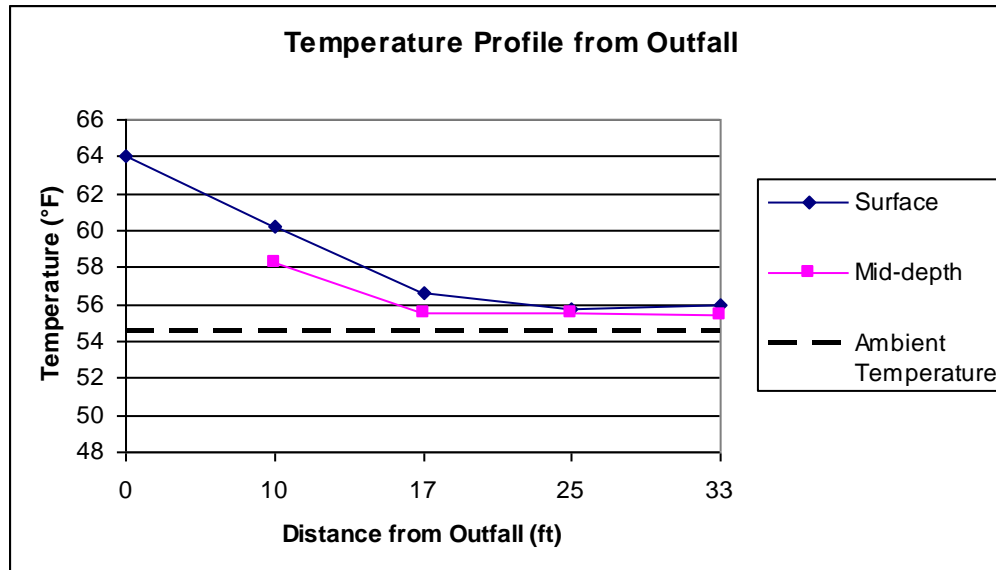
Stoughton DC example

- Unidirectional waters
- Rough bottom substrate present resulting in turbulent flow
- Zone(s) of free passage exist for fish and aquatic life



Stoughton Profile Results

- Discharge 10 °F warmer than the ambient
- 85% of heat lost at 33 ft from the outfall source
- Thermal mixing zone does not extend more than 50% of the width of the receiving stream



DC Evaluation Process

Send POTW Thermal Letter &/or Permit Application with **DC Request Form**.

DC Request Form submitted before or with Permit Application.

DC Request Form is analyzed by Department staff.

DC decision is included in public notice. Weekly limits are dropped, if applicable.

DISSIPATIVE COOLING EVALUATION CHECKLIST

This checklist is meant to be a tool to help WQBEL calculators analyze dissipative cooling (DC) requests made by POTWs under NR 106.59(4) or (6).

Permit Information:

Permittee name: _____ WPDES Permit No.: _____

This operation is (check one): New POTW, or Existing POTW

This DC evaluation is (check one): Original DC proposal, or Updated DC proposal

Submitted Information:

Physical Characteristics:

Type of Receiving Water	<input type="checkbox"/> Non-unidirectional water <input type="checkbox"/> Unidirectional water	Comments:
Waterbody type	<input type="checkbox"/> Cold water fishery <input type="checkbox"/> Warm water sport fishery <input type="checkbox"/> Warm water forage fishery	Comments:
Substrate	<input type="checkbox"/> Rocky <input type="checkbox"/> Gravel <input type="checkbox"/> Sand <input type="checkbox"/> Silt <input type="checkbox"/> Other <input type="checkbox"/> Unknown	Comments:
Emergent features	<input type="checkbox"/> Rocks <input type="checkbox"/> Other <input type="checkbox"/> Structure <input type="checkbox"/> None <input type="checkbox"/> Rip-rap	Comments:
Ambient temperature data	<input type="checkbox"/> Available <input type="checkbox"/> Not available	Comments:

Operation Characteristics:

Multiple Discharges	<input type="checkbox"/> There are multiple discharges that may contribute thermal loads <input type="checkbox"/> There are NOT multiple discharges	Comments:
Availability of effluent temperature data	<input type="checkbox"/> Available <input type="checkbox"/> Month(s) only (<i>explain</i>) <input type="checkbox"/> 12 months of representative data (as defined in NR 106.59(4) or 6(3)) <input type="checkbox"/> Not available	Comments:
Temperature profile of thermal plume	<input type="checkbox"/> Data available <input type="checkbox"/> Zones of free passage identified <input type="checkbox"/> Zones of free passage present <input type="checkbox"/> Zones of free passage absent <input type="checkbox"/> No data available	Comments:
Mixing zone characteristics	<input type="checkbox"/> Visual/photographic information <input type="checkbox"/> Dye study <input type="checkbox"/> No data available	Comments:
Heat loss to the atmosphere	<input type="checkbox"/> Significant <input type="checkbox"/> Not significant <input type="checkbox"/> Unknown	Comments:

Biological Characteristics:

Discharge impacts on migration of organisms	<input type="checkbox"/> Impeded <input type="checkbox"/> Not impeded <input type="checkbox"/> Unknown	Comments:
Difference between communities in and outside of discharge	<input type="checkbox"/> Observed <input type="checkbox"/> Not observed <input type="checkbox"/> Unknown	Comments:
Threatened or endangered organisms	<input type="checkbox"/> Present; source? <input type="checkbox"/> Not present; source? <input type="checkbox"/> Unknown	Comments:

What is required to be submitted?

- **NR 106.59(4) or NR 106.59(6)**
- **Required**
 - Written description of physical characteristics
 - Written description of other thermal loads
- **Required if available**
 - Effluent temperature data
 - Biological quality data
 - Presence of threatened/endangered species
 - Receiving water temperature
 - Other
- **All pertinent data should be included in submittal whether affirmative or negative**

Conclusion

- Municipalities may be subject to thermal limits, particularly daily maximum and weekly limits
- Effluent temperature monitoring will likely be required
 - If unspecified, can use continuous or multiple grab methods
- Dissipative cooling can provide relief from weekly limits
 - Marginal amounts of data collection will likely be required

Additional Resources

- **Thermal Website:**

- <http://dnr.wi.gov/org/water/wm/wqs/thermalrulesrevisions.htm>

- Thermal Guidance Document

- Frequently Asked Questions

- **Thermal Email:** DNRthermal@wisconsin.gov

Questions?

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