TECHNICAL OPERATING PROCEDURE

PROCEDURE TITLE:

Procedures for Conducting Rhodamine WT Dye Dilution Studies

APPLICABILITY:

Procedure applies to the use of Rhodamine WT dye to estimate the dilution of lampricides prior to application to streams.

PRINCIPLE:

Rhodamine WT dye is applied with a continuous addition technique to simulate a lampricide application. The application is made at a uniform rate over a period of time to ensure a stable concentration of dye at a downstream location. The loss of dye concentration is used to predict lampricide losses during stream treatments.

SAMPLE COLLECTION AND PRESERVATION:

Samples of water containing fluorescent dye are collected by hand or by automatic water sampler (IOP:002.x and IOP:003.x). Water samples are usually analyzed immediately, but if storage is necessary the samples are labeled and refrigerated. Subsequent analysis is completed as soon as possible.
EQUIPMENT REQUIRED:

I. Sample collection
   A. Sample bottles of sufficient volume for measurement of samples. Maximum requirement is about 500 mL for a Turner Designs fluorometer utilizing a flow-through cell configuration.
   B. Sigma or ISCO brand automatic sampler

II. Analytical equipment
   A. Fluorometer (IOP:004.x, IOP:004.xA, IOP:004.xB, and IOP:004.xC)

POTENTIAL INTERFERENCES:

There can be significant losses to adsorption of Rhodamine WT on certain clays. Ambient air temperatures below 32°F will cause freezing in the suction hose of the automatic sampler if left exposed. If an intake is not suspended above stream bottom, silt and other debris will obstruct hose. If two units are set next to each other electro-magnetic interference may occur.

SAFETY:

No special safety precautions

DISPOSAL:

Not applicable

REAGENTS:

Not applicable

PROCEDURES:

I. Calibration
   
   Note: Rhodamine WT Dye is considered 100% active for this procedure
   
   A. Preparation of a 1000 uL/L (part per million) Rhodamine W.T. standard solution
      1. Pipette 1 mL Rhodamine W.T. into a 1000 mL volumetric flask
      2. Fill to the 1000 mL mark with deionized water
      3. Label the flask
   
   B. Preparation of a 1 uL/L Rhodamine W.T. standard solution
      1. Pipette 1 mL of a 1000 uL/L Rhodamine W.T. into a 1000 mL volumetric flask
      2. Fill to the 1000 mL mark with deionized water
      3. Label the flask
C. Preparation of a 100 nL/L (part per billion) Rhodamine W.T. standard solution

1. Dispense 100 mL of 1 uL/L standard stock solution into a 1000 mL volumetric flask
2. Fill to the 1000 mL mark with deionized water
3. Label the flask

D. Calibrate the fluorometer with the 100 nL/L standard solution (IOP:004.x, IOP:004.xA, IOP:004.xB, and IOP:004.xC)

II. Dye dilution investigation must be indexed to the discharge of the stream section under study. A stream discharge measurement is conducted prior to the application of dye (TOP:001.x).

III. The application rate of dye is determined by the formula:

\[ qd = Q \times C / 10^9 \]

Where:
- \( qd \) = application rate (cc/min)
- \( Q \) = discharge (cc/min)
- \( C \) = desired concentration of dye (ppb)

Note:
1. Concentrations are based on volume:volume relationships.
2. Discharge must be multiplied by a factor of \( 10^9 \) (cubic meter to cubic centimeter) and 60 (minutes to seconds).

Example:
- \( Q = 20 \text{ m}^3/\text{s} \)
- \( C = 2 \text{ ppb} \)

\[ Qd = Q \times C / 10^9 = 20 \text{ m}^3/\text{sec} \times 10^6 \text{ cc/m}^3 \times 60 \text{ sec/min} \times 2 \text{ parts}/10^9 = 2.4 \text{ cc/min} \]

IV. An application rate of 0.06 cc/min will yield 1.0 ppb in 1 cubic meter per second. Diluted mixtures of dye are required for application. A 1:1000 dilution is appropriate to determine dye concentrations on small to medium discharge streams; a rate of 60 mL/min yields 1 ppb in 1 cubic meter per second discharge.

V. The addition of dye is usually made at a proposed site for application of lampricide. A sufficient volume of dye solution is made to ensure an appropriate application time. It is desirable to feed the dye for the same period of time that lampricides are to be applied, however, shorter feed times can be used. Pertinent application data (start time of application, feed rates, amount of dye used, staff gauge readings, application location) are recorded.

VI. Dye is applied to the stream by methods similar to those used to apply lampricides (IOP:005.x).

VII. Concentrations of dye are measured to determine the downstream progress of the block at pre-selected sites. Water samples are taken by hand or collected by automatic water samplers. Sampling continues until a profile of dye concentrations is complete.

VIII. Concentrations of dye can be measured with a fluorometer either on site (with battery power) or in a lab (line power). All sample times are recorded.
IX. The time of travel is also determined and is considered the time necessary for the dye to reach maximum concentration at each sampling site.

REFERENCES:


This procedure has been reviewed and approved by the undersigned representatives of the U.S. Fish and Wildlife Service and Fisheries and Oceans Canada.

REVIEWED/APPROVED ______________________________     DATE ____________

Field Supervisor (U.S.)

REVIEWED/APPROVED ______________________________     DATE ____________

Division Manager (Canada)