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AERATED LAGOON SYSTEM O&M GUIDELINE

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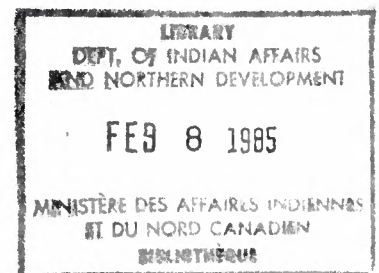
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AERATED LAGOON SYSTEM O&M GUIDELINE

August 1984

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Guide d'exploitation et d'entretien des
étangs aérés

AERATED LAGOON SYSTEM
O&M GUIDELINE

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AERATED LAGOON SYSTEM
O&M GUIDELINE

1.0 INTRODUCTION

This publication provides guidelines for the operation and maintenance of aerated lagoon systems used to treat wastewater on Indian reserves.

The guidelines are intended to be used by wastewater treatment plant operators and maintenance supervisors. They do not replace the instructions provided by the individual equipment manufacturer, but rather form a supplement. Copies of the manufacturer's manuals should be available at all times. Copies of all drawings applicable to a facility's sewage system should be kept up to date at the facility and be available for use when needed.

The following documents are also useful:

1. BTP-MS-2, "Waste Stabilization Pond O&M Guideline"
2. TSD-41-5, "Aerated Lagoon Development Guidelines".

These publications are or will be available from your local office of Indian and Inuit affairs.

2.0 DEFINITIONS

Definitions are given in Appendix 1. Although not all the terms appear in this publication, they are frequently encountered in the literature on aerated lagoons.

3.0 RESPONSIBILITIES

The band's responsibilities are as follows:

- a. to have a trained operator who is capable of operating and maintaining the installation;
- b. to supply the operator with all the necessary tools, materials and parts needed for plant operation and maintenance;
- c. to provide for proper instruction and orientation;
- d. to provide opportunities for plant personnel to increase their knowledge by participation in meetings and special training courses; and
- e. to obtain any permits required for operation of the plant from the appropriate regulatory agency.

The operator must:

- a. operate the plant efficiently and meet the effluent qualities stipulated by regulatory agencies;
- b. maintain the equipment, buildings and grounds;
- c. maintain a safe and healthy environment;
- d. perform tests and make observations needed for the proper operation of the plant;
- e. understand and apply laboratory tests and results;
- f. warn the owners far enough in advance so that tools, parts and supplies will be available when needed; and
- g. keep maintenance records up to date.

4.0

PROCESS DESCRIPTION

In facultative lagoons solids settle to the bottom where they eventually undergo anaerobic

decomposition. The wastewater itself is oxidized by a stream of air, high enough to avoid disturbing the solids on the bottom.

The aeration system consists of air blowers that supply air to tubing which is weighted down near the bottom of the pond (see Figure 1). The tubing is laid in a grid which divides the lagoon into hydraulic cells. Air is released from the plastic tubing causing slow moving currents which keep the waste moving within each cell. The spacing between cells depends upon oxygen requirements. The spacing increases as the liquid moves away from the influent point and BOD decreases. The aeration tubing is suspended approximately .6 m (2 ft.) from the bottom to avoid disturbing the anaerobic zone where sludge is decomposing.

The partially mixed aerated pond is particularly useful in Canada because aerobic oxidation can continue under the ice cover.

5.0 PLANT START-UP

The equipment supplier should check for leaks and make any measurements and adjustments needed at start-up before the operator takes control of the treatment system. When the operator takes over, the system should be fully operational. For detailed instructions on start-up refer to the manufacturer's operation and maintenance manual.

6.0 ROUTINE OPERATION

For consistent and effective performance the operator should ensure that:

- a. full design water level is maintained above the aeration tubing;
- b. the air blower system is operated continuously to satisfy the BOD requirements of the wastewater; and

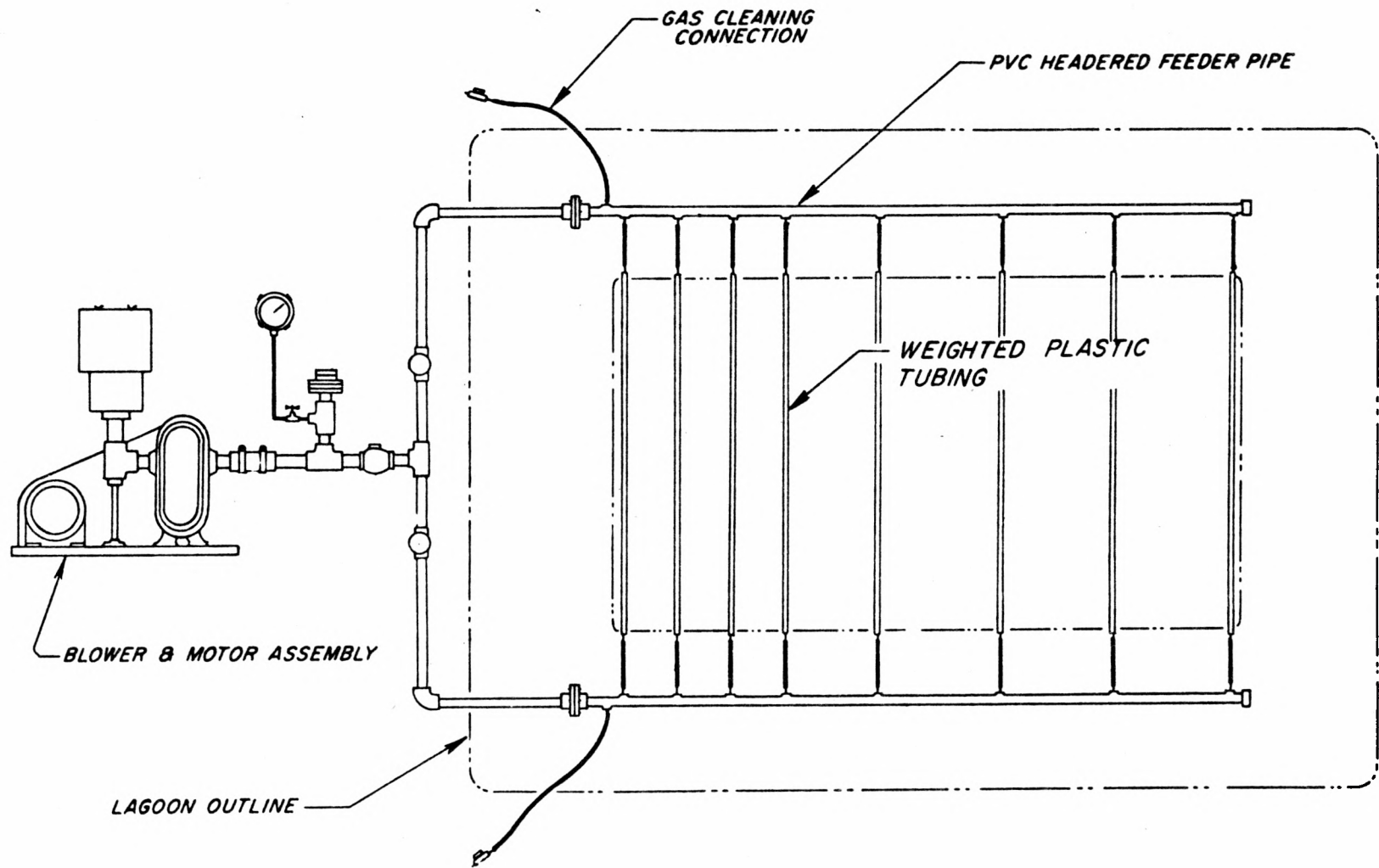


FIGURE 1 BASIC AIR SUPPLY SYSTEM

- c. the air relief valves are operated at the design pressure limits.

7.0 MAINTENANCE PROCEDURES

7.1 General Remarks

It is recommended that the operator of an aerated lagoon system be given at least one week's training in basic wastewater treatment.

7.2 Preventive Maintenance

Inspect the mechanical equipment every day. Refer to the manufacturer's instructions on maintenance and lubrication. Preventive maintenance procedures are summarized as follows:

a. Daily:

- (1) Check water level.
- (2) Check pond for anaerobic conditions noted by odour and black colour.
- (3) Check banks for leakage and erosion -- repair as required.
- (4) Check for signs of burrowing animals -- remove as required.
- (5) Inspect fence for damage -- repair as required.
- (6) Check blowers for overheating, unusual noise, vibration etc.
- (7) Check oil levels in blower gear case.
- (8) Check drive belt for wear -- replace as required.
- (9) Check pressure relief valve and operating pressure of blower.

- (1) Contact the servicer for annual inspection of mechanical equipment.
- c. Annually:
- (8) Check the hydrogen chloride (HCL) cleaning valves and connecting tubing.
 - (7) Clean the blower intake filter.
 - (6) Grease the impeller hub.
 - (5) Change the oil in the blower.
 - (4) Inspect the control structure for proper operation and remove objects which may cause blockage of the outlet.
 - (3) Remove any build-up of grease, dirt and foreign matter from the water as required.
 - (2) Remove excess weed growth at pond edge.
 - (1) Cut grass on berm -- the grass should be no taller than 15 cm (6 ins.).
- b. Monthly:
- (14) Keep the plant site looking attractive.
 - (13) Check electrical and mechanical equipment for proper operation and lubrication.
 - (12) Check diffusers for leaks -- repair, following the manufacturer's instructions.
 - (11) Check airlift and diffusers for clogging -- clean as required.
 - (10) Check inlet and discharge pipe supports.

8.0 PROCESS CONTROL

Final effluent quality tests should be performed as required by regulatory agencies. In order to make appropriate adjustments the operator must be able to perform tests for dissolved oxygen. A number of companies such as Hach, supply kits for dissolved oxygen measurements. Detailed instructions are provided with each kit.

9.0 HYDROGEN CHLORIDE (HCL) GAS CLEANING

Periodically, diffusers become clogged and must be cleaned. Indications of clogging are a reduction in the air bubble pattern and an increase in the blower discharge pressure resulting in higher operating costs. Applying HCL gas dissolves and removes the deposits of carbon that form on the diffusers over time and is an effective means of restoring treatment efficiency. Check with your manufacturer's instructions for details on gas cleaning procedures. An example of a gas cleaning connection is shown in Figure 2. Also see 11.2.

10.0 TROUBLE-SHOOTING

A trouble-shooting checklist for aerated lagoon systems is presented in Appendices 2 and 3. The operator should use the checklist as a guide in correcting operational problems. If there are continual problems with a particular installation, contact the regional or district office for assistance.

11.0 CHLORINATION

Refer to BTP-MS-4, "Hypochlorination O&M Guideline" for operating instructions and chlorine residual test procedures.

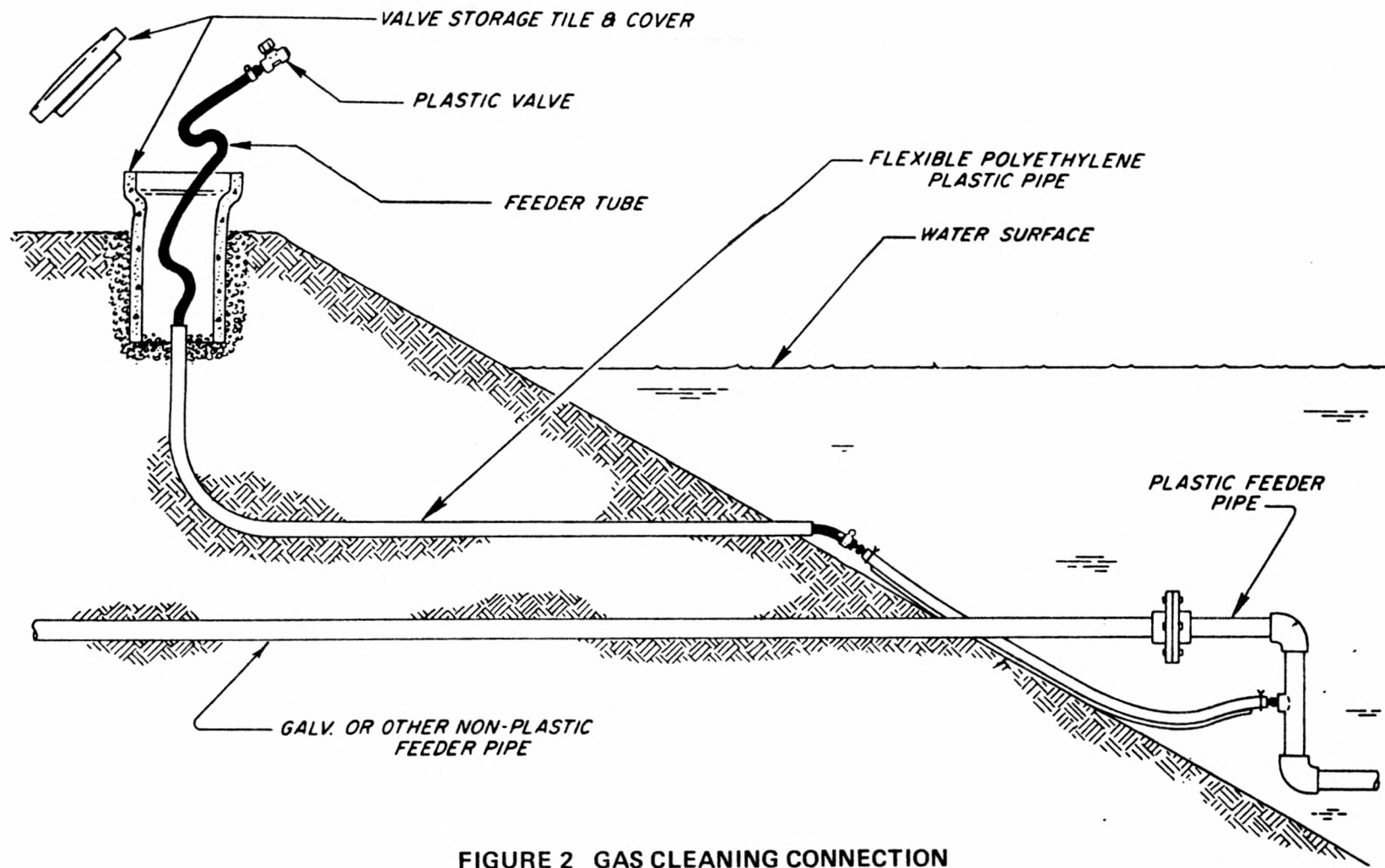


FIGURE 2 GAS CLEANING CONNECTION

13.0 REFERENCES

Hinde Manufacturing. Operation and Maintenance
Instruction Manual.

This can be obtained from Hinde Manufacturing, 260
Burlington St. E., Hamilton, Ontario. Telephone:
416-529-7515.

Appendix 1

TERMS COMMONLY USED IN LITERATURE
ON AERATED LAGOONS

AERATED POND - A wastewater treatment pond in which mechanical or diffused-air aeration is used to supplement the oxygen supply.

AEROBIC - A condition characterized by the presence of free dissolved oxygen in the aquatic environment.

ALGAE - Primitive one or many-celled plants, usually aquatic, that produce their food by photosynthesis.

ANAEROBIC BACTERIA - Bacteria which grow in the absence of free dissolved oxygen and must obtain their oxygen by chemically breaking down organic compounds which contain combined oxygen.

ANAEROBIC DECOMPOSITION - The breakdown of complex organic matter by bacteria in the absence of dissolved oxygen.

AQUATIC VEGETATION - Vegetation that grows in or near water.

BACTERIA - A group of microscopic organisms lacking chlorophyll and using organic nutrients as a food source.

BIOCHEMICAL OXYGEN DEMAND (BOD) - This is a common measurement of the amount of oxygen required to stabilize wastewater.

COLIFORM GROUP - A group of bacteria that inhabit the intestinal tract of humans and warm blooded animals and may be found in plants, soil and air, and the aquatic environment.

DISSOLVED OXYGEN (DO) - Dissolved molecular oxygen usually expressed in mg/L, ppm or percent saturation.

EFFLUENT - A liquid flowing out of a chamber, treatment unit or basin.

Appendix 1 (Cont'd)

SHORT-CIRCUITING - The hydraulic conditions in a tank, chamber or basin where the flow is quicker than normal.

SLUDGE BANKS - The accumulation of solids including silt, mineral, organic and cell mass material, that is produced in an aquatic system.

STABILIZATION - The process of reducing a material, using biological and/or chemical means, to a form that does not readily decompose.

STANDARD METHODS - Methods of analysis prescribed by joint action of the American Public Health Association (APHA), American Water Works Association (AWWA) and Water Pollution Control Federation (WPCF).

SUSPENDED SOLIDS (SS) - The concentration of insoluble materials suspended or dispersed in waste or used water. Generally expressed in mg/L on a dry weight basis. Usually determined by filtration methods.

Appendix 3

MECHANICAL TROUBLE-SHOOPING CHECKLIST

<u>PROBLEM</u>	<u>PROBABLE CAUSE</u>	<u>BEST REMEDY</u>
No pattern down centre.	Improper gas cleaning. Uneven bottom (centre deeper than sides in some places).	Gas clean correctly. Lift and reset tubing.
No pattern along sides.	Uneven bottom (sides deeper than centre in some places). Tubing covered with debris from bank.	Lift and reset tubing. Lift and reset tubing.
No pattern one end.	Improper gas cleaning.	Gas clean at nearest gas cleaning connection or add connection where required.
Random or spotty pattern.	System needs gas cleaning.	Gas clean as directed.
Variable pattern between lagoons.	Difference in water depths. Air control valves.	Balance water depths. Balance air distribution.
No pattern at all.	Blowers off.	Restart, using blower start-up procedure.
Air-boil over header.	Ruptured air header.	Draw lagoon down below header and repair, or use diver and repair clamp.
Air-boil over tubing.	Rupture in tube or fitting.	Lift tubing, cut out bad section and connect with nipple and clamp.
Broken baffle.	Rotting or ice damage.	As soon as possible, draw lagoon down below break and repair.
Ineffective gas cleaning.	Poor air distribution or too long between gas cleaning.	Review gas cleaning instructions.
Inoperative blower.		Check blower start-up procedure and manufacturer's operating manual.