SMITH & LOVELESS DESIGN

FACTORY-BUILT "OXIGEST" SEWAGE TREATMENT PLANT

Air Products LIMITED

PUBLIC HEALTH ENGINEERING DEPARTME

For Design Features and Details **SEE INSIDE**

Mike Microbe Explains AEROBIC DIGESTION PROCESS

Mike Microbe represents the little microscopic, living organisms in domestic sewage. He is a "blob" with a personality, created to help explain the biological process that occurs in treatment plants such as the "Oxigest."

The process is best described as an "Extended Aeration" or "Aerobic Digestion" treatment system. It provides simple, dependable treatment for domestic sewage by introducing an abundant supply of air to the sewage to keep the sewage solids in suspension for a sufficient period of time to permit adsorption and digestion to take place.

Mike Microbe and the other living organisms live off the organic matter and consume it. They are stimulated to activity by the abundant oxygen and thrive on the rich food source of high-energy organic wastes.

Actually, the treatment plant provides an ideal environment or "living conditions" for the organisms. They multiply rapidly, as needed, to adsorb the organic matter and digest it.

The turbulence in the aeration tank aids the digestion process by rapidly mixing the fresh sewage solids with the activated sludge, by breaking up the sewage solids and by bringing the contents of the aeration tank in contact with the atmosphere where additional oxygen may be absorbed.

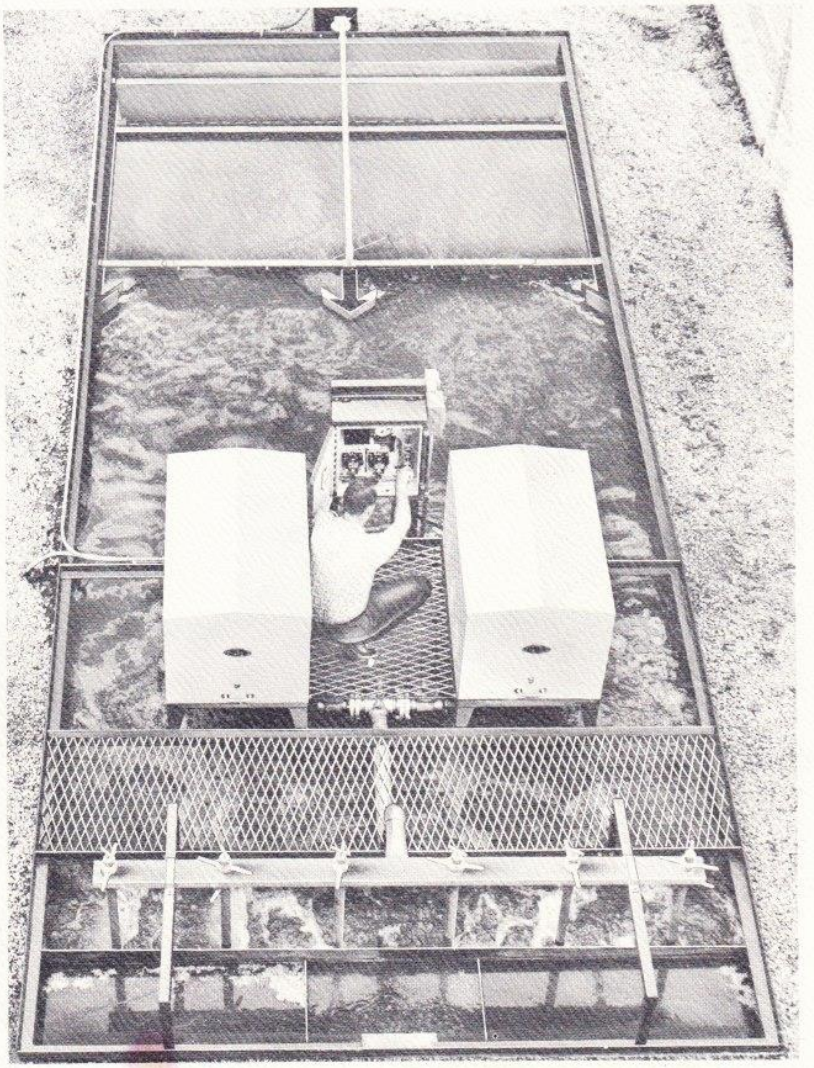
Thus the aerobic bacteria and microbes reduce the organic matter and waste to a stable form—odour and nuisance-free.

Sewage engineers often refer to the process as a long-period aeration system or a "complete mixing, extended-aeration, activated-sludge process."

"OXIGEST"

WITH AUTOMATIC SURFACE SKIMMING*

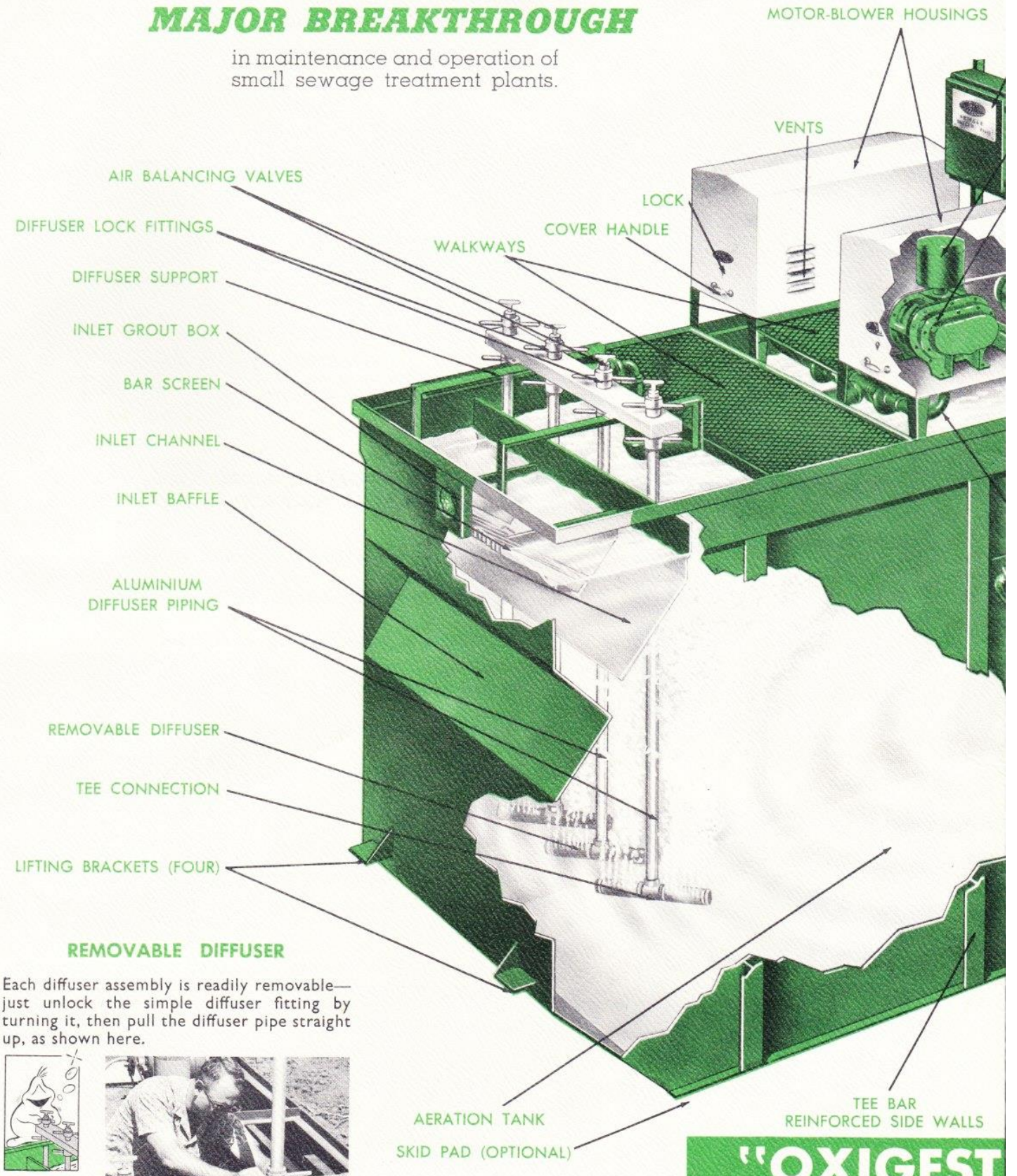
The factory-built "Oxigest" sewage treatment plant is designed specifically for housing development, mobile home sites, motels, holiday resorts, hospitals, schools and factories in outlying areas without municipal sewer facilities. With the new Automatic Surface Skimmer, the "Oxigest" requires less maintenance — much less operating attention than accepted conventional treatment systems.



Efficient, Dependable, Factory-Built

MAJOR BREAKTHROUGH

in maintenance and operation of small sewage treatment plants.



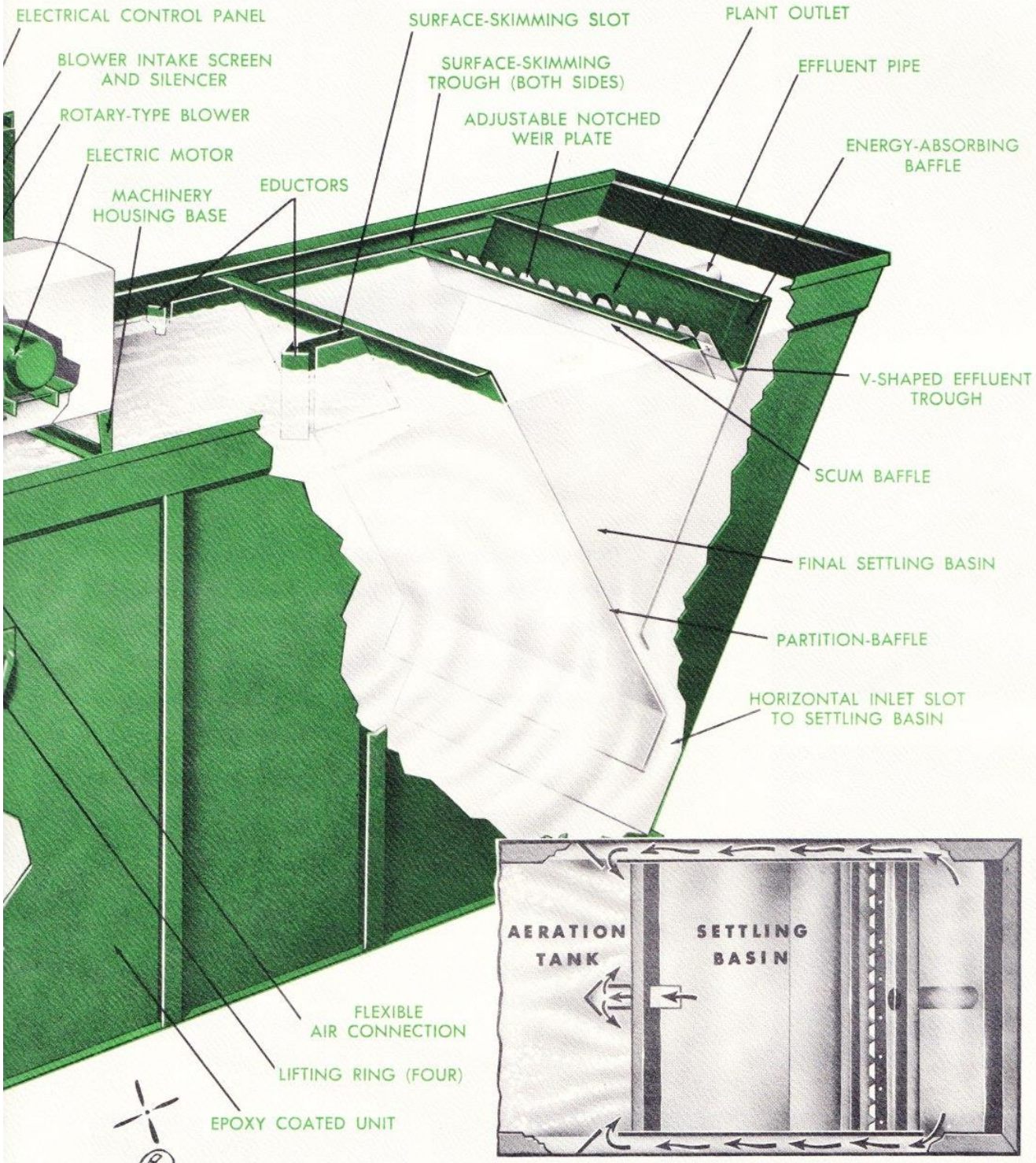
REMOVABLE DIFFUSER

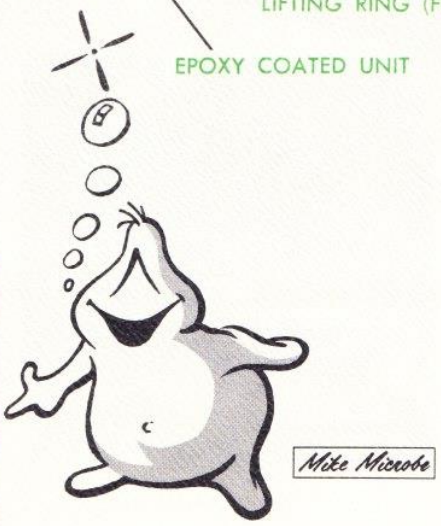
Each diffuser assembly is readily removable—just unlock the simple diffuser fitting by turning it, then pull the diffuser pipe straight up, as shown here.

"OXIGEST

DESIGNED BY

Smith & Lovele



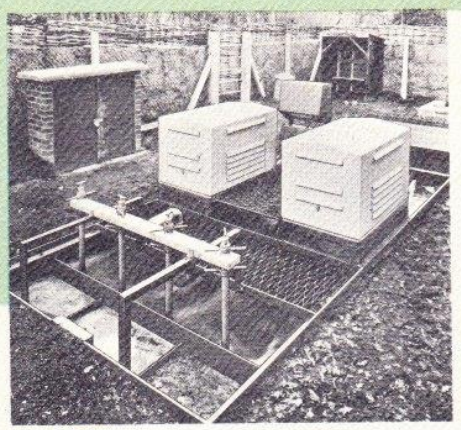


* Exclusive—Automatic Surface Skimming

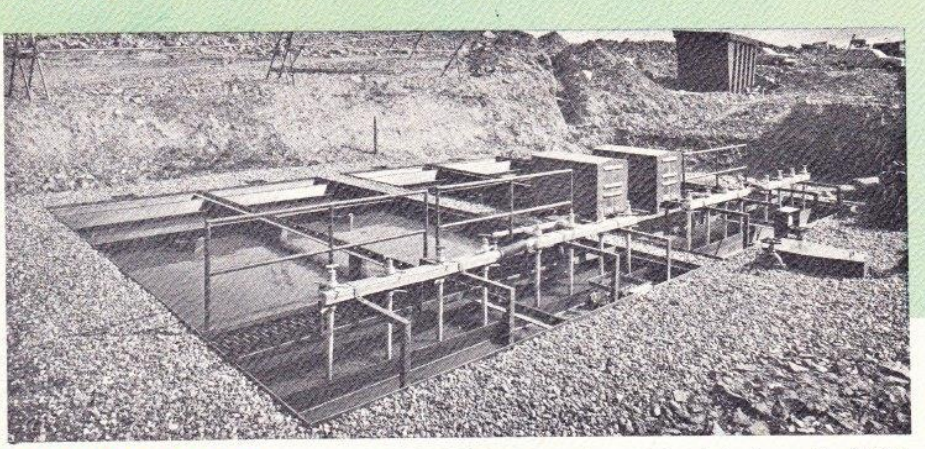
A new non-mechanical surface skimmer on all standard factory-built models provides automatic removal of floating material from the surface of the settling basin by a new hydraulic system—an exclusive feature. The system reduces maintenance by removing floating particles (such as grease, garbage and denitrified sludge) from the settling basin. The circulating liquid in the aeration tank (at left), flowing past the strategically located eductors, sets up a "return flow" which skims the surface of the settling-basin compartments by drawing the surface liquid through the skimming troughs to the aeration tank. The recirculation effect eliminates operation problems, reduces maintenance expense.

AVAILABLE ONLY WITH "OXIGEST" *PATENTS PENDING

THE "OXIGEST" IS IDEAL FOR HOUSING DEVELOPMENTS, CARAVAN SITES, SCHOOLS, FACTORIES, HOLIDAY CAMPS, POWER STATIONS

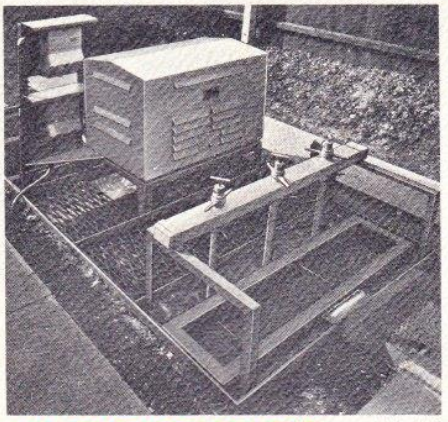


VILLAGE . . . A 4,160 gallon per day unit installed by the Cuckfield R.D.C. to provide sewage treatment for the village of Slaugham, Sussex.



CONSTRUCTION SITE . . . Two **OXIGEST** units each capable of dealing with 15,830 gallons per day of domestic sewage, installed at a large construction site in North Wales. In the background, a further **OXIGEST** plant is ready for installation as the working population increases.

Three completed **OXIGEST** units ready for despatch to site.



HOUSING DEVELOPMENT . . . A 1,660 gallon per day **OXIGEST** serving a small council housing development in the village of Tempsford, Near Biggleswade, Bedfordshire.

HERE ARE SOME IMPORTANT ADVANTAGES OF THE FACTORY-BUILT "OXIGEST" . . .

- **Can Be Installed in Less Than a Day**
- **Provides Simple, Dependable Treatment**
- **Economical to Operate, Easy to Maintain**
- **Requires Minimum Land for Plant Site**
- **Odour-Free and Nuisance-Free**
- **Can Be Installed Close to Occupied Buildings**
- **No Freeze Up During Winter Conditions**

The "Oxigest" is produced in 27 different sizes to serve populations ranging from 30 to 600 in single units. For larger capacities, units may be installed in parallel or added to keep pace with growing demand.

Although intended as a permanent plant, the "Oxigest" may be transferred from one location to another if, and when main drainage becomes available.

The treatment plant is delivered by road transport and can be installed above or below ground within one day.

TRADE WASTES. Certain trade wastes are amenable to treatment by extended aeration and the "Oxigest" is eminently suited to provide complete or partial treatment of these wastes so that they may be accepted into the municipal sewer. We will be pleased to examine your special problem.

"Oxigest" units are manufactured under rights granted by Smith & Loveless, Division-Union Tank Car Company, Lenexa, Kansas, U.S.A.

Air Products LIMITED

PUBLIC HEALTH ENGINEERING DEPARTMENT

ACREFAIR · WREXHAM · DENBIGHSHIRE

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CONTENTS

OPERATING AND MAINTENANCE INSTRUCTIONS FOR FACTORY BUILT OXIGEST UNITS

1. INTRODUCTION

The OXIGEST plant is designed to treat sewage or trade wastes to produce a purified effluent suitable for discharge to a watercourse.

Maintenance requirements have been reduced to a minimum, but it cannot be overstressed that good results will not be consistently achieved unless those items listed below are attended to on a regular basis.

The amount of time required for maintenance should not exceed 15 minutes per day, plus 2 hours on one day per week. (Allow 3 hours where a clarifier is provided).

2. PRINCIPLE OF PROCESS

Not infrequently, the person called upon to maintain an OXIGEST plant has had no previous experience of sewage treatment, and, as it is important for the plant operator to have some understanding of the process involved, we offer the following brief explanation:-

All organic matter, when exposed to the elements, decays. This is due to the activities of certain bacteria and microscopic animals, collectively called micro-organisms.

These organisms exist in the air, water and more particularly, soil, and account for all natural decay processes, such as composting of vegetable matter or the rotting of animal refuse.

There are two basic types of organisms - those for which air is essential, called aerobic bacteria, and those which function without air, called anaerobic bacteria. Both types can break down waste matter, but the great difference so far as sewage treatment is concerned is that decay in the absence of air, called putrefaction, is accompanied by foul odours, whereas aerobic decay, called oxidation is a virtually odourless process.

In the activated sludge process, as employed in an OXIGEST plant, an environment is created in which the aerobic bacteria are stimulated to the point where the anaerobic types are completely suppressed and therefore there is no odour from a properly maintained plant. In this process, a mass of aerobic organisms, called 'Activated Sludge' is maintained in liquid suspension in a tank by blowing air through the liquid.

The air serves two purposes - both to mix the contents of the tank, and to provide the air necessary for the organisms to liver. The suspension of activated sludge is called 'Mixed Liquor'.

When sewage is added to mixed liquor, the organisms in the sludge rapidly absorb all the organic matter, using this "food", as a source of energy for their natural processes, e.g. movement and breeding. Thus the sewage is purified, and the activated sludge can be settled from the Mixed Liquor leaving a clear supernatant layer of liquid which may be discharged as effluent.

In the OXIGEST plant, the mixing and settlement phases are occurring continuously.

The important things to note from the foregoing are:-

2.1. The organisms must be given sufficient air, or anaerobic (septic) conditions will result and foul odours will be produced.

2.2. The organisms use part of the organic material in the sewage for breeding, and therefore increase in numbers with time. This means that it is necessary from time to time to remove some of the activated sludge and dispose of it.

3. OPERATING INSTRUCTIONS

It is assumed that the clarifier has been correctly installed and that the effluent weir is level, all pipe joints watertight, and the media correctly graded and level.

3.1. Day to day maintenance

Floating objects should be removed from the inlet chamber.
The quantity of material so removed will be very small. Growths of algae etc. should be removed by brushing as soon as they appear at any point on the waterline.

3.2. Backwashing

From time to time the medium will become choked with solids, as indicated by an increasing difference in level between the water in the inlet chamber and that above the medium - or occasionally by plumes of solids being carried up from the gravel bed.
When this occurs, or, preferably, on a regular basis not less than once per month, the clarifier must be back-washed.
This involves either pumping the accumulated solids back to the aeration compartment of the plant, or removing them by tanker.
The method used will depend on local circumstances and the quantity and type of solids concerned.
A mass of septic sludge from a badly choked clarifier must never be returned to the aeration tank of an OXIGEST or the process will be upset.
Whichever method of disposal of the solids is chosen, however, the procedure for backwashing is the same,
i.e.:-

3.2.1. The sheargate 'F' is opened, allowing the contents of the lower chamber to flow into the sump, 'E' and the pump or suction hose started.

3.2.2. When the clarifier is empty, the pea-gravel should be thoroughly washed through with a hosepipe, and at the same time turned over with a garden fork or shovel.
The washings are disposed of in the same way as the original contents of the lower chamber.

3.2.3. Once the gravel is clean, the pump/suction hose is stopped, the shear gate closed, and the clarifier allowed to operate normally again./

It cannot be overstressed that regular backwashing is the key to successful and trouble free clarifier operation, but the period between backwashings must be left to the discretion of the plant operator, as a number of different factors are involved which vary from installation to installation.

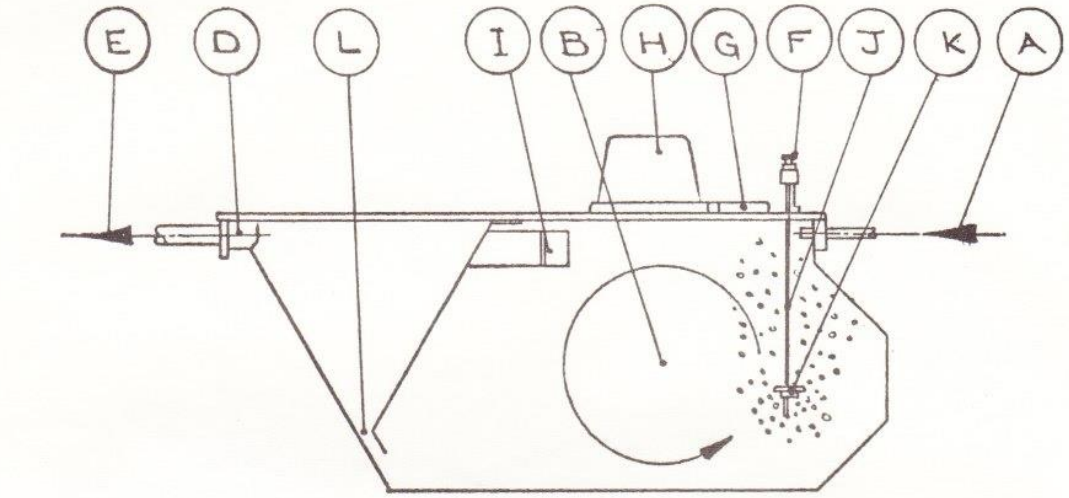
3.3. Paintwork

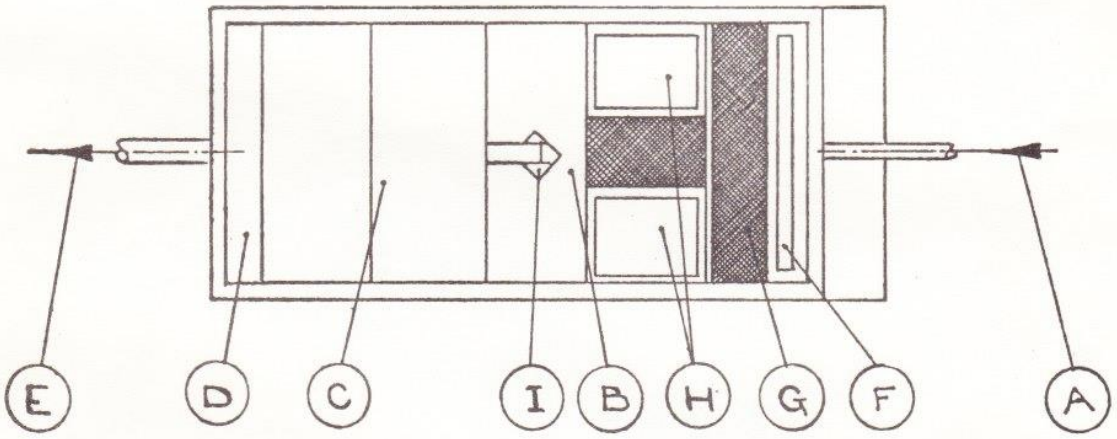
Damaged paintwork may be repaired by wire brushing, and then touching up with epoxy resin paint, as supplied by APL. It is of the utmost importance to adhere strictly to the manufacturer's instructions when using this paint.

560 at 2-12
500 " 2-42

3. DESCRIPTION OF PLANT

3.1. Flow pattern





(A) Influent (crude sewage)
(B) Aeration tank (Mixed Liquor)
(C) Settlement tank
(D) Effluent trough and weir
(E) Effluent pipe
(F) Air header
(G) Walkway
(H) Air Blowers
(I) Eductor (Settlement tank skimming device
(J) Drop-pipe
(K) Diffuser
(L) Settlement tank sludge return slot.

Sewage enters at (A), and is mixed with the mixed liquor in (B) Settlement of the activated sludge takes place in (C), supernatant liquor flows over the weir into the trough at (D), and is discharged as effluent through (E).

((F), (G), (H), (J), and (K) indicate the general arrangement of the air supply). (I) is the eductor, a device which automatically skims the settlement tank surface to remove floating objects. It is activated by the direction of flow/

of the mixed liquor induced as indicated by the air supply.

3.2. Construction

The unit is constructed of mild steel and protected by epoxy resin paint.

3.3. Air Supply

Duplicate Roots-type blowers are provided. These are high-precision machines and have a very long life provided they are maintained entirely in accordance with the manufacturers instructions, as laid down in the manual supplied with the plant.

Three sizes of pulley are provided for each blower drive motor. These correspond to 50%, 75% and 100% of design air output, the correct air supply for any particular plant being determined by experiment on site. The output from one blower is sufficient for the requirements of the plant, the other being provided as a standby.

4. OPERATING INSTRUCTIONS

It is assumed that the plant has been installed in accordance with our instructions and is filled with water or sewage.

4.1. Start-up

Check blower gearcase oil level is correct (see manufacturers manual). Start one blower. Normally the 50% air output drive pulley will be fitted to the motor at this stage. (NOTE smaller pulleys give less air). Allow the blower to run continuously and check the plant daily. Foaming will almost certainly occur during the first two or three weeks, and this should be controlled by use of the anti-foam oil supplied with the plant.

Do not allow foam to dry on the paintwork as this will then prove very difficult to remove - hose it off daily.

After 3-4 weeks, the mixed liquor in the aeration tank should become brown in colour, and settle rapidly when a sample is examined in a test jar.

If, after 4 weeks, offensive odours are being produced or the Mixed Liquor is grey, increase the air supply by fitting the next larger size of pulley to each of the drive motors, (instructions for this are given under (4) (2) (6)) and allow the plant to run for a further two weeks. If conditions do not improve, the largest drive motor pulleys should be fitted. /

After 8-10 weeks, the plant should be producing a good, clear effluent with no smell apart from a faint earthy odour similar to damp soil. In cases where the initial load on the system is much less than the maximum, achievement of this condition may take several weeks longer, but in case of any difficulty, contact Air Products Limited for advice. Do not allow poor operating conditions to persist. Both during this period and thereafter the plant should be generally maintained on a day-to-day basis as set out in our attached "Operators Instructions".

4.2. Routine Maintenance

4.2.1. Cleanliness

It is extremely important to keep the plant clean and tidy, as accumulations of scum etc. can cause odour nuisance. A hose and stiff broom are the only equipment necessary for cleaning the paintwork. A small wire scoop should also be provided so that floating rags, greaseballs etc. may be removed.

Skimmings from the plant should be disposed of by burying or incineration, and NOT dumped on the ground around the plant as this material will subsequently cause odour nuisance and attract vermin. The volume of the skimmings will be small, no more than 2-3 lbs/week normally.

4.2.2. Process

Little attention is required once the correct air supply has been determined, but the quantity of sludge in the plant must be checked weekly by means of the "Jar Test", which is carried out as follows:-

Two 1-litre polythene measuring cylinders are supplied with all new plants, and once each week one of these should be filled to the 1 litre graduation mark with mixed liquor from the aeration tank, and the solids allowed to settle for 30 minutes. At the end of this period the volume of settled solids should be noted and recorded in a note-book kept for the purpose.

If the solids settle to less than 60% of the total volume, no action is required, but if a greater quantity is recorded/

desludging is necessary.

4.2.3. Desludging

This is normally carried out by means of a tanker, such as a County Council gulley emptier, but the sludge may be pumped to drying beds or onto grassland where this is acceptable.

The procedure is as follows:-

Take a 900 ml. sample of mixed liquor in a test cylinder, and allow this to settle in a shady spot. Turn off the air supply to the plant, and allow the tank contents to settle for 2-4 hours.

Normally, only one half of the sludge should be removed at any desludging, so note the volume of settled solids in the test jar. Each 100 ml. division in the jar is equivalent to 1 ft. depth in the tank itself, and thus, if the sludge has settled to, for example, 400 ml., 2 ft. of liquor should be removed from the tank. The suction hose should be moved over the floor of the tank whilst desludging, particularly at the inlet end, where rags etc. tend to accumulate.

It is not possible to predict the frequency with which desludging will be necessary as this will vary according to the conditions at any particular installation, and the operator must use the jar test to determine the characteristics of his plant.

However, intervals of two to six months are normal.

If laboratory facilities are available, or if the A.P.L. Analysis Service is being utilised, desludging will be carried out according to the Mixed Liquor Suspended Solids concentration, as determined by Laboratory analysis. The M.L.S.S. concentration should be maintained in the range 2,000 - 4,000 mg/l for optimum results, and the procedure for removing excess sludge is exactly as above.

NOTE: Never empty an OXIGEST installed below ground without first checking on the possibility of flotation.

4.2.4. The Eductors

The eductor opening should normally be the minimum possible which gives effective skimming of the settlement tank surface.

However, if, in the summer, sludge is found to be floating on the surface of the settlement tank, the eductor opening should be increased, but not to the point where the sludge blanket is drawn up so that solids carry over with the effluent.

4.2.5. The Settlement Tank

The slot at the bottom of the settlement tank should be checked weekly by probing along its whole length with drain rods and any obstructions removed, or pushed through, back into the aeration tank.

4.2.6. The Air Blowers

These should be maintained entirely in accordance with the manufacturer's maintenance manual (see Appendix) supplied with the plant. It is most important to adhere strictly to the recommended lubrication schedule, and to ensure that the inlet air filters are cleaned regularly once per week. Neglect of either of these items will lead to premature blower failure.

NOTE: Do not drain waste oil into the OXIGEST.

The duty and standby blowers should be changed over once per week in order to obtain an even degree of wear. If manual-type isolation valves have been supplied the procedure is to shut off the duty blower, close the valve to this blower, open the valve to the standby blower, and then start the standby blower. (Most plants manufactured after January 1968 are fitted with automatic non-return valves, eliminating the need for this procedure).

Drive motor pulleys are changed as follows:-

Turn the power off

Remove 'V' belts

Remove socket-headed screws from drive motor pulley, and insert these in the other holes in the pulley collar. /

In this position they act as jacking screws when tightened, and thus the pulley may be removed.

Place the selected replacement pulley on the motor shaft and ensure that this is in line with the blower pulley.

Insert and tighten up the securing screws.

Now move the motor on the slide rails until the drive belts can be replaced, and tensioned correctly. Before restarting the blower check that the pulleys are secure and in line, and that the motor has been properly tightened down.

4.2.7. Electric Drive Motors

Maintain in accordance with the manufacturer's instructions (see Appendix).

4.2.8. The Air Supply System

A regular check should be made for airleaks, and if any are found, these should be rectified at once. Spare air-seals and rubber hoses are available from A P.L.

To dismantle the drop-pipe assembly, first switch off blowers, then slacken the two clamp-nuts holding the drop pipe to the air header. TAKE CARE NOT TO DROP THE PIPE INTO THE TANK. A rubber ring seal will be found inside each clamp nut. Replacement of damaged seals takes only a few minutes.

If, when the duty blower is running, air returns via the standby machine (making it rotate backwards), a new sealing disc is required on the Non-return valve, situated on the air header.

4.2.9. Paintwork

When necessary, paintwork should be repaired by wire-brushing and touching up with epoxy resin paint as supplied by A.P.L. It is most important to adhere strictly to the manufacturer's instructions when applying this paint.

5. TROUBLE SHOOTING

The table below indicated the action to be taken in the event of any difficulty with the Process.

SYMPTOM		REMEDIAL ACTION	REMARKS
Appearance of plant	Jar Test		
Much foam	Little Sludge	Apply anti-foam oil	Condition will remedy itself with time
Much foam	Normal amount of sludge but dark in colour	Apply anti-foam oil	Indicates plant recovering from under-aeration
Foul odours, M. L. Greyish or black	Heavy, dark sludge supernatant liquor cloudy settled vol. 30% or less	Increase air supply	
"	As No. 3 but settled vol. 50% or more	Desludge	Increase air supply after 1 week if desludging does not correct condition
M. L. brown, but sludge carrying over with effluent	M. L. settled Vol. 50% or less	Reduce eductor opening to minimum	If condition persists, check flow into plant. Condition can be caused by excessive flowrate
"	M. L. settled vol. 60% or more	Desludge	
Floating sludge on settlement tank. No smell	M. L. settled vol. 50% or less	Increase eductor opening, but do not allow sludge blanket to rise	Condition occurs sometimes in summer rarely in winter

A sudden deterioration in the performance of the plant indicates that either the load on the system has increased suddenly, or that a toxic chemical is present in the influent.

If a plant which normally performs well tends to discharge sludge during wet weather, this indicates that large quantities of surface water are entering the system and overloading the plant hydraulically. The source of the infiltration should be traced and rectified. In the event of process difficulties not covered by the foregoing, the plant attendant should contact A. P. L. for advice. Never allow poor conditions to persist.

6. NOTES FOR PLANT OPERATOR

The following serves as a day-to-day maintenance schedule, covering all the points mentioned above in brief, and may be used as a check-list on site.

6.1. Daily

6.1.1. Check motors and blowers for unusual noises or overheating.

6.1.2. Make visual inspection of liquor in plant. Aeration tank contents should be brown, similar in colour to cigar tobacco with only a faint earthy odour. The effluent leaving the plant should be almost clear, objects submerged in the settlement tank being visible to a depth of at least 18". If this is not so , see No. (6) (5) (1) below 'Air Supply'.

6.1.3. Remove large floating objects from tank and bury or incinerate these.

6.1.4. Ensure that the eductor is not blocked by rags etc.

6.1. Weekly

6.2.1. Clean tank at waterline in all areas by brushing and hosing.

6.2.2. Probe slots at bottom of settlement tank with a suitable pole, clear any obstructions.

6.2.3. Top up oil in blower gearcases. DO NOT OVERFILL, and be sure to use recommended grade of oil.

6.2.4. Change over duty and standby blowers.

6.2.5. Clean air filter on duty blower unit.

6.2.6. Carry out "30 minutes settlement test". This entails filling a 1 litre jar with aeration tank liquor and allowing this to settle for 30 minutes. The sludge will collect at the bottom of the jar and should occupy not more than 50% of the volume of the liquor. If more than 50% is recoded, see note (6) (5) (2) below, "desludging".

6.3. Monthly

6.3.1. Grease blower bearings in accordance with the manufacturer's instructions.

6.3.2. Change blower gearcase oil.

6.4. 6-Monthly

6.4.1. Lubricate electric motor bearings sparingly. Use same grade of grease as for blower bearings.

6.5./

6.5. As required

6.5.1. Air supply - If the appearance of the liquor in the plant is not as described in (6) (1) (2) or if there is any sign of offensive odours being produced, the air supply must be adjusted.

This is done by changing the pulleys on the drive shafts of the electric motors. The blower pulleys should not be changed. Larger pulleys give more air when fitted to the motors.

Simplified chart for guidance

	Sympton	Action
1.	Aeration tank grey or black	Increase air supply
2.	Offensive odour	
3.	Effluent cloudy	
1.	Aeration tank light brown	Decrease air supply
2.	No offensive odours	
3.	Effluent contains much suspended matter	

NOTE: In emergency, run both blowers together - never allow odour producing symptoms to persist under any circumstances or the condition of plant will become much worse.

6.5.2. Desludging - If the test described in (6) (2) (6) indicates that sludge must be removed from the plant, the procedure to be followed is described in the operating instruction manual.

NOTE: If the plant is working correctly, the sludge which is removed will be stable and inoffensive and may be disposed of on grassland, to sea, or by soakaway as dictated by local conditions.

Keith

MEMORANDUM

Nelson (0874) 5221
Telefacsimile (0874) 4588

WELSH WATER AUTHORITY
SOUTH EASTERN DIVISION
St. Johns Mount
Pendre
Brecon
Powys LD3 9EA

28th September 1988

To K. C. Houston - Area Controller Sewage.

From P. Thomson - Sewage Controller.

Our Reference ON/REC/26.27
Your Reference

Subject Elan Village STW.

Introduction:- The sewage treatment is provided by a SATEC package activated sludge plant commissioned in 1970. The oxygen for the aeration process is supplied by an air compressor delivering up to 30 cfm. There is a standby compressor.

The following information has been supplied by Satec Ltd.

Design capacity	–	150 persons (approx)
Maximum flow	–	5 m^3/hr.
	–	23.6 m^3/day
Loading (BOD)	–	8.1 kg/BOD/day
Clarifier loading	–	4 m^3/hr.
Compressor (each)	–	2HP 1.5 Kw.
	–	30 cfm air.

The resident population is small, approx 40 persons.

Public toilets are available in the village, but useage is uncertain. This could almost certainly be accomodated without difficulty if there were no other loading.

Police cadet camp: ≈ 80 persons per day of camp.

Outward Bound Centre – occupancy is not known but is likey to be of the order of 60 persons per day. This centre appears to be linked to blockages by paper towels affecting the works.

Elan Visitors Centre:- The reported attendance for 1987 was 80,000 and it is estimated that this will have increased to 100,000 plus

for 1988. It is also apparent that there is a high use of the toilets at the visitors centre which is open from Easter to end of October each year, approximately 210 days. ie. average of 400 to 500 visitors every day. The sewerage system at the visitors centre consists of :-

2 bottle type septic tanks in parallel, capacity 6.0 m^3 each, overflow to a wet well of capacity 1.0 m^3, pumping from wet well via 25mm alkathene main to gravity sewer pump is Mono G type, model GG 2Bar. - quotes pumping rate is 0.69 m^3 per hour for water at 935 rev/min.

The visitors centre also includes a snack bar/canteen type facility.

The present sewerage arrangements have given rise to smell complaints in both the vicinity of the visitors centre and in the village. The smell problem sounds as though it may be due to ammonia release in the village and general septic tank odours around the visitors centre.

Present Operation :-

The control of the air compressors is by manual selection of blowers combined with a simple timer clock. Thus one blower is run continuously and the second blower is controlled by the time clock. From about 6.00am to about 11.30pm the timer controlled compressor runs continuously, and it then runs for 30 minutes on and 30 minutes off. Monitoring by the treatment section has shown that during the night time period the dissolved oxygen can rise to nearly 50% but rapidly drops to 5% or less during the day (position for mid to late September 1988). During the peak summer months of June, July and August the position is worse with a maximum night time D.O. of approximately 30% rapidly dropping to 0% during the day. A positive D.O. may sometimes be achieved during the daytime.

The poor D.O. level is not helped by a low

output from one of the compressors. Problems have also been experienced with the surface skimmer becoming blocked (paper towels are a particular problem) but some modifications by Austin Morgan (fitter) appear to be helping in this respect.

Recommendations :-

1/ Dissolved oxygen level control is vital to prevent over aeration at night and to attempt to maintain at least 10% saturation during the day.

2/ The low output compressor (not the motor) to be replaced or overhauled so that maximum output (60 cfm) is obtainable.

3/ D.O. control of the compressors to be on a duty and assist basis so that operation of the compressors will vary from both compressors running continuously to one compressor running intermittantly.

4/ Visual display of mixed liquor dissolved oxygen level in the control cabinet is highly desirable in order to give operations staff some indication of how the plant is operating should problems arise. Recording of D.O. levels would be even better in this respect but may not be realistic for such a small works.

5/ All flows should receive either comminution/maceration or screening. Screening is the better option, particularly if automatic, but would present a disposal and handling problem. Comminution is therefore considered to be the preferred option.

6/ A simple balancing tank to produce some flow equalisation during the day is probably not feasible due to a lack of "head" between the incoming sewer and the plant inlet. However, a storm type balancing tank discharging to the plant should be practicable. Such a tank could be emptied automatically every night using an air lift pump, the standby compressor supplying the air or possibly even the duty compressor.

7. The sewerage facilities at the Elan Visitors Centre would appear to be rather inadequate for the number of visitors being received. However, it is also difficult to improve these facilities without incurring significant expenditure. Due to the severely restricted size of the wet well there appears to be little to be gained by overnight emptying of this chamber. However since a time clock to achieve this is cheap and it will achieve a small redistribution of the flow to the night-time period it is probably worth carrying out. N.B. The time switch must not alter the low level switching off of the pump as dry running very rapidly ruins the rotor of a Mono type pump. Greater benefit from overnight pumping would be achieved if the size of the wet well were to be increased to 3 or 4 cubic metres, but careful sealing and venting of the wet well would be necessary to avoid creating a smell nuisance due to the liquor becoming septic. The answer might be to have a small compressor to aerate the wet well for about 20 minutes every hour been 11·00am and 10·00pm. Overnight pumping should also eliminate the smell nuisance currently being experienced by residents in the village, particularly if the liquor has been kept aerated.

Rural Thomson.