EXTRACTION WELLS

1. **Well Flow.** A design flow of 1.5 cfm per foot of well depth was decided upon. During discussion, various flows of 1, 1.5, and 2 cfm per foot of well depth were considered. Normally, 1 cfm should be sufficient. This factor should be applied against total well pipe depth (i.e., the distance between the ground surface and the bottom of the well pipe). Since well depths vary between 30 and 45 ft, design flows will vary between 45 and 67.5 cfm per well.

2. **Well Head Vacuum.** A well head vacuum of 10 in. water column is to be delivered to each well. The system should be initially started up with valves half open. We believe that a well head vacuum of 5 in. water column should be sufficient to operate the system. The balance is a factor of safety.

3. **Radius of Influence.** Well spacing is 150 ft, and the required radius of influence is 75 ft or more. The radius of influence delivered by our design is believed to be a minimum of 100 ft.

EXTRACTION WELL HEADS

4. **Well Head Covers.** Plastic hand-holes from Associated Plastics (or similar) are to be used. These are to be as small as possible, but in any event slightly larger than the drill hole diameter of the extraction well. Hand-holes are to be mounted in concrete, and allowed to protrude about 6 in. above the surrounding grade.

5. **Well Caps.** The top of the well is to have a 4 in. diameter PVC cap greased (not cemented) into place. A single quick-connect fitting is to be placed through the well cap, to allow access to check for water accumulations, or access to check for vacuum.

6. **Well Laterals.** At the ground surface, a PVC tee at the well head shall lead to a 4 in. diameter PVC butterfly valve. Quick-
connect openings are to exist on each side of the butterfly valve, so as to allow access to check for vacuum on either side of the valve.

7. **Flexible Connectors.** After the valve, a length of flexible connection pipe is to feed from the area of the valve, to the 4 in. diameter PVC well lateral leading over to the header line.

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**HEADER LINES**

8. **Piping Material.** Polyethylene piping shall be used on all header lines (rather than PVC as has been used for the wells). This pipe will be SDR 17, 100 psi pressure rating.

9. **Minimum Depth.** Header lines are to be placed a minimum of 3 ft below the ground surface. Frost penetration depths in the area may be deeper than this, but this should be sufficient to prevent freezing, and to prevent breakage from passage of heavy vehicles over the ground surface.

10. **Slopes.** The header line will be placed largely in native soil, rather than refuse fill. Thus, somewhat lower minimum slopes are acceptable. Pipes shall slope a minimum of 2 percent when gas and condensate flow are in the same direction. Where the slope of the pipe is reversed from the gas flow direction, a 5 percent slope shall be used.

11. **Pipe Sizing.** Header line sizing is to be based on a 100 percent factor of safety above the design extraction flow for the wells. Thus, header line sizing shall assume 3 cfm per foot of well depth (i.e., twice the 1.5 cfm per foot of well depth assumed earlier).

12. **Vehicle Crossing.** No special sleeving for crossing of vehicles shall be required. At a 3 ft depth, this should be sufficient to protect the pipe from passage of vehicles above.

13. **Signage.** Signs, markers, and tape will be used to identify the presence of the subsurface header line.

14. **Pipeline Alignment.** Some discussions centered on potentially having to jog header line around a private property which juts into the landfill. Evidently, permission to access this property has been acquired. For our purposes, we will take the header line straight across that property, not jogging it into the landfill.

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**MOISTURE TRAPS**

15. **Trap Design.** The standard SCS Engineers design for moisture traps shall be used. This consists of a U-trap with a corrugated ADS drain field extension.
16. **Trap Clean-outs.** Both ends of the U-trap shall extend to the ground surface, to allow access to check for water level, and to remove any sediment or water accumulations as may be necessary.

17. **Drain Field Extension.** The length of the drain field extension will be a minimum of 10 ft. Percolation tests shall be performed (as was required on the two previous projects above) to determine the required length of the drain field extension. If poor percolation test results are obtained, the length of the drain field may need to be extended beyond the minimum 10 ft length.

18. **Piping Material.** ADS preslotted pipe shall be used for the drain field extension.

19. **Alignment of Drain Field.** The drain field extension shall run parallel to the header line. It shall be placed on the landfill side of the header line at that point.

20. **Moisture Trap Covers.** The moisture trap head shall be similar to the extraction well heads described previously. Plastic hand-holes available from Associated Plastics (or similar) shall be installed. These should be as small in size as possible, but ideally, one hand-hole could be used for both ground surface extensions of the U-trap.

21. **Moisture Trap Caps.** As for the extraction well heads, well head caps should be greased and fitted into place (not glued). Quick connect openings through the well cap should be installed to allow access for vacuum or water level depth checks.

**EXTRACTION BLOWER**

22. **Blower Specification.** The extraction blower should meet all requirements met by blowers on recent SCS landfill projects. Likely, this would entail the installation of Lamson blowers. These are explosion-proof and air-tight. They are fairly corrosion resistant as is, and it was decided not to treat them for special corrosion resistance (causes longer lead times).

23. **Blower Electrical.** Electrical supply will likely be three-phase, 277/480 volt. Transformer 277/480 to be put in

24. **Blower Sizing.** Two blowers are to be installed in parallel. Each of these shall be sized to handle the design flow. During operations, only one will be operated, with the other held in reserve for backup. Each blower shall be sized to allow a 50 percent factor of safety above the design criteria for the extraction wells.

One blower at a time - and alternate individual drawdown tests as part of system startup.
25. **Blower House Location.** The blower house is to be located on fill, atop the landfill hill, and away from any marshy areas. A heavy duty floating slab will be required as is typical for blower houses constructed above fill.

26. **Housing Construction.** The blower house is to be a wood structure, with a sloped shingle roof. The sides of the structure will be of opaque plastic to allow natural light to enter. Ventilating louvers shall be located at the top and bottom of the wells to maximize ventilation of the structure. The structure will not be heated.

27. **Explosion-Proofing.** Electrical components on the interior of the blower house will be explosion-proof. This would include the blower, overhead light, one or more electrical outlets, as well as any controls. Every attempt shall be made to move as much of the electrical system outside the blower house as possible.

28. **Fencing.** The entire blower house area will be encompassed with a chain link fence. The top of the fence should have barbed or razor wire. Wood slats will be inserted into the fence as a visual shield.

29. **Electrical Supply.** Electrical will be mounted on an electric pole outside the blower house, but within the fenced area. So as to avoid the need to explosion-proof these electrical components, it likely will have to be located a minimum of 25 ft from the blower house.

30. **Flame Arrestors.** Flame arrestors will be installed on both the inlet and outlet sides of the blowers.

31. **Instrumentation.** Controls and instrumentation in the blower house will generally consist of the following:
   - Vacuum and pressure gauges installed on both the inlet and outlet sides of the blower. These will be direct read-out gauges.
   - Amp gauges, thermosensors, and flow measurement devices will be provided in a weathertight electrical box away from the blowers.

   The above can be made part of the blower package delivered by Lamson. Some minor variations from the above may occur as a result.

32. **Alarm.** The alarm system is to be connected either to the amp meters, or to dedicated differential pressure indicators across each blower. Whenever the readings delivered by these instruments passes over or under a preset range, the alarm system will be activated. Tentatively this would consist of an automatic dialer to notify prespecified locations. This system would be activated under conditions of electrical outage, blower failure, and rupture or clogging of the header lines.
33. **Flare.** A candle-type flare such as those available from Varec or John Zink Company is recommended. Alternatively, an equivalent flare could be shop fabricated similar to these, but at less cost and delivery time. These would probably be available for about $5,000 to $10,000. Though less sophisticated than ground flare units, these latter systems cost about $50,000. We believe it appropriate to fine-tune the system and verify that the exhausted gas is of sufficient fuel content that it can be combusted, before specifying a more sophisticated/expensive combustion unit.

\[ 1400 - 2000 \text{°} \]

No flame-shrouded

- <10% suspected methane content
- 25-30% for sustaining this type of flame

Migration control 1st goal
Sustaining flame 2nd.

If <10% should not be an o&m problem

\[ 3-4 / \text{Btu lb} \]

lot of O-M work to operate blowers
one on, off = mechanical problems =
cost to putting time on blowers
+ timing for when to start operation.

Maybe time during daytime only.

1000 feet est. trench would be necessary.

Roger Hanas CEPH-agreement for O-M

Odor - can be used in L.H.

liq. to apply - cut down smell.