State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

January 17, 1995

Mr. Frank L. Gray III
Browning-Ferris Industries
8607 Roberts Drive, Suite 100
Atlanta, Georgia 30350

RE: Use Of Grundfos Rediflow Pumps For Ground-water Monitoring At Landfills In North Carolina

Dear Skeet,
The Solid Waste Section has evaluated BFI's request to use dedicated Grundfos Rediflow pumps for ground-water monitoring at the CMS Development Corp. Landfill V and the Sampson County Disposal Inc. Landfill. Use of these dedicated sampling devices is approved subject to the following conditions:

- The Grundfos Rediflow pumps must be constructed of inert materials (high grade stainless steel and Teflon). Teflon tubing must be used.

- The pumps must be properly installed and maintained.

- The pumps must be operated properly. The purge rates and sampling rates must be adjusted to provide representative ground-water samples. The flow rate for Volatile Organic Compound sampling shall be 100 ml/min.

The Solid Waste Section will amend the Design and Operation Plans for the two facilities referenced above to reflect these changes in the Water Quality Monitoring Plans. If you have any questions regarding this conditional approval of the use of dedicated Grundfos Rediflow pumps for ground-water monitoring at North Carolina landfills, please contact the Solid Waste Section at (919) 733-0692.

Sincerely, Bobby Lutfy

Bobby Lutfy, Hydrogeologist
Solid Waste Section

cc: Mark Poindexter, Ikie Guyton, Rick Doby
Kenn Cassell, Harold Watson, Bill Crumley

1.5 Well Purging and Sampling

Prior to well sampling, water levels will be measured from the top of PVC casing to calculate the amount of water within the well casing. The wells will be purged of stagnant well casing water. Three to five well casing volumes of water will be purged or to dryness. In addition, field measurements of pH, specific conductance turbidity and temperature will be recorded during purging to evaluate the removal of the stagnant water from the monitoring well.

Prior to the initial well sampling, the top of casing for each well will be surveyed relative to the site benchmark in order to calculate the elevation of the groundwater surface.

Prior to the well evacuation, the depth to the water table will be determined with the use of a cleaned electronic water level indicator. The water level will be measured by turning the instrument on and slowly lowering the instrument probe into the well until the water level indicator contacts the water and a buzzer alarm is activated. The distance from the measuring point of the well casing to the water level will then be measured and recorded. All measurements will be made and recorded at the nearest .01 foot.

The primary objectives during the collection of groundwater samples for analysis is to obtain a representative groundwater sample and to reduce the potential for alteration or contamination during sample withdrawal and sample preparation. Special procedures are often necessary for sampling monitoring wells based on their yield. For the purpose of this plan a high-yield well will be defined as a well that can be bailed or pumped with little drawdown of the water level. A moderate yield well can be drawn down; however, it cannot be evacuated to dryness. A low yield well can be evacuated to dryness and requires from a few hours to a day to fully recover. For low to moderate yield wells, a minimum of 1.5 well volume will be removed if evacuated to dryness and all wells will be sampled within 24 hours of purging.

The wells will be purged and sampled utilizing dedicated submersible pumps. The pumps to be used are the Grundfo's Rediflow pumps which are manufactured to accommodate a specific well depth and diameter. Once the pump is placed in the well, the well head is then capped with a fixed cap in order to allow connection by a controller which operates the pump for purging and sampling. The well cap is vented in order to equalize air pressures in and out of the well. Teflon tubing is connected to the well cap for sampling. Following sampling of each well the tubing is discarded.

Volatile organics sample collection is completed by setting the pump flow rate at 100 milliliters per minute (or less) and filling the collection containers until full. Samples will be handled in order to minimize aeration. For the volatile organic containers, no air bubbles will be allowed. Preservatives will be added as necessary (in accordance with EPA Method SW-846 protocol) to the sample bottles prior to sampling. Sample and project information will also be placed on the container labels prior to sampling. Care will be taken to prevent contacting the inside of the sample bottle and lid during sampling. After filling and capping, the sample bottles will then be securely placed into a precleaned cooler and a chain of custody form completed. The samples will be refrigerated until delivered to the laboratory. Finally, the well locking cap will be reattached and secured.

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SOUTH ATLANTIC REGION

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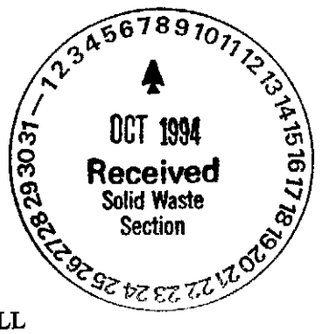
Frank (Skeet) L. Gray, III, P.E.
Engineering Manager

October 4, 1994

Mr. Bobby Lutfy
North Carolina Department of Environment, Health
and Natural Resources
Solid Waste Section
Post Office Box 27687
Raleigh, North Carolina 27611



RE: **CMS DEVELOPMENT CORP. - LANDFILL V**
SAMPSON COUNTY DISPOSAL INC. - SAMPSON COUNTY LANDFILL

Dear Bobby,

As we have discussed over the last several months, BFI is interested in amending our groundwater sampling procedures outlined in our Design and Operation Plans for the above referenced sites to include the use of the Grundfo's Rediflow pumps. After you have reviewed the previously submitted test data from **SAMPSON COUNTY LANDFILL** and the technical information which I sent you several weeks ago, I believe you will agree with this request. I have included as an attachment an amended **Well Sampling and Purging** plan as shown in both of our D & O plans for the sites. Also included is a copy of the pertinent section from the November 1992 **Technical Enforcement Guidance Document**, written by EPA, which concurs with the acceptance or use of submersible pumps.

If you have any questions please do not hesitate to call.

Sincerely,

Frank L. Gray III, P.E.

cc\Kenn Cassell, Sampson County Landfill
Harold Watson, CMS Landfill V

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RCRA GROUND-WATER MONITORING:

DRAFT TECHNICAL GUIDANCE

OFFICE OF SOLID WASTE
U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

NOVEMBER 1992

This document is distributed by the USEPA to update technical information contained in other sources of USEPA guidance, such as Chapter Eleven of SW-846 (Revision 0, September 1986) and the Technical Enforcement Guidance Document (TEGD).

GENERALIZED GROUND-WATER SAMPLING DEVICE MATRIX

	Device	Approximate Maximum Sample Depth	Minimum Well Diameter	Sample Delivery Rate or Volume†	GROUND-WATER PARAMETERS: INORGANIC: EC	pH	Redox	Major Ions	Trace metals	Nitrate Fluoride	Dissolved gases	GROUND-WATER PARAMETERS: ORGANIC: Non-volatile	Volatile	TOC	TOX	GROUND-WATER PARAMETERS: RADIOACTIVE: Radium	Gross alpha & beta	GROUND-WATER PARAMETERS: BIOLOGICAL: Coliform bacteria
PORTABLE SAMPLING DEVICES: SUCTION LIFT: GAS CONTACT	Open Bailer	no limit	1/2 in.	variable	●	□	□	●	●	●	□	●	□	□	□	●	□	●
	Pneumatic Bailer	no limit	1/2 in.	variable	●	●	●	●	●	□	□	●	□	●	□	●	□	●
	Syringe sampler	no limit	1 1/2 in.	0.01-0.2 gal	●	●	●	●	●	●	□	●	□	●	□	●	●	●
	Gas-drive	300 ft.	2 in.	0-0.5 gpm	●	●	●	●	●	●	●	●	●	●	■	●	●	□
	Bladder pump	400 ft.	1 1/2 in.	0-2 gpm	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Helical rotor	160 ft.	2 in.	0-1.2 gpm	●	●	●	●	●	●	●	●	●	●	●	●	●	□
	Piston pump (gas-drive)	600 ft.	1 1/2 in.	0-0.5 gpm	●	□	□	●	●	□	□	●	●	□	□	●	●	□
PORTABLE SAMPLING DEVICES: POSITIVE DISPLACEMENT (SUBMERSIBLE)	Centrifugal (surface)	variable	2 in.	variable	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Peristaltic	25 ft.	1/2 in.	0.01-0.3 gpm	●	□	□	●	●	●	□	●	□	●	●	●	□	●
PORTABLE SAMPLING DEVICES: GRAB	Glass-lift	variable	1 in.	variable	□	□	□	□	□	□	□	□	□	□	□	□	□	□
	Glass-drive	150 ft.	1 in.	0.2 gpm	●	□	□	□	□	□	□	□	□	□	□	□	□	□
IN SITU SAMPLING DEVICES‡	Pneumatic	no limit	no limit	0.01-0.13 gpm	●	●	●	●	●	●	□	●	□	□	□	●	●	●

* Sampling devices on this chart are divided into two categories: 1. portable devices for sampling existing monitoring wells, and 2. in situ monitoring devices (often multilevel) that are permanently installed. Sampling device construction materials (including tubing, lead lines, etc.) should be evaluated for suitability in analyzing specific ground-water parameters. It is assumed on this chart that existing monitoring wells are properly installed and constructed of materials suitable for detection of the parameters of interest.

† Sample delivery rates and volumes are average ranges based on typical field conditions. Actual delivery rates are a function of diameter of monitoring well, size and capacity of sampling device, hydrogeologic conditions, and depth to sampling point. For all devices, delivery rate should be carefully controlled to prevent aeration or degassing of the sample.

• Indicates device is generally suitable for application (assuming device is cleaned and operated properly and is constructed of suitable materials).

□ Indicates device may be unsuitable or is untested for application.

Source: Modified from Pettyjohn and Hass, 1989

Based on Literature Review

5569-28

TABLE 12

stainless steel cable. The tubes convey the gases to and from the pump; the electric cable powers the water level indicator, and a steel cable supports the downhole assembly. Flow rate can be controlled by adjusting the driving pressure to the pump. The piston pump provides continuous sample withdrawal at depths that are greater than most other devices. The pump can be constructed of materials that minimize the possibility of chemical alteration of the sample.

The bulk of associated equipment may reduce the portability of the pump. The valving mechanism may cause a series of pressure drops in the sample that could cause sample degassing and pH changes. The tubing bundles may be difficult to decontaminate between wells. The pump intake should be filtered so that particulate matter does not damage the pump's valving. A study by Yeskis et al. (1988) indicates that gas-drive piston pumps perform similarly to bladder pumps when collecting samples for volatile organics analysis.

7.3.2.4 Gear-Drive Electric Submersible Pumps

Gear-drive submersible pumps are designed to be portable and easily serviceable in the field. A gear-drive pump operates using a small high-efficiency electric motor that is located within the pump housing. The electric motor rotates a set of PTFE gears from an intake screen at the top of the pump. The water is drawn through the gears and driven to a discharge line that transports the water to the surface. The pumps have self-contained power sources, however, external sources may be used. Flow rates cannot be controlled on conventional gear-drive submersible pumps. Wells that have high levels of suspended solids may cause the gears to require frequent replacement.

7.3.2.5 Centrifugal Pumps *Redi Flo 2*

Centrifugal (also called impeller) pumps transport fluid by accelerating it radially outward. Specifically, a motor shaft rotates an impeller that is contained within a casing. Water that is directed into the center of the rotating impeller is picked up by the impeller vanes, accelerated by the rotation of the impeller, and discharged by centrifugal force into the casing. A collection chamber within the casing converts much of the kinetic energy into head or pressure. Certain submersible centrifugal pumps are constructed for ground-water monitoring purposes. These pumps are fabricated of stainless steel and PTFE, and can be adjusted to achieve flow rates as low as 0.1 L/min. Studies conducted by Gass et al. (1991) concluded that low flow-rate submersible centrifugal pumps can deliver "representative" ground-water samples. A study conducted by Paul and Puls (1992) comparing a low flow-rate submersible centrifugal pump, a bladder pump, and a peristaltic pump concluded that the low flow-rate submersible centrifugal pump produced the least negative impacts when trying to obtain representative and reproducible ground-water samples at the particular site and wells investigated. Research performed by Yeskis et al. (1988) indicates that submersible

impeller pumps perform similarly to bladder pumps when collecting samples for volatile organics analysis.

7.3.2.6 Peristaltic Pumps

A peristaltic pump (also called rotary peristaltic) is a low-volume pump that operates by suction lift. Plastic tubing is inserted around the pump rotor. Rotating rollers compress the tubing as the rollers revolve around the rotor, forcing fluid movement ahead and inducing suction behind each roller. As the rotor revolves, water is drawn into a sampling tube that has been inserted into the well, and discharged into the sample container. Peristaltic pumps often require the use of flexible silicone tubing, which is unsuitable for ground-water sampling purposes. The withdrawal rate of peristaltic pumps can be carefully regulated by adjusting the rotor head revolution. The use of a peristaltic pump is limited by the depth of sampling; the depth of sample collection is limited to situations where the potentiometric level is less than 25 feet below land surface (Herzog et al., 1991).

The Agency does not recommend the use of peristaltic pumps to sample ground water, particularly for volatile organic analytes. The method can cause sample mixing and oxidation resulting in degassing and loss of volatiles. Although Tai et al. (1991) indicated that peristaltic pumps may provide adequate recovery of volatile organic compounds, Imbrigiotta et al. (1988) concluded that for sampling volatile organic compounds, peristaltic pumps were inferior in comparison to other sampling devices. Imbrigiotta et al. attributed the poor performance of the peristaltic pump to degassing of volatile contaminants into the vacuum created by the pump. Puls and Barcelona (1989a) and Puls and Barcelona (1989b) indicated that vacuum pumps such as peristaltic pumps may significantly alter ground-water chemistry leading to colloid formation in the monitoring well.

7.3.2.7 Gas-Lift Pumps

An air- or gas-lift pump allows collection of ground-water samples by bubbling air or gas at depth in the well. Sample transport occurs primarily as a result of the reduced specific gravity of the water being lifted to the surface. Water is forced up a discharge pipe, which may be the outer casing or a smaller diameter pipe inserted into the well. The considerable pressures required for deep sampling can result in significant redox and pH changes. Gas-lift pumps should not be used for any purpose in ground-water investigations.

7.3.2.8 Gas-Drive Pumps

Gas drive (gas displacement) pumps are distinguished from gas-lift pumps by their method of sample transport. Gas-drive pumps force a column of water under linear flow conditions to the surface without extensive mixing of the pressurized gas and water. A vacuum also can be used to assist the gas. The disadvantages of a gas drive pump are that the drive gas comes into contact with the water and therefore, can be a source of

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S. A. Region
S. Co. — 919-525-4150
CMS. — 704-782-2177
Fax No: _____

From: Mark A. Allendorf
GROUND WATER SERVICES

Re: Submersible Pump Information

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IMPORTANT

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of EPA Atlanta

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Message Grundfos Rediflow
Submersible Pumps

O.K. to try

Signed

(also 2L standards ... ?)

N.C. Dept. of Environment, Health, and Natural Resources

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