

3

Item SWM-21-83

A Cartridge and Syringe Method for Down-hole Sampling
for Trace Organic Compounds in Groundwater

James F. Pankow and Lorne M. Isabelle

Department of Environmental Science
Oregon Graduate Center
19600 N.W. Walker Rd.
Beaverton, Oregon 97006

and

Janet P. Hewetson and John A. Cherry

Department of Earth Sciences
University of Waterloo
Waterloo, Ontario
N2L 3G1

For Submission to Ground Water

August, 1983

DRAFT

the laboratory or one of the authors (JFP) to determine these efficiencies.

Regardless of whether or not Tenax-GC proves to be the aqueous ATD sorbent of choice for all compounds of interest, the ATD method in general is attractive for certain groundwater sampling situations. This is the case because it is both sensitive and easily adaptable to down-hole sampling procedures. The sensitivity of the method arises from the fact that 100% of the sorbed organics are transferred to the GC column. Within the limits posed by breakthrough losses (Pankow, Rosen and Wojcik, 1983), the mass amount of analyte sorbed can be increased by increasing the volume sampled. The adaptability of ATD to down-hole sampling is due to the fact that the cartridge alone and not the actual water sample is returned to the laboratory. Therefore, it is not necessary to bring a sample to the surface and risk volatilization losses: passage of the sample through the cartridge can occur down-hole.

2 The ATD-based down-hole sampling technique discussed here was developed in response to a need to obtain reliable measurements of trace organic contaminant levels in groundwater down-gradient of the Bayview Park Landfill in Burlington, Ontario. This 18 hectare landfill (Figure 1) began to receive waste from the City of Burlington in 1960. It was closed and covered over with earth in 1970. It is situated on the edge of the Niagara Escarpment where bedrock is either exposed at the surface, or covered by a thin veneer of clay till. The bedrock is fractured, red Paleozoic shale of the Queenston Formation which extends to depths of over 100 m.

Groundwater movement is to the southeast and towards Lake Ontario (3.5

Pg. 12

2.1 miles

See "Map 2 - Property Ownership"

of Dillon Draft report "Burlington Landfill Site
Proposed Continued Use", Feb. 1984

(Region application to MoE)

km away). It flows in the fractured shale along the slope of the escarpment which corresponds to the regional slope in the water table. Down-gradient of the landfill there is a 1 km long expanse of land that is partly forested and is unoccupied. The land surface further down-gradient is characterized by industrial and urban areas of the City of Burlington which extend to the shore of Lake Ontario.

(2)
Cont'd

The fact that the Bayview Park Landfill is situated on fractured shale makes it particularly interesting. This is the case because many groundwater systems that are receiving waste materials or have received them in previous years are fractured in a manner which makes them quite permeable to groundwater and solute transport. For example, fractured shale of the Queenston formation also exists within the stratigraphic sequence at landfill and hazardous waste disposal sites in the Niagara Falls area where leakage of contaminants through the shale and other formations is of concern. Furthermore, compared to porous media where much information exists on the theory of contaminant migration (Bear, 1972; Fried, 1975; Freeze and Cherry, 1979) and on behavior at field sites (e.g. MacFarlane, 1983; Cherry et al., 1983a; Egboka et al., 1983, Sudicky et al., 1983; Dance et al., 1983; Nicholson et al., 1983; and Greenhouse and Harris, 1983), contamination migration in fractured systems is relatively poorly understood.

Initial attempts at the Bayview Park Landfill by Cherry et al. (1983b) and Hewetson and Cherry (1983) to delineate a zone of contamination on the basis of inorganic parameters (major ions, transition metals and heavy metals) and organic indicator parameters (dissolved organic carbon (DOC), chemical oxygen demand (COD), phenols, and organic nitrogen) were unsuccessful due to the naturally high levels of these parameters: typical chloride and DOC concentrations in the area of the site are 12,500 and 500 mg/L, respectively. It was hoped that: 1) the ATD method with detection by mass

BAYVIEW PARK
(closed landfill)

KING ROAD

AZOVA
INVESTMENTS LIMITED

NATIONAL SEWER PIPE

NORTH SERVICE ROAD

ONTARIO HYDRO

CLOSED



SOLID WASTE MANAGEMENT
COMMITTEE

DATE OF MEETING:

Friday, September 9, 1983.

PLACE OF MEETING:

Committee Room 2, Eighth Floor
at 9:00 a.m.

AGENDA

MATTERS FOR CONSIDERATION:

SWM-20-83 Correspondence dated August 29, 1983 from D. Perlin, Regional C.A.O. submitting an update from Dr. Cherry re: the University of Waterloo Research Project - Hydrogeological Investigations; Bayview Park Existing Regional Landfill and Proposed N.S.P. Landfill site.
File: 75.01-1

SWM-21-83 Correspondence dated August 29, 1983 from D. Perlin, Regional C.A.O. submitting a further report from Dr. Cherry, being a draft copy of a paper for a scientific journal (Ground Water).
File: 75.01-1

SWM-22-83 C.A.O. Report 63/83 - Municipal solid waste source separation and recycling financing scheme and sale of 3100 Guelph Line to Halton Recycled Resources.

Note: Report will be delivered on Wednesday, September 7th by courier.

NOTE:

1. Copies of the Halton Environmental Assessment Phase 2 - Stage 2A General Overview Analysis - Final Evaluation Report were delivered to the Clerk's Department by the Region on August 30th and copies were forwarded to members of the Committee.
2. At the September 23rd Solid Waste Management Committee meeting, Dr. J.A. Cherry will appear as a delegation.

ADJOURNMENT:

Item SWM-20-83
University of Waterloo

RECEIVED

A.M. _____ P.M. _____

JUL 1 1983

CHIEF ADMINISTRATOR
REGIONAL MUNICIPALITY
OF HALTON



Waterloo, Ontario, Canada
N2L 3G1

Faculty of Science
Department of Earth Sciences
519/885-1211

July 4, 1983

Mr. Dennis Y. Perlin,
Chief Administrative Officer,
The Regional Municipality of Halton,
P.O. Box 700,
1151 Bronte Road,
Oakville, Ontario.
L6J 6E1

Dear Mr. Perlin:

During February and March we collected water samples from thirteen of the Morrison and Beatty piezometers at the Bayview Park landfill. These samples were sent to the Department of Environmental Chemistry at the Oregon Graduate Center where they were analysed in May and June for concentrations of organic compounds. Because the groundwater from the fractured shale at the site has a complex chemistry with high concentrations of natural dissolved organic matter, it was necessary to have the analyses done by sophisticated methods i.e. combined mass spectrometry and gas chromatography.

We received the results of these analyses a week ago. More than seventy organic compounds were identified in the samples. The compounds that are of most interest to us are those that are diagnostic of landfill contamination rather than those that can occur naturally in the shale as well as in landfill leachate. We are primarily interested in the diagnostic compounds because they will provide a means of mapping the zone of leachate-influenced groundwater at the site.

Several diagnostic compounds have been identified in the groundwater. These compounds are common chlorinated hydrocarbons produced by the chemical industry. A summary of the results pertaining to three of these compounds is provided in a table included with this letter.

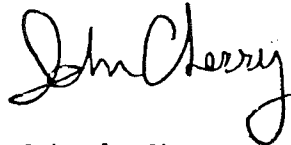
① (The results indicate that a zone of leachate influence extends from the landfill at least to piezometer nest OW12 and that the zone of influence extends to the deepest piezometers in the nests that were sampled. Of the various nests that were sampled, OW12 is the farthest from the landfill.

Therefore, we do not know how far beyond OW12 the zone of influence extends. These results are not unexpected because the tritium data and the hydraulic conductivity data included in our April progress report suggested that the groundwater flow system in the fractured shale is moderately active.)) (1) catid

The chlorinated hydrocarbons can be used to identify groundwater that has been influenced by the landfill, but regardless of their presence or absence, the conclusion reached in earlier studies, which is that the natural groundwater as well as the leachate-influenced groundwater in general have poor quality and are unsuitable for human consumption is valid. At present we do not have sufficient data to predict the fate of the chlorinated hydrocarbons in the hydrologic system.

The \$20,000.00 drilling budget that you arranged for us to have access to was consumed during our drilling in the summer and fall of 1982. Our Lottery Fund Grant expired in April, 1983. We have not received word regarding the fate of the Lottery Fund proposal that we submitted in March, 1983. We are continuing our studies of contaminant migration at the site but at a low level of activity supported only by a small NSERC grant. We do not expect to be reporting any significant new information in 1983. If we receive the funds requested in our Lottery Fund proposal, we will be able to do additional sampling and analyses at an earlier date than would otherwise be the case.

Yours sincerely,



John A. Cherry,
Professor.

JAC/msb