Good Report Received Sept. 6th 83.

CITY OF BURLINGTON

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:

MC/mbg
0823b

Item SWM-20-83

THE REGIONAL MUNICIPALITY OF HALTON

P.O. BOX 7000
1151 BRONTE ROAD
OAKVILLE, ONTARIO L6J 6E1
416/827-2151

OFFICE OF THE CHIEF ADMINISTRATIVE OFFICER

1983 08 29

The City of Burlington
426 Brant Street
BURLINGTON, Ontario

Attn: Mr. Michael Boggs
Chief Administrative Officer

Dear Sir:

Re: University of Waterloo Research Project - Hydrogeological Investigations: Bayview Park Existing Regional Landfill and Proposed N.S.P. Landfill Site

I have now received a further Update from Dr. Cherry of the University of Waterloo updating the situation and indicating in his opinion the desirability to continue to gather further information by way of obtaining funds from the Lottery Fund.

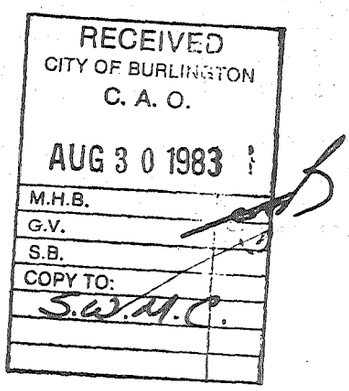
If you have any questions, please feel free to call me.

Yours very truly,

Dennis Y. Perlin
Chief Administrative Officer

DYP*pm

cc: R. Mohammed
R. Moore



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) cont'd

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 Cherry

JAC/msb

John A. Cherry,
Professor.

Item SWM-21-83

THE REGIONAL MUNICIPALITY OF HALTON

OFFICE OF THE CHIEF ADMINISTRATIVE OFFICER

P.O. BOX 7000
1151 BRONTE ROAD
OAKVILLE, ONTARIO L6J 6E1
416/827-2151

1983 08 29

The City of Burlington
426 Brant Street
BURLINGTON, Ontario

Attn: Mr. Michael Boggs
Chief Administrative Officer

Dear Sir:

Re: University of Waterloo Research Project - Hydrogeological Investigations: Bayview Park Existing Regional Landfill and Proposed N.S.P. Landfill Site

Enclosed please find a copy of a further Report from the University of Waterloo on the above noted Research Project with the covering letter dated August 23rd, 1983 from Dr. Cherry.

(See p. 7)

This material is submitted to you as in the past for your information.

You will note that Dr. Cherry is very optimistic about the Lottery Fund approving the Fall Sampling Program which he believes should be done and that he is seeking an indication from the City as well as from the Region and National Sewer Pipe that they would be prepared to contribute a few more dollars to the drilling of a few more boreholes.

In discussions with Dr. Cherry, if that circumstance occurred, the cost would be approximately $3,500. per borehole. Dr. Cherry indicates that he can foresee a need for perhaps three - six boreholes; his Lottery Fund funding, he would expect, would provide money for one, thus we should be expecting to receive a request or a contribution for two - five boreholes at a total cost of around $18,000. to be shared three ways.

I would ask you to give some thought to making a further contribution and letting me know so that I would be in a position to indicate to Dr. Cherry once he has his Lottery Fund contribution secured, that I will be in a position to help out in the further research.

Item SWM-21-93

University of Waterloo

Waterloo, Ontario, Canada
N2L 3G1

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

(See p.5)

August 23, 1984 1983

Mr. Dennis Y. Perlin,
Chief Administrative Officer,
The Regional Municipality of Halton,
P.O. Box 7000,
1151 Bronte Road,
Oakville, Ontario.
L6J 6E1

Dear Mr. Perlin:

Please find enclosed a draft copy of a paper that we intend in September to submit to a scientific journal (Ground Water) for publication. It is a draft, however I expect that the final manuscript will not be significantly different than this draft. When the editor of Ground Water receives the manuscript, he will send it to two persons that he will select for peer review. This will take a few months. When we receive the review comments, we will make revisions and then, if all goes well, it will be published.

When we make the final revisions, we would take into consideration any comments that we receive from the parties that receive copies of this draft through distribution from your office. This paper contains the data that I sent to you a couple of months ago.

No new data have been acquired in recent months, although work by our students and technicians has been going on at the Bayview site. This work represents preparatory efforts towards a major program of sampling that we intend to conduct in September or October when we receive a grant from the Lottery Fund.

The purpose of the fall sampling program will be to analyse many groundwater samples for concentrations of the diagnostic chlorinated organic compounds that were identified in the results reported on in the enclosed manuscript. The analyses will be done at the Oregon Graduate Center through a cooperative research program that is in effect for 1983-84. I expect that analytical results from this sampling will be available by early 1984. I think that it is quite possible that the results will indicate that there exists a large zone of contaminated groundwater in the shale at the Bayview site. By contamination, I am referring to groundwater that contains above-background level (i.e. above blank levels) of chlorinated organic

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.
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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

Item SWM-21-83

INTRODUCTION

The number of groundwater systems which are recognized as having become contaminated with trace organic compounds is steadily increasing. In many cases, the compounds of interest are relatively volatile, often being members of the list of "purgeable" U.S. Environmental Protection Agency (EPA) priority pollutants (Keith and Telliard, 1979). Such compounds are usually present in groundwaters at low levels (ng/L (ppt) to mg/L (ppm)). Their typically low concentrations as well as their high volatilities places stringent requirements upon the sampling and analytical method(s) selected for groundwater monitoring programs.

When attempting to obtain a sample for analysis by a method such as purge and trap (Bellar and Lichtenberg, 1975), many of the procedures used to bring samples of groundwater to the surface can lead to the formation of bubbles and/or the exposure of the sample to a headspace. The volatilization losses which may then occur can cause artifacts. Landfill leachates high in methane and carbon dioxide are particularly troublesome in this regard. A possible means of circumventing this volatilization loss problem is provided by the adsorption/thermal desorption (ATD) method developed for water samples by Pankow et al. (1982a, 1982b, 1982c, 1983), and for air samples by Zlatkis et al. (1973) and Pellizzari (1975a, 1975b).

Aqueous ATD involves the: 1) passage of a water sample through a pre-prepared cartridge of sorbent material (e.g., Tenax-GC); 2) drying of the cartridge; 3) thermal desorption of the cartridge to a fused silica capillary gas chromatography (GC) column at approximately -80 C; and 4) a temperature program GC run with some type of detector. Tenax-GC is an attractive sorbent for this type of work since it is very thermally stable. Its possible use for water sampling was first considered by Bertsch et al. (1975). Although this sorbent has been shown to be effective in trapping

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

selected so that the flow rate through the cartridge would not exceed 0.1 mL/s with a total pressure differential of 1 atmosphere (10.3 m of water column) across the cartridge/needle system. The flow rate of 0.1 mL/s was selected based on the dimensions of the cartridge and the recommendations of Pankow et al. (1982b). For piezometers which had more than 10 m of water column above the desired sampling interval, additional flow restriction was achieved by placing a 3.25 cm long pre-cleaned section of 0.15 mm O.D. piano wire inside of the needles of the cartridges. Cartridges were prepared in sets, one blank cartridge to a set.

Prior to shipment to the field, each entire cartridge system was evacuated, then forcibly wetted by releasing the vacuum with water which had been pre-cleaned by: 1) passage through an activated carbon bed; and 2) boiling with simultaneous sparging with nitrogen which had been pre-cleaned by passage through a molecular sieve trap in liquid nitrogen. The Luer hub was then sealed with a Teflon plug, and the entire cartridge system stored in a muffle-furnaced Pyrex culture tube with a Teflon cap liner. The cartridges were prepared in groups so that each group contained one blank cartridge. After preparation, all of the cartridges were shipped (together with the down-hole syringe sampling devices to be described below) via overnight air courier from OGC to U. Waterloo.

Syringe Sampling Device.

The syringe sampler (Figure 2) was a glass and Teflon version modelled after a similar polyethylene and rubber device developed by Gilham (1982) for sampling for inorganic constituents in groundwater. Concerns about contamination and losses associated with polyethylene and rubber led to their replacement. Glass syringes with a 50 mL capacity and Luer-lock fittings were obtained from Popper and Sons (New Hyde Park, NY). The top

pulling a vacuum on the tubing to allow sample to pass through the cartridge and into the syringe; 6) bringing the device to the surface; and 7) removing the cartridge, resealing it with the Swagelok endcap and Teflon Luer plug, and replacing it in the culture tube for air courier shipment back to OGC. It should be noted that the low pressure portion of the sampler occurred in the exit end of the cartridge. In this manner, the needle served to control the flow rate as well as eliminate degassing prior to or in the cartridge. At the point in time during which cartridges from a given set were used in sampling, the endcaps on the blank cartridge from that set were removed, the cartridge thereby opened to the atmosphere. The blank cartridge was then immediately closed again, and returned to its culture tube for shipment.

For the 3.2 cm I.D. PVC casings, it was not possible to sample down-hole. Approximately 1 L of groundwater was brought to the surface with a stainless steel bailer previously rinsed with methanol and sample water. The sample was then transferred to a glass erlenmeyer flask. The syringe and cartridge were prepared and assembled as described above. The cartridge was then partially submerged. A vacuum was then applied with the pump to allow sample to be pulled through the cartridge. Further handling of the cartridge proceeded as described above for down-hole sampling.

Cartridge Desiccation, Desorption, and Analysis

Upon arrival at OGC, each cartridge was dried according to a two-step centrifugation/vaccuum desiccation method. This desiccation does not cause losses for the analytes of interest. The cartridges were then resealed and refrigerated for a maximum of two weeks before desorption and analysis occurred. The desorption procedure began with the addition of 2.0 uL of a standard solution in methanol (containing 10 ng/uL each of toluene-d8 and 2-

peak area quantitation of toluene-d8 and 2-bromo-m-xylene were 98 and 184, respectively. The 26 target analytes which were specifically sought in the samples (and the ions used for peak area quantitation) included: 1,1-dichloroethene (61), dichloromethane (84), trans-1,2-dichloroethene (61), 1,1-dichloroethane (63), chloroform (83), 1,1,1-trichloroethane (97), 1,2-dichloroethane (98), tetrachloromethane (carbon tetrachloride) (117), benzene (78), 1,2-dichloropropane (63), trichloroethene (trichloroethylene) (130), bromodichloromethane (83), trans-1,3-dichloropropene (75), toluene (91), cis-1,3-dichloropropene (75), 1,1,2-trichloroethane (83), dibromochloromethane (129), tetrachloroethene (129), chlorobenzene (112), ethylbenzene (91), bromoform (171), 1,1,2,2-tetrachloroethane 83), 1,3-dichlorobenzene (meta-dichlorobenzene) (146), 1,4-dichlorobenzene (para-dichlorobenzene) (146), 1,2-dichlorobenzene (ortho-dichlorobenzene) (146), and hexachloroethane (117).

The identification of the compounds in a sample data file was carried out by manual means to avoid misassignments. To this end, the system software was first used to plot the extracted ion current profiles (EICPs "ion chromatograms", or "mass chromatograms") for up to seven characteristic ions of each target compound in a narrow (+/- 25 s) window. The center of the window was predicted on the basis of the predetermined RRT of the compound and the observed internal standard RT. An identification was considered to be confirmed if: 1) the EICPs all maximized within +/- 1 s of each other, and very near to the predicted RT; and 2) the intensities of all of the plots relative to the most intense EICP were within +/- 20% of those observed in a standard run which had been carried out within 6 h of the sample run under consideration. Computer matching of the background-subtracted spectrum at the peak maximum was used to further confirm the assignment.

Although it is known that the value of the relative standard deviation (coefficient of variation, or CV) for the concentration of an analyte as given by an analytical method is a function of the concentration of the analyte (Glaser et al., 1981), we will assume that to a first approximation it is independent of concentration for these analyses. This assumption allows one to pool replicate data and obtain estimates of the CV (Davies and Goldsmith, 1972). The data sets which were included in this pooling process, marked with an asterisk in Table I, were limited to those piezometers for which the concentrations were substantially above blank levels. The blank values (calculated by dividing the ug amounts of each compound found on a blank cartridge by smallest sample volume employed = 0.050 L) were not subtracted from the data prior to the calculation of individual standard deviations. The pooled CV were therefore observed to be 25., 6.9, and 6.3% for 1,1,1-trichloroethane, chlorobenzene, and para-dichlorobenzene, respectively.

In view of its substantially higher volatility, it is not surprising that the 1,1,1-trichloroethane data should exhibit the highest CV. If the surface samples are excluded from the calculation of the pooled CV for this compound, the result is 23% rather than 24%. There are too few data points to allow a statistical distinction to be made between those samples which could be obtained down-hole and those which had to be obtained at the surface. Some of the variability may reside in errors associated with the cartridge handling and analysis which occurred after the sampling.

The average blank values for 1,1,1-trichloroethane, chlorobenzene, and para-dichlorobenzene were 0.30, 0.38, and 0.011 ug/L, respectively. A blank cartridge prepared by exposing it to a section of the type of O-ring used in the syringe device showed no contamination from these compounds. It is

number of water column volumes that should be removed from a well or piezometer before sampling can occur. Since most pumping methods cause the mixing of fresh formation water with water which previously existed in the water column, it is generally desirable to pump considerably more than one column volume when sampling permeable formations. Down-hole sampling techniques such as those described in this paper have the advantage of allowing the sampler to be placed near the bottom of the piezometer when the pump is operating near the top of the water column. While the low permeability of the shale at the Bayview Park Landfill prevented the use of this configuration in this study, its application in higher permeability formations would allow the sample to represent new formation water even when a only small total volume is removed from the water column.

While the same water could be sampled conventionally by placing a pump at the piezometer tip, losses by adsorption and volatilization may be problematic as the sample rises in the tube leading to the surface. The use of a conventional bailer equipped with a one-way valve may eliminate the sorption loss problem, but volatilization at the surface remains a source of uncertainty. If a pump/tube assembly or a bailer is not dedicated to each piezometer, a process which involves additional expense, cross-contamination may also occur.

Disadvantages associated with the cartridge down-hole sampling technique as developed here with the sorbent Tenax-GC are: 1) the cost in labor time in preparing the cartridges as compared to cleaning glass sample vessels; and 2) the potential for less than quantitative sorption for very volatile compounds such as 1,1,1-trichloroethane. For many sampling applications, the many advantages of the technique outweigh the cost of preparation. Furthermore, it is likely that the first problem will be reduced in the

ACKNOWLEDGEMENTS

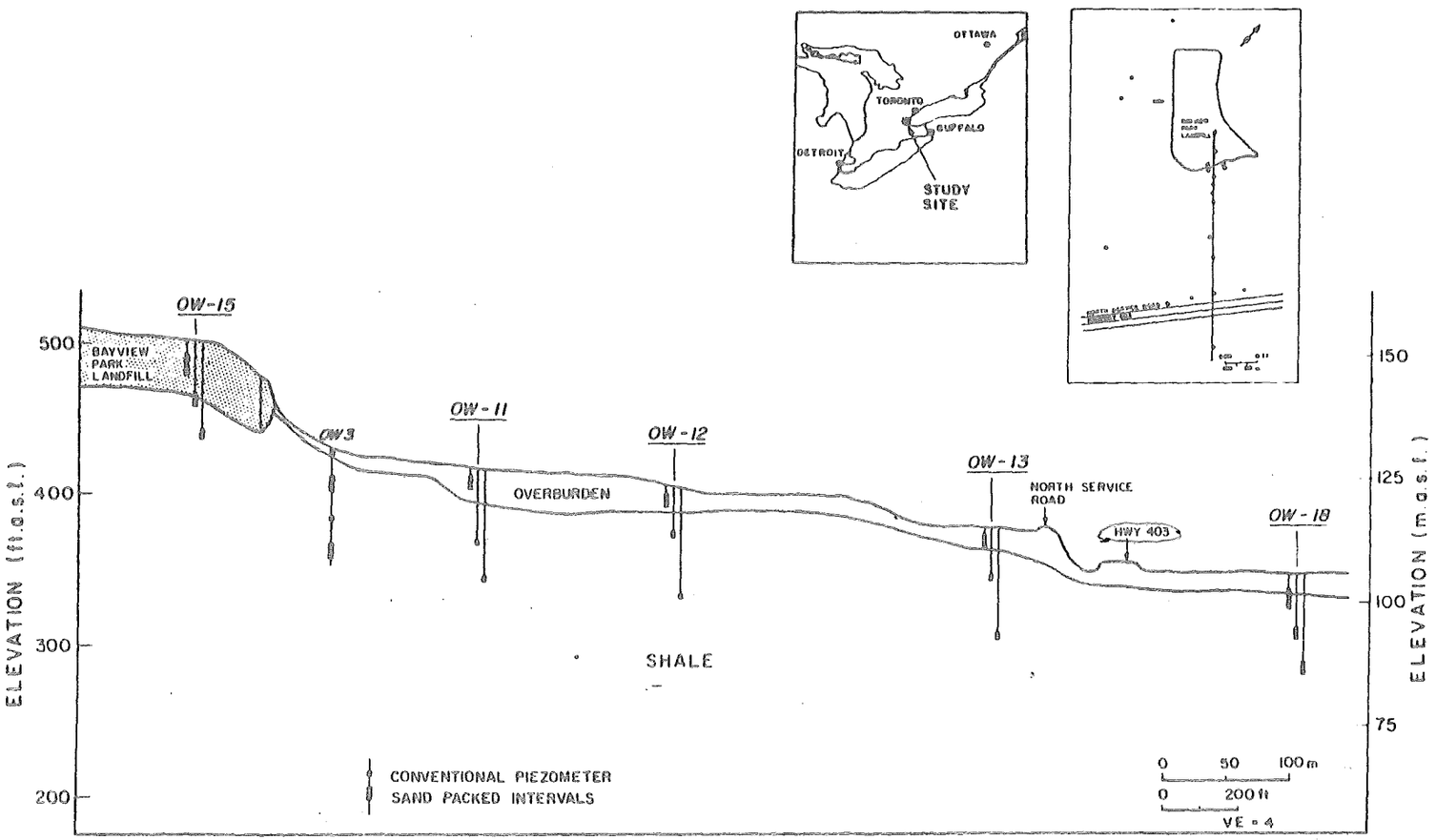
Funds for the development of the sampling technique and its application at the Bayview Park Landfill were obtained from grants provided by the National Science and Engineering Research Council of Canada. We gratefully acknowledge the permission to conduct research at the site provided by The City of Burlington, Ontario and by National Sewer Pipe Ltd., owners of the land in the vicinity of the landfill. Assistance with equipment preparation and field sampling by Toni J. Kristensen and Paul E. Johnson is also gratefully acknowledged.

Item SWM-21-83

Table I. Concentrations of selected organic compounds in ug/L (ppb) in Bayview Park Landfill samples from OW sample well series. Volume sampled data are given in mL.

Well	Slotted Depth (m)	Cartridge Number	Volume Sampled	1,1,1-Trichloroethane	Chloro-benzene	Para-dichlorobenzene
OW 15-3 down-hole	27.7	419	50	* 35.	* 3.4	* 0.37
		421	50	38.	2.9	0.35
	Blank	409	-0-	0.17	0.89	0.041
OW 1-2 down-hole	8.2	402	56	* 0.30	* 11.	* 1.8
		404	58	0.41	12.	2.0
	Blank	409	-0-	0.17	0.89	0.041
OW 1-4 down-hole	8.0	570	65	* 25.	0.080	0.003
		580	60	13.	0.051	ND
	Blank	640	-0-	0.18	0.042	0.001
OW 3-2 surface	7.3	415	54	* 0.94	* 8.0	* 1.5
		416	50	1.6	8.3	1.6
	Blank	418	-0-	0.40	0.91	0.011
OW 3-3 down-hole	14.3	411	54	* 7.6	0.90	0.013
		412	56	11.	0.74	0.011
		413	57	8.4	0.72	0.008
	Blank	418	-0-	0.40	0.91	0.011
OW 3-4 surface	21.0	559	54	* 48.	0.19	ND
		560	50	30.	0.16	ND
	Blank	640	-0-	0.18	0.042	0.001
OW 11-1 down-hole	3.0	554	60	0.24	* 2.8	* 0.52
		555	105	0.12	2.9	0.57
	Blank	505	-0-	0.25	0.029	ND
OW 11-2 down-hole	14.8	552	62	* 1.4	0.025	0.001
		553	68	2.0	0.026	ND
	Blank	505	-0-	0.25	0.029	ND
OW 11-3 down-hole	22.4	591	61	* 5.7	0.044	0.005
		593	188	6.1	0.027	0.009
		596	58	7.7	0.050	0.007
	Blank	505	-0-	0.25	0.029	ND
OW 12-3 down-hole	19.4	558	56	* 11.	* 0.84	* 0.051
		600	46	9.3	0.75	0.057
	Blank	505	-0-	0.25	0.029	ND
OW 5 surface	7.6	650	50	0.50	0.053	ND
		680	50	0.53	0.051	0.002
	Blank	780	-0-	0.50	0.045	0.001
Average concentration on * data sets:				14.	5.3	0.88
Average blank level (ug/L):				0.30	0.38	0.011
CV based on pooling of * data sets:				25.%	6.9%	6.3%

Item Sum-21-83



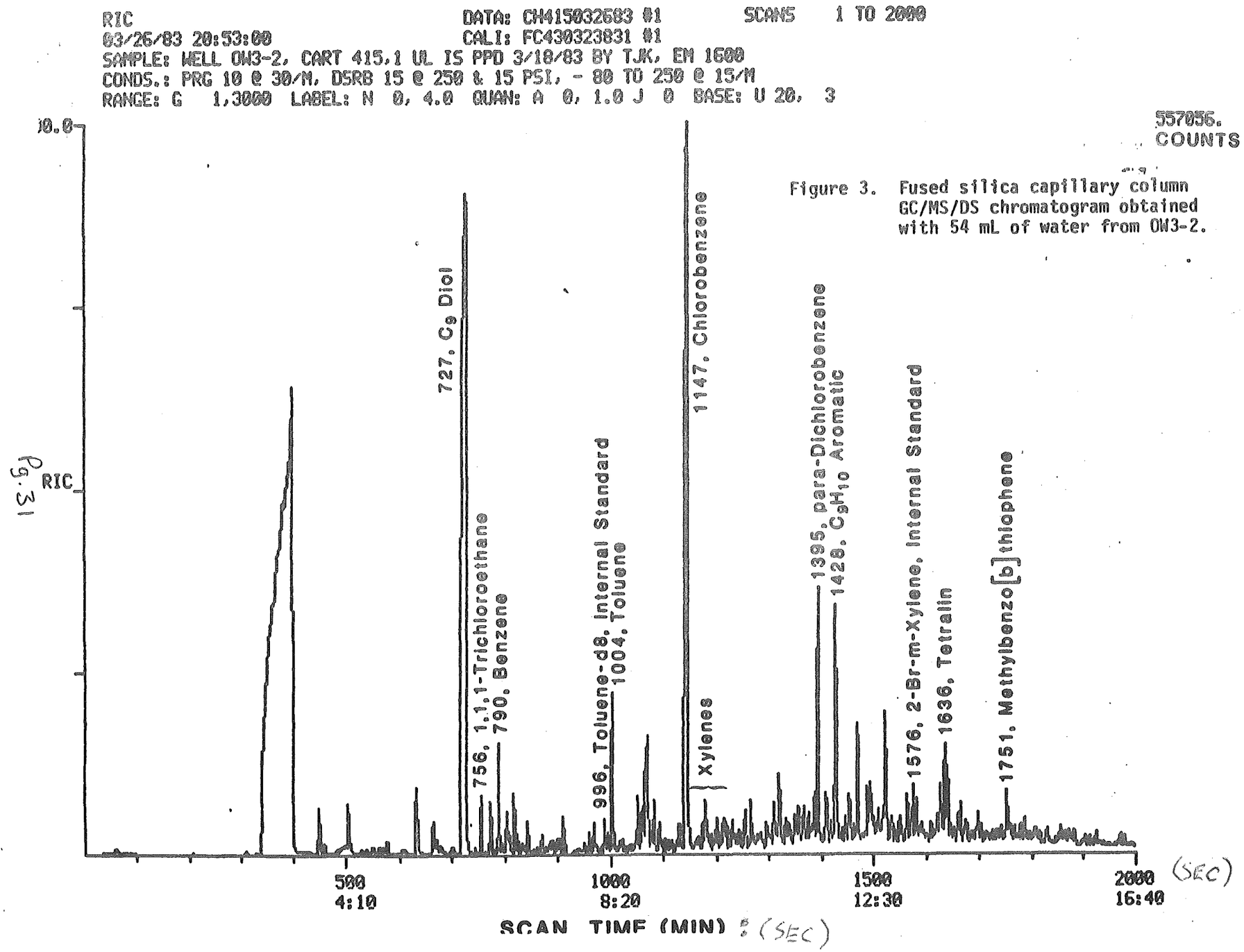


Figure 3. Fused silica capillary column GC/MS/DS chromatogram obtained with 54 mL of water from OW3-2.

Pg. 31

Items WM-21-83

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