Environment Canada | Environnement Canada
Regional Director General | Directeur général régional
Ontario Region | Région de l'Ontario

55 St. Clair Ave. E.
7th Floor
Toronto, Ontario
M4T 1M2

March 10, 1982

Ms. Barbara Morrison, Esq.
and
Ms. Toby Vigod
Barrister & Solicitor
c/o Canadian Environmental Law Association
8 York Street
Toronto, Ontario
M5J 1R2

Dear Ms. Vigod:

In answer to your request of March 2, 1982 for technical assistance in appraising hydrogeological and analytical documents regarding the Hyde Park landfill, I enclose the following two reports prepared by DOE scientists. If further discussion is necessary, please contact Mr. K. Shikaze regarding the hydrogeological documents or Dr. D. Hallett regarding the analytical documents.

Yours sincerely,

H.L. Ferguson
A/Regional Director General
Ontario Region

Encls.

DH:ek

Government of Canada / Gouvernement du Canada

MEMORANDUM NOTE DE SERVICE

TO / À: H.L. Ferguson
A/Regional Director General
Ontario Region

FROM / DE: D. Hallett
Scientific Advisor
Ontario Region

SECURITY - CLASSIFICATION - DE SÉCURITÉ:

OUR FILE/NOTRE RÉFÉRENCE:

YOUR FILE/VOTRE RÉFÉRENCE:

DATE: March 12, 1982

SUBJECT / OBJET: Evaluation of Hyde Park Landfill Recent Chemical Testing Data Submitted by U.S. EPA to the Honourable John T. Curtin

It is my understanding that the Canadian Environmental Law Association requested a scientific evaluation of sampling analyses performed by West Coast Technical Services Inc. (WCTS) for the U.S. Environmental Protection Agency, recently submitted to the Honourable John T. Curtin in the Hyde Park matter. I have reviewed the analytical report as well as a letter dated February 19, 1982 from Michael Elder, (U.S. Department of Justice) to the Honourable John T. Curtin (with two attachments) which attempts an interpretation of the analytical results.

I have consulted with a number of research scientists and analytical chemists within the Department of the Environment and have carefully considered the chemical data with Grant Anderson and Dr. R. Jackson, who have reviewed the Johnston/Maslia report and have reported on the accuracy of the model presented there.

The conclusions of all three reviews (enclosed) find serious errors in key parts of the analytical data and hydrogeological model and as such, find no evidence to alter the previous conclusions of the amici in September 1981.

D.J. Hallett

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Encl.

Review of the Analytical Report of West Coast Technical Services (WCTS) to the U.S. Environmental Protection Agency January 21, 1982 and Interpretation of the Report by M. Elder to the Honourable John T. Curtin February 19, 1982

Summary

1. The analytical procedures used by WCTS do not follow the standard analytical protocols of USEPA or acceptable analytical procedures in Canadian Department of Environment Laboratories.

2. The analytical protocol followed by WCTS for sediment samples taken from groundwater seeps at the face of the Niagara gorge allowed gross interferences or inadequate recovery.

3. This has rendered the data provided by WCTS regarding lindane (gamma BHC), other BHC isomers, mirex, TCDD, and dichlorobenzenes, all markers of chemicals of Hyde Park leachate, (which are reported as non-detectable) invalid.

4. No quality assurance is evident or external validation and verification of the WCTS data was provided, similar to that presented by amici (using three independent laboratories).

5. The conclusions reached by M. Elder which in part contradict those of amici, are therefore unsubstantiated by this data.

6. Data reported by WCTS on PCB's and tri, tetra, penta, and hexachlorobenzenes and trichlorophenol (which are marker chemicals of Hyde Park leachate), present in the sediments and water taken from the face of the Niagara gorge, appear to be valid and substantiate the previous conclusion of amici that groundwater contaminated with marker chemicals from the Hyde Park landfill permeates the rock strata of the Niagara gorge to the bottom of the Rochester Shale and whirlpool sandstone formations and is seeping from the face of the Niagara gorge.

Analysis of WCTS

a. General Procedure

Standard analytical protocols should be followed which have been validated in the scientific literature or

by the contracting agency. Recovery experiments for each type of media (e.g. soil or water) are essential to validate the analytical procedure which is used to test for the presence of absence of each type of environmental contaminant.

A valid recovery occurs when the addition of a known amount or "spike" of the chemical to a representative sample of the media (e.g. soil or water) yields a subsequent analytical detection of approximately 100% of that known amount of chemical. Any recovery substantially exceeding 100% recovery of that "spike" is indicative of interfering substances native to the sample. This renders the analytical procedure unusable, unless further chemical separation and different protocols are used.

Just as a recovery percent which exceeds 100% must be suspect, a recovery of substantially less than 100% and specifically where recovery is less than 50%, invalidates the procedure and new protocols should be adopted. Where recovery is less than 100%, the error factor in the result's accuracy is determined by at least the percentage less than 100 and more conservatively, by doubling. Therefore, for example, where percentage of recovery is less than 50% the error factor in an analytical results will exceed 100%. Analytical error also increases greatly near the limit of detection of the substance.

Quality assurance procedures must be applied within each batch of analyses of a particular sample types. The lowest form of quality assurance is replicate analysis which should be very reproducable (within 20% at the extreme) when levels are over ten times the limit of detection. Quality control of contract analysis such as that by WCTS should include blind replicates or analysis of standard reference samples of the environmental substrate (e.g. soil or water) containing known amounts of contaminants which are analyzed by at least two laboratories for comparison. Within the Department of Environment, such contract analysis is quality controlled by the in-house laboratory of the expert scientific authority.

The analytical report of WCTS does not meet these general fundamental requirements.

b. Review of the Sample Analysis

The analytical procedures employed by WCTS (as described in its report) do not follow the analytical protocols of the USEPA (see EPA-600/8-80-038; Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples) nor do they follow acceptable laboratory procedures used by Canadian government and analytical laboratories, or confirmatory procedures validated in the scientific literature.

Because the protocols used by WCTS deviated from recognized protocols and the laboratory attempted confirmation of its results only through repitition within WCTS with no outside validation of testing results, the report was scrutinized in detail.

The original water and sediment samples taken at the gorge face at the direction of Grant Anderson were tested, verified and validated by three independent laboratories, two of which are Canadian Department of Environment laboratories with proven experience and ability to analyze the presence and quantity of environmental contaminants commonly found in the Great Lakes Basin. The three laboratories, including the Canada Centre for Inland Waters (DOE), the Canadian Wildlife Service Laboratory (DOE), and Technical Services, Inc. all used acceptable analytical protocols similar or identical to USEPA protocols or validated improvements of them.

1. Dichlorobenzenes (meta and para isomers)

The WCTS data on these dichlorobenzenes as non-detectable is scientifically incorrect. The specific recovery of dichlorobenzene should be noted as 28,000 ng/kg when sample spiked with only 7,000 ng/kg. Therefore, the actual recovery was 400% indicating gross analytical interferences. The recovery was reported as 40% (Table III - WCTS Report). By misplacing the decimal point, the WCTS analyst has mislead himself.

2. Mirex

Mirex is incorrectly reported as undetectable when the recovery is 0 (see Table III, WCTS). This renders the report on this chemical invalid. Analysis of mirex in any sediment sample from the Niagara gorge face using the WCTS procedures would be "non-detectable" with a 0 recovery.

3. Lindane

Analytical interference totally masked the ability of the laboratory to determine the presence or absence of lindane in the samples. Again, analytical interference is improperly reported as non-detectable. Here the recovery was 319% which indicates gross analytical interference. This interference renders all lindane results invalid.

4. Alpha, beta, delta BHC's and Ortho-dichlorobenzene

The recovery on each is far too low to provide accurate analytical results using the WCTS procedures. With respect to these chemicals, the percent recovery for

alpha BHC is 25%
beta BHC is 15%
delta BHC is 50%
ortho-dichlorobenzene is 30%

Such a result should be deemed invalid, and new procedures adopted.

5. TCDD (dioxin)

The testing equipment utilized by WCTS (gas chromotography using electron capture detection and packed column separation) is incapable of testing for the presence or absence of dioxin in environmental samples. The problem is compounded by the presence of PCB isomers in the samples which will definitely mask the presence or absence of TCDD using the WCTS procedure. It was therefore improper for WCTS to report that TCDD was non-detectable in soil samples.

The laboratory does not have proper adequate analytical equipment to analyze TCDD in accordance with EPA protocols or methods accepted in the scientific community. I prepared a list of U.S. and Canadian laboratories capable of successfully performing TCDD analysis which was provided to the Honourable John T. Curtin during the 1981 proceedings. EPA should be encouraged to follow up with a proper analysis for TCDD as soon as possible.

Interpretation of the Data

1. Trichlorophenol Detected in Groundwater

The 2,4,6 isomer (see Chemical Compilation Report of A.D. Little for samples associated with the Hyde Park landfill), of trichlorophenol is present in the Hyde Park landfill along with 2,4,5 trichlorophenol (which was not analyzed by WCTS) is easily leached and readily movable in groundwater, and is a key marker of Hyde Park leachate. The presence of 2,4,6 trichlorophenol in one groundwater sample of four tested from the Niagara Gorge face in the area of the Hyde Park landfill is indicative of Hyde Park leachate in that seepage. Ambient 2,4,6 trichlorophenol could not account for the presence of this chemical in groundwater at this point.

2. PCB's

WCTS reports the presence of Aroclor 1260 in all sediment at the gorge face in the vicinity of the Hyde Park landfill, yet no PCB's were detected in the control sample taken.

Michael Elder, in his letter to the Honourable John T. Curtin, dated February 19, 1982, offers the conclusion

that "EPA's chemical analyses of samples of groundwater seepages on the Niagara Gorge face and soil collected at the seepage points show low ppt concentrations of.....and polychlorinated biphenyls. These concentrations were not significantly different from the concentrations in the downstream or ambient samples."

In fact, Elder's statement completely contradicts both EPA's and amicis analytical reports. PCB's were detectable at all sediment samples taken by EPA at the gorge face but were not detected at the control location 7,000 feet downstream. Mr. Elder incorrectly states that these low PCB residues were found only in low parts per trillion, whereas EPA's own data clearly shows that the levels present at the gorge face in the vicinity of Hyde Park landfill are in the high parts per billion (278,000 ng/kg = 278 parts per billion).

Mr. Elder further states that "the isomer of PCB detected in the EPA sediment samples (PCB 1260) is not the same isomer of PCB that has been detected in the Hyde Park landfill." This statement cannot be supported scientifically. Aroclor 1260 is not one PCB isomer but a mixture of approximately 70 polychlorinated biphenyl isomers having predominantly 5,6,7 and 8 chlorines and an average chlorine content of 60%. The 12 in 1260 describes the biphenyl structure and the 60 represents the percentage of chlorine. A majority of the same PCB isomers found in Aroclor 1254 (54% chlorine) which is present in Hyde Park leachate, are also contained in Aroclor 1260.

When analyzing a mixture of PCB isomers taken from an environmental sample which has been subjected to the rigors of environmental influences (which include photodegradation and volatilization), a test for total PCB's rather than limited testing for specific mixtures of PCB's is a more accurate determination. In addition, previous to their entry into the environment, PCB's are also subject to thermal industrial degradation which can alter the pattern of isomers from those present in the original commercial mixture.

Those patterns which are the only basis for identification of a particular commercial PCB mixture such as Aroclor 1260, cannot account for alterations in the chemical composition of the mixture which have occurred as a result of industrial or environmental degradation. This is clearly stated in Section 9(c), page 6, of the EPA-600/8-80-038 Analytical Manual.

Testimony submitted during the 1981 proceedings by Lemar Millar (EPA) (p. 103), acknowledged that there were "huge quantities of PCB's contained in Hyde Park landfill". This is given further support by a letter from John R. Nichter (Program Manager for Special Environmental Operations at Hooker) to John McMahon (N.Y. State Department of Environmental Conservation) on March 6, 1980, which indicates that at least one leachate sample taken from Hyde Park landfill and analyzed by gas chromotography/ mass spectroscopy revealed a content of 1.5 percent (total) PCB's (letter attached).

Dr. Philip Levins testified that there could be many unanalyzed isomers of PCB's in Hyde Park landfill for which no data or records exist (p. 1182). Chemical concentration data for samples associated with Hyde Park landfill site was compiled by Arthur D. Little, Inc., July, 1980. The computer index in that compendium shows that the PCB pattern for aroclor 1260 was not included in the analyses undertaken for Hyde Park landfill leachate. Aroclor Patterns for other PCB mixtures such as Araclor 1254 were found. The presence or absence of Araclor 1260 has not been determined.

The presence of PCB's at only those locations samples at the gorge face in the area associated with the Hyde Park landfill groundwater flow system, as analyzed by Anderson, and the absence of any PCB's at the control location as sampled by EPA (7,000 feet downstream), supports the data and conclusions previously presented by amici that PCB's are leaching from the Hyde Park landfill to the Niagara Gorge.

Lindane

As previously discussed, valid scientific determination as to the presence or absence of lindane in soil samples at the gorge face in the area of Hyde Park landfill was not made by EPA because of the inadequacy of procedures employed by WCTS which resulted in gross interferences.

The statement of Elder that "due to false positive signals produced by interfering substances, BHC's were intially indicated to be present in some soil samples" is not scientifically substantiated by the WCTS report. The analytical procedure used is inadequate to report on the absence or presence of lindane or the BHC's in those samples because of the gross interferences.

Lindane was detected at all 4 locations on the face of the Niagara Gorge samples and was reported by Anderson in September to be present in all sediment and in one groundwater sample out of two analyzed. Lindane is

extremely unstable in the environment and degrades quickly in sunlight to alpha BHC. It is extremely unlikely that this lindane is due to ambient environmental conditions. For this and other reasons provided in an affidavit, on October 16, 1981, to the proceedings (attachment 2), the presence of lindane is the key indicator that leachate from the landfill is reaching the Niagara Gorge face.

Control Sample

The only chemical residues detected at the EPA control sample site No. B0778, showing any data which is considered valid, are tri, tetra, penta and hexachlorobenzenes. The dichlorobenzene result is considered to be an artifact due to interference. This is the only sample in which PCB's are not detectable. Both the total absence of PCB's from only this sample, and the significantly lower levels of the valid chlorobenzene data at this control site, in comparison to EPA samples Nos. 779 and 750, are in definite disagreement with Elder's conclusion that "the concentrations were not significantly different from the concentrations detected in the downstream or ambient samples". The control result on the other hand, strongly supports the conclusion that the seepage samples influenced by groundwater flowing from the Hyde Park landfill, in accordance with the analysis of Anderson, are contaminated with marker chemicals in Hyde Park leachate.

Some confusion exists in comparing the levels in these sediments contaminated by the groundwater seeps and suspended sediment at Niagara-on-the-Lake. The residue data on soils taken from the gorge face are reported as concentrations based on the weight of the soil containing water, whereas the suspended sediment centrifuged out of the water column at Niagara-on-the-Lake is expressed on a weight of freeze-dried sediment with all water removed. Comparison of the levels of residues found in these two matrices is therefore invalid. The water content of the sediments from the groundwater seeps will obviously lower the apparent concentration of any chemical residue expressed on a per weight basis when compared with a freeze-dried sample.

In addition, contaminant levels in sediments from groundwater seeps cannot be compared with those in suspended sediments since these are two completely different sample matrices or media. Such a comparison would be analagous to comparing levels in two different species of fish. Both sample types are exposed to the contaminant for different periods of time and are subject to different chemical mechanisms which affect the levels in

the two sediment types. Comparison of the type of chemical contaminant found is, however, valid. The same marker chemicals found in the seepage from the Niagara Gorge face are present in suspended sediments of Niagara-on-the-Lake and the implications are obvious.

Conclusion

No valid data has been provided by the WCTS report which alters the previous conclusions of the amici. The valid new data provided serves to substantiate their conclusion that groundwater contaminated with marker chemicals from the Hyde Park landfill permeates the deep rock strata of the Niagara Gorge to the bottom of the Rochester Shale and whirlpool sandstone formations and is seeping from the face of the Niagara Gorge.

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Hooker

345 THIRD STREET, BOX 728, NIAGARA FALLS, NEW YORK 14302, PHONE (716) 278-7000

March 6, 1980

Mr. John McMahon
New York State Department
of Environmental Conservation
584 Delaware Avenue
Buffalo, New York 14202

Re: Hyde Park Organic Leachate

Dear John:

The alternatives for ultimately disposing of the organics leachate in the Hyde Park East lagoon have been reviewed by Hooker. The present volume of this material is estimated at 40,000 gallons, and the chemical and physical properties are shown in Attachment 1. The concentration of PCB's in this material considerably restrict the possible courses of action as discussed below.

1. Remove and incinerate or secure in a landfill.

For liquids with PCB's in excess of 500 ppm there is presently no EPA-approved incinerator or secure landfill.

2. Remove and store pending approved disposal method.

Hooker knows of no approved bulk storage area to which this material could be moved. The EPA requirements for such storage of PCB's would entail construction of an approved facility which would require considerable time for a temporary solution. Drumming of this material for storage is impractical because of the large volume and low pH of the material. A substantial risk of leakage would accompany this alternative.

3. Immobilize in place.

Hooker is presently carrying out bench scale work on the immobilization or organic wastes including the Hyde Park organic waste. This work, which is being done with the assistance of consultants in this field, shows considerable promise and will require about 6 months work to define the optimum method for this waste.

Hooker

Successful results from this program would allow the organic material to be immobilized in place and eliminate any possibility of movement of an organic phase from the lagoon area. The area would then be clay capped and any small amount of leachate percolating through this area will be collected and treated as part of the remedial plan being developed for the entire site.

Immobilization would minimize the risks of spillage or leakage associated with transporting and storing this material and secures it on a site containing large quantities of similar soil contaminants and solid phase wastes. This entire site will be contained with hydraulic barriers and monitored under the remedial action plan proposed by Hooker. It is anticipated that the immobilization of this organic material and clay capping of the lagoon area will be the last step of the remedial program.

Yours truly,

John R. Nichter

John R. Nichter
Program Manager
Special Environmental Operations

JRN:rm
Attachment
cc: J. Spagnoli

ATTACHMENT NO. 1

HYDE PARK LEACHATE - ORGANIC LAYER
(Sample No. 50279002)

Sodium	62.4 ppm
Potassium	27.1 ppm
Chlorine, total	28.6%
Sulfur	1.2%
Fluoride	2.3%
Freeze Point	-34° C.
Flash Point	125° C.
pH of water layer	2.4
Density at 25° C.	1.216
Boiling Point	143° C.

GC/MS ESTIMATE OF MAJOR COMPONENTS
(Sample No. 50279002)

Component	~Area %
Cyclohexene	1.4
BTF	1.1
Toluene	1.8
PCE	1.0
MCB	0.3
Monochloro BTFs	2.0
Xylenes	3.6
Anisole	0.6
Monochlorotoluenes	3.7
Dichloro BTFs	1.8
Dichlorotoluenes	5.6
Trichloro BTF	0.3
Trichlorobenzenes	1.3
C-46	0.8
Trichlorotoluenes	2.1
Tetrachlorobenzenes	1.9
Tetrachloro BTF	0.8
Benzoic Acid	11.2
Tetrachlorotoluene	0.4
Pentachlorobenzene	1.0
Hexachlorobenzene	0.7
Phenol	6.7
Dichlorophenol	1.0
Trichlorophenol	7.1
Mirex	0.1
	~58.3 Area %

* In March, 1979 a sample was analyzed by GC/MS using selected ion monitoring and found to contain 1.5% PCBs.

Environment Canada / Environnement Canada
Environmental Protection / Protection de l'Environnement

Inland Waters Directorate
National Hydrology Research Institute
Contaminant Hydrogeology Section
Contaminant Hydrogeology Section
c/O EPS River Road Labs.,
Ottawa, Ontario
K1A 1C8

March 9, 1982

Mr. K. Shikaze
Ontario Region
Environmental Protection Service
Environment Canada
7th. Floor
25 St. Clair Avenue, East
Toronto, Ontario

Dear Kim:

I have received and read the reports on the modeling of groundwater flow in the vicinity of the Hyde Park Landfill (USGS Open-File Report 82-159) and on the analysis for toxic organic chemicals of samples taken from the Niagara River Gorge (WCTS Report, Jan. 21, 1982). I have consulted several colleagues here in Ottawa on technical matters concerning the simulation modeling and the analytical techniques employed.

The modeling study conducted by USGS falls far short of their usual standards of excellence even though it has received a review by the Reston, Virginia, H.Q.. The USGS model has not been properly calibrated as can be readily appreciated by comparing the observed hydraulic heads of OW 1 and 18 in Figure 2 with the simulated heads in Figure 5. The failure to calibrate the model properly results in unreasonable values for the predicted vertical hydraulic conductivity of the Rochester Shale (K_{zz} <10^{-8} cm/s); this value is more likely to be of the order of 10^{-5} cm/s from Grant Anderson' work in the same rock unit on the Canadian side of the Niagara River. Consequently the model predicts minimal flow through the Rochester Shale, below which there is a no-flow boundary (KB in Figure 4) imposed in the model. Not surprisingly the USGS modelers conclude that the majority of ground-water flow, and hence toxic organic solutes, occurs through the Lockport Dolomite. Not only is the modeling of

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poor quality, the basic data available for the calibration of the model is probably inadequate to allow the prediction of the ground-water flow pattern with any confidence.

Furthermore, from discussions I have had with the organic chemists here at River Road, I have several areas of doubt concerning the claims of the US Justice Department (Letter from Elder to Judge Curtin, dated February 19, 1982) on the situation with respect to dioxin and lindane along the Gorge face. The WCTS lab in California indicates detection limits of 50 ppt for dioxin and lindane, rather than the 3 and 2 ppt values, respectively, quoted in the EPA protocol. I am far from confident that the packed-column GC technique was appropriate given the complexity of such a chemical matrix.

These conclusions were arrvied at independently of those of Grant Anderson, and prior to telephone discussions I had with him today. Nevertheless our conclusions seem to be substantially in agreement on the simulation model.

Yours sincerely

Dick Jackson

R.E. Jackson, Ph.D.
Acting Head
Contaminant Hydrogeology Section

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NEW YORK

UNITED STATES OF AMERICA
THE STATE OF NEW YORK

Plaintiffs,

- vs -

Civil Action No. 79-989

HOOKER CHEMICALS & PLASTICS CORP.; OXY CHEMICAL CORPORATION; HOOKER CHEMICAL CORPORATION; OCCIDENTAL PETROLEUM INVESTMENT CO.; OCCIDENTAL PETROLEUM CORPORATION; THE TOWN OF LEWISTON; THE TOWN OF NIAGARA, (Hyde Park Landfill)

AFFIDAVIT OF DOUGLAS J. HALLETT

Defendants.

STATE OF NEW YORK)
COUNTY OF ERIE) ss.
CITY OF BUFFALO)

Dr. Douglas J. Hallett, a resident of the Township of West Carleton, Province of Ontario, being duly sworn, hereby deposes and says:

1. On October 6, 1981, I gave testimony in the Hyde Park hearing with respect to chemical analyses results from water and sediment samples taken at 4 sites (see Exhibits 86,87 and 102) along the gorge face at specific locations which correspond to photographs taken by Grant Anderson. (see Exhibit 85, photograph 8(sample 1),photograph 9 (sample 2) and photograph 10 (sample 3)

2. The analytical testing of sample #3(which corresponds to Photograph 10 in Exhibit 85) was obtained 300 feet below the top of the gorge from the whirlpool sandstone formation. This was visually described in testimony by Mr. Anderson (Tr. Vol. VI p.1496).

3. Analysis of sample #3 had not been completed by my laboratory, the National Wildlife Research Center in Hull, Quebec, by October 6,1981, because the sample contained a high level of sulphur in the form of sulphides and mercaptans which interferred with the normal operation of the gas chromatographic instrument used to analyse these samples.

4. The high level of sulphur necessitated a further routine cleanup step to ensure proper analysis of the organochlorine contaminants in this sample.

5. Olfactory detection of mercaptans (also buried in substantial quantities in the Hyde park landfill- see Federal Complaint at p. 9) is considered

evidence of non-aqueous phase contamination. Four chemists in my laboratory, including myself, all of whom are experienced in rendering these determinations, identified the characteristic odours of these substances.

6. Sample #3 was analysed on Tuesday October 12,1981 in my laboratory in Hull, Quebec by a chemist under my direct supervision.

7. Analysis of alpha, beta and gamma(lindane) isomers of BHC in sample #3 revealed concentrations of 185 ppt of gamma BHC (lindane). and 17 ppt beta BHC. Alpha BHC was not deteted.

8. The high proportion of gamma BHC (lindane) relative to alpha or beta BHC is indicative of Hyde Park leachate. The proportions are similar to those found in the leachate analyses presented in the "Indicators" chart prepared by Dr. Mason and the Chemical Compilation by Arthur D.Little,Inc.

9. In my opinion, the high proportion of the unstable gamma isomer can only originate from a current primary industrial source ie. Hyde Park landfill.

10. Gamma BHC(lindane) degrades quickly in sunlight to the alpha isomer and is the least environmentally persistent of the three isomers mentioned. The alpha and beta isomers are found to predominate in environmental samples and are present in agricultural use of lindane as an insecticide.

11. Upon Information and belief, Hooker was the only producer of lindane in the Niagara Falls, New York area.

12. Widespread agricultural use of lindane has been severely restricted since 1972.

13. Large amounts of lindane are buried in the Hyde Park landfill, and leachate in the groundwater emanating from the landfill contains predominantly gamma BHC (lindane) relative to the other isomers.

14. Mr. Anderson testified that the bulk of this leachate moves vertically downward from the landfill into the groundwater moving into the Lockport Dolomite and Rochester Shale.

15. Because of the reasons listed in paragraphs 11-14 above, it is my opinion that the Hyde Park landfill is the source of gamma BHC (lindane) which is now oozing along with mercaptans through cracks in the Rochester shale into the Niagara Gorge and Niagara River.

Sworn to Before me
on this 15th day of October, 1981

BARBARA MORRISON
Notary Public, State of New York
Qualified in Niagara County
Commission Expires March 30, 19

NOTARY

DOUGLAS E. HALLETT

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NEW YORK

UNITED STATES OF AMERICA
THE STATE OF NEW YORK

Plaintiffs,

- vs -

Civil Action No. 79-989

HOOKER CHEMICALS & PLASTICS CORP.; OXY CHEMICAL CORPORATION; HOOKER CHEMICAL CORPORATION; OCCIDENTAL PETROLEUM INVESTMENT CO.; OCCIDENTAL PETROLEUM CORPORATION; THE TOWN OF LEWISTON; THE TOWN OF NIAGARA, (Hyde Park Landfill)

AFFIDAVIT OF E. GRANT ANDERSON

Defendants.

STATE OF NEW YORK)
COUNTY OF ERIE) ss.
CITY OF BUFFALO)

E. Grant Anderson, a resident of the Town of Markham, Province of Ontario, duly sworn, hereby deposes and says:

1. Sample #3 was taken on September 30, 1981 by Mr. P Madenovich, a chemist with Technical Service Laboratories in Mississauga, Ontario under my direct supervision.

2. The sample (#3) was split and sent to Dr. D.J. Hallett for quality assurance testing in his laboratory, the National Wildlife Research Centre in Hull, Quebec.

3. The sample (#3) was taken from a white chemical gook oozing out of a vertical joint in the Whirlpool Sandstone Formation.

4. The Whirlpool Sandstone Formation is the fractured bedrock layer situated on top of the Queenston Shale all of which is located about 150 feet below the Rochester Shale.

5. The presence of non-aqueous and aqueous phase chemicals present in and oozing from vertical fractures in the Whirlpool Sandstone Formation confirms my scientific and hydrogeological analysis of vertical flow of chemicals through all of the rock layers below the Lockport Dolomite.

6. Further, the gamma BHC (lindane) concentration of 185ppt measured in sample #3 (photo 10 Ex. 85) represents the highest concentration of lindane

determined by Dr. D. Hallett in all of the samples tested.

7. The fact that the highest concentration was determined in the sediment sample deepest below the top of the Gorge supports my scientific and hydrogeological analysis that chemicals are moving deep vertically through the Rochester Shale and the underlying rock layers.

8. In addition, the highest concentraion in the deepest sample further supports my analysis that dilution substantially reduces chemical concentrations in the Lockport Dolomite, in the infrequent and isolated areas where contaminants do reach the Gorge face on top of the Rochester Shale.

Sworn to before me
on this 15th day of October, 1981

Barbara Morrison
NOTARY

BARBARA MORRISON
Notary Public, State of New York
Qualified in Erie County
My Commission Expires March 30, 1981

E. Grant Anderson
E. GRANT ANDERSON

JAY, KLAIF & MORRISON

ATTORNEYS AND COUNSELORS AT LAW
1032 ELLICOTT SQUARE
BUFFALO, NEW YORK 14203

(716) 855-6300

BARBARA MORRISON
LEONARD J. KLAIF
DAVID GERALD JAY

15 October 1981

Hon. John Curtin
United States District Court
Western District of New York
U.S. Courthouse
Buffalo, New York

Dear Judge Curtin:

Re: U.S. v. Hooker et al. Civil No. 79-989
(Hyde Park Landfill)

Pursuant to your request of October 6, 1981, Dr. Douglas Hallett has provided the following list of laboratories at which analysis of PCBs, mirex, chlorobenzenes, lindane and TCDD can be quickly and efficiently analysed by gas chromatography and by GC/MS (low resolution) screening for TCDD.

1. Environment Canada. Inland Waters Directorate, Burlington, Ontario, Canada.

2. Environment Canada. Canadian Wildlife Service, Hull, Quebec.

3. Environment Canada. Air Pollution Control Directorate, Ottawa, Ontario.

4. Ontario Ministry of Environment. Toronto, Ontario.

5. Environment Canada. National Water Research Centre Burlington, Ontario.

6. Environment Canada. Inland Waters Ontario Region, Burlington, Ontario.

7. Ontario Research Foundation. Mississauga, Ontario.
- currently analysing all residues mentioned except TCDD, but have the equipment and expertise to analize for TCDD.

8. New York State Department of Health. Albany, New York.

9. U.S. Fish and Wildlife Service (Dr. D. Stalling) St. Louis, Missouri.

10. Dow Chemical Co. Midland, Michigan.

11. US EPA a) Research Triangle Park North Carolina
b) Chicago, Illinois

The final two laboratories have the equipment and technical expertise but must adopt state of the art methodologies that are published in the scientific literature

and accepted by the scientific community.

12. SCA New Youngstown New York (except TCDD currently, but have GC/MS capability and expertise.)

13. Likely Hooker Chemicals Co. from the data that I have reviewed.

The methodology uses standard gas chromatography using capillary columns and electron capture detectors or GC/MS equipped with capillary columns. Standard extraction and column chromatographic cleanup is adequate for this analysis and TCDD screening. If TCDD is suspected present then further confirmatory analysis can be sought on only those limited samples suspect.

Sincerely,

Toby Vigod

Toby Vigod
Counsel