

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF NEW YORK

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THE UNITED STATES OF AMERICA, and	:	
THE STATE OF NEW YORK,	:	
	:	
Plaintiffs,	:	
	:	
-against-	:	Civ. 79-989(JTC)
	:	
HOOKEr CHEMICALS & PLASTICS CORP.,	:	
HOOKEr CHEMICAL CORP., OCCIDENTAL	:	
PETROLEUM INVESTMENT CORP., OCCIDENTAL	:	
PETROLEUM CORP., THE TOWN OF LEWISTON,	:	
NEW YORK, and THE TOWN OF NIAGARA,	:	
NEW YORK,	:	
	:	
Defendants.	:	
	:	
(Hyde Park Landfill)	:	

-----X

AFFIDAVIT OF KERNAN DAVIS

STATE OF NEW YORK)
 : SS.:
COUNTY OF ALBANY)

Kernan Davis, being duly sworn, states:

1. I have carefully reviewed the Memorandum and Affidavit submitted by Amici Curiae in Opposition to U.S. Motion to Withdraw Testimony and Affidavit of David Bruce Twedell, and the Response to Government's Motion, filed by Applicants for Intervention.

2. I have also reviewed my testimony, the testimony of E. Grant Anderson, and my affidavit filed with Response of State of New York to Court Order of July 10, 1981 (hereinafter July 10 Affidavit) (attached hereto as Attachment A).

3. Much of the argument offered by counsel for Amici and applicants for intervention turns on the practical definition of the term "hydrogeologist." As a matter of professional nomenclature, a hydrogeologist is a geologist who, by additional education or experience, has developed expertise in the area of groundwater circulation. As is evident from my educational background (see Tr. 265; Resume attached to July 10 Affidavit), I have a Bachelor's degree in geology and geography, have taken graduate courses in hydrology and groundwater movement, and have done substantial professional consulting work in the field of hydrogeology over the past 25 years (see Tr. 265-267; July 10 Affidavit, pp. 1-2). I call myself a geologist, rather than a hydrogeologist, because my civil service title at the Department of Environmental Conservation is that of "Engineering Geologist."

4. My educational and professional background is, in fact, similar to that of E. Grant Anderson, a "hydrogeologist by profession" who has a Bachelor's degree in engineering geology, has taken graduate courses in hydrology, and has consulted as a hydrogeologist. (See Andersen Affidavit, ¶ 3, attached to Brief of Amici Curiae, filed June 30, 1981). The major differences are the length of experience, and the location of experience. During the past 25 years I have worked as a geologist on the hydrogeology of several locations, including some 10 years working directly with the hydrogeology of the Niagara Falls area, whereas Mr. Anderson has been working over the past 10 years in Canada.

5. As set forth in ¶ 4 of my July 10 Affidavit, I was present at many of the negotiating sessions which produced the proposed Agreement, including all sessions which involved geologic or hydrogeologic issues.

6. It was my responsibility to review the hydrologic and geologic data available during the negotiations and to provide my professional interpretation to negotiators for the State of New York (Tr. 307, 308; July 10 Affidavit, ¶¶ 4, 6, 7, 8, 10).

7. My personal approach to interpretation of geologic and hydrologic data is conservative, and I have my own stringent requirements which I apply to such interpretation (see, e.g., Tr. 304, 311, 312-313, 316, 317-318, 320-321).

8. All of my interpretations of data and recommendations to the State of New York negotiators based upon those interpretations were premised upon my own knowledge of specific data relative to the Hyde Park Landfill and upon my professional experience in the immediate vicinity. Although I discussed aspects of the data with David Twedell, I did not rely upon him for any information, but formed my own opinions from my own personal review. With 25 years of experience in interpreting hydrogeologic data, and 10 years collecting and interpreting hydrogeologic data specifically in the vicinity of the Hyde Park Landfill, I have confidence in relying upon my own expertise in this area.

9. I reviewed all geologic and hydrologic data available during negotiations. Some material was adequate from which to derive reasonably accurate determinations, such as direction of

groundwater flow and gradient, e.g. piezometric data (Tr. 270-273). Other types of information were not adequate, in my professional opinion, to provide reliable information, and I did not therefore rely upon them (e.g., permeability calculations [Tr. 315-320]). In the latter case, I assured myself that the proposed agreement contained provisions to obtain necessary site-specific data. For example, the proposed Agreement requires pump tests on all water-bearing zones throughout the "Lockport Bedrock Zone" (Addendum I, ¶ C(6), p. I - 16). These tests will provide specific information about the velocity and volume of water in this Formation, rather than a "ball-park figure" (Tr. 318; July 10 Affidavit, ¶ 9(c), p. 8-9).

10. In my professional opinion, before the most effective methods for remediation of the Hyde Park Landfill can be determined, it is necessary to accurately delineate the extent to which, areally and vertically, chemicals have migrated. Provisions in the proposed Agreement are designed to accomplish that goal (Addendum I, ¶ C; July 10 Affidavit, ¶¶ 5,8.)

11. The vertical extent of migration depends upon fracturing in the Lockport Bedrock. Site specific data about the fracturing in this formation will be obtained pursuant to Addendum I, ¶ C.

12. None of the witnesses who testified about the geology of Hyde Park had sufficient information to determine the distance from the gorge at which the Rochester Shale became

sufficiently fractured to permit migration of chemicals. See Johnson, Tr. 253-254; Davis, Tr. 293; Anderson, Tr. 1493. See also July 10 Affidavit, ¶ 9(b), pp. 6-7. This information will be obtained pursuant to the proposed Agreement (Addendum I, ¶ C). (See also, Hooker's Oct. 14, 1981 Memorandum, p. 5).

13. I have had professional experience in evaluating the fracture patterns of the Lockport and Rochester Formations in the Niagara Falls Area, and in Canada. As I noted in my July 10 Affidavit, pp. 7-8, there is a difference in the fracturing patterns in the American and Canadian sides of the escarpment, the Canadian side being more highly fractured. It is therefore inappropriate to apply, without further data, experience gained on the Canadian side to geologic structures occurring in the vicinity of Hyde Park.

14. By obtaining the data required by the proposed Agreement, accurate information about the precise nature of chemical migration, geology, and hydrology will be available for use in planning the most appropriate remedies. It is intended that such remedies prevent migration of chemicals downward, and contain chemical migration before it reaches the face of the Niagara gorge.

15. Having reviewed the hydrogeologic testimony offered by witnesses during the hearing, and having reviewed the relevant provisions of the proposed Agreement, it remains my professional opinion that the proposed Agreement contains a scientifically

sound approach to developing the most appropriate remedial plans
for the Hyde Park Landfill.

KERNAN DAVIS

Sworn to before me this
10th day of January 1982.

Kernan S. Davis
NOTARY PUBLIC

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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. 79-289

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

AFFIDAVIT OF

KERNAN DAVIS

Defendants.

STATE OF NEW YORK)
) ss.:
COUNTY OF ALBANY)

Kernan Davis, being duly sworn, states:

1. I reside in the Town of Schodack, Rensselaer County,
State of New York.

2. I am employed as an engineering geologist by the
New York State Department of Environmental Conservation, in the
Division of Solid Waste, Bureau of Hazardous Waste Technology.

3. A brief resume is attached, outlining my education and
experience. Of particular background interest in the instant
case would be my employment as an engineering geologist for the
Niagara Power Project, from 1958 to 1961. During those four
years, I became intimately acquainted with the geology and
hydrology of the Niagara Falls area as a part of my daily work.

ATTACHMENT A

I worked with the Lockport dolomite and the underlying formations. I scaled the gorge face in the vicinity of the power project many times, examining the rock conditions. I collected and interpreted groundwater data in the vicinity. When Richard Johnston came to Niagara Falls to gather information for the preparation of his Bulletin GW-53, "Ground Water in the Niagara Falls Area, New York with Emphasis on the Water-Bearing Characteristics of Bedrock", I gave him guidance, assistance and arguments (see page 7 of his Bulletin, "Acknowledgements"). Some of his words in print appear to have sprung from my ideas.

4. I was present at many of the negotiation meetings in the instant case. My objective was to have logical geological bases be used for whatever agreements could be hammered out by lawyers for the parties.

I believe I have succeeded.

5. In the absence of detailed knowledge of the hydrogeology of any hazardous waste site, no design of remedial measures can be accomplished. At the same time, a general knowledge of the site can lead parties to agree upon performance standards, terms and conditions to be met, in order to set up appropriate programs of action. By execution of those programs, sufficiently detailed information would be gathered and analyzed so that design of remedial measures could be accomplished. That, as I perceive it, was done in the instant case.

6. The issues and concerns raised in Affidavits by E. Grant Anderson and Edward W. Kleppinger were known to me and

were among the issues raised by me in negotiations and were addressed and considered by the parties in reaching their agreement. The issues were, in my opinion, resolved in a manner appropriate to restore and protect the area environment.

7. I raised the issue of direction of groundwater flow. Through a series of observation wells, the flow directions were learned. The Barrier Collection systems take this into account (see Addendum 1, paragraphs D(1) through D(8)).

8. I raised the issue of control of leachate migration to depths beyond fifteen feet below the surface of the bedrock. It is not known, to what extent, laterally and vertically, the leachate has already migrated. Before any remedial measures can be designed, it is necessary to gather facts about the hydrogeology and the extent of leachate migration. Subparagraph C of Addendum I provides for such fact-gathering. The fifteen-foot depth was chosen as a limit, based upon Johnston's Bulletin GW-53, upon the data collected to date and upon our combined judgments. I agree, barriers must extend downward to at least that depth. I believe there is not now sufficient information to determine what measures would be appropriate below that level. Therefore, Subparagraph C of Addendum I was prepared to provide factual bases for constituting programs which would be appropriate to meet the objectives of the agreement.

9. Some of the concepts and contents of the Affidavits of Kleppinger and Anderson are inapt to such an extent as to render the arguments laid thereupon invalid.

(a) As Amici pointed out, the direction in which groundwater flows is a basic factor in any landfill remediation analysis.

(i) The northwestward groundwater flow direction has been determined by on-site observations, by actually measuring the piezometric pressures in the bedrock and the overburden, and mapping the results at a scale commensurate with the data. Based upon this information, the Overburden Barrier-Collection System installation was planned and the Bedrock Barrier-Collection systems were tentatively proposed. I reviewed this procedure and found it to be appropriate for the purposes of this agreement.

(ii) Edward Kleppinger determined the direction of groundwater flow by describing the location of the site over the telephone to Dick Johnston, who (twenty years absent from Niagara Falls) is alleged to have said that the groundwater flow was eastward, toward the power Authority conduits, which are buried in the ground more than four thousand feet east of the landfill site. (Kleppinger Affidavit, item 44). In my opinion this is not a reliable determination for the purposes of this case.

(iii) E. Grant Adnerson determined the direction of groundwater flow to be westerly, northerly and possibly easterly away from the site (items 34 and 35 of his Affidavit). On pages 10 through 13 of his Exhibit B, he shows how he determined these groundwater flow directions. He took Johnston's "Figure 14 - Inferred direction of ground-water movement in the upper water-

bearing zones of the Lockport dolomite in the vicinity of Niagara Falls "(published at a scale of one inch equals two miles), plotted the location of the landfill on it, and interpreted what he could see (page 12 of Anderson's Affidavit). In my opinion this is not a reliable determination for the purpose of the instant case because this regional map is too general to accurately determine groundwater movement at a specific site.

(iv) Johnston, on page 55 of his Bulletin GW-53, expressed some of his concerns about his ability to accurately determine groundwater movement directions. Prior to the start of the investigation, he had assumed that water in the bedrock in the western part of the Niagara Falls area moved westward, to discharge into the gorge. He could find practically no evidence of seepage into the gorge to support that idea. He found very few wells in that area suitable for the necessary water-level observations. The only accessible wells were those which I had been working with, in the vicinity of the Power Project. Even with my well data, we could not determine the width of the area from which groundwater was flowing toward the gorge. Therefore, he presented his surmised or inferred directions on a small scale map that permits the plotting of comparatively little detail. Considering the purpose of his Bulletin, to describe the general occurrence, availability and quality of groundwater and the hydrogeology of a five hundred fifty square mile area, not of any particular site in that area, in my opinion this was a reliable method for those purposes only.

(v) Therefore, one can see that the Amici Curiae did not aptly determine the direction of groundwater flow and one may conclude that all arguments based upon said flow directions are rendered invalid to the extent to which they rely upon such determinations.

(b) Because Kleppinger Affidavit items 17 and 23 overstate and oversimplify and erroneously describe the structural character of the bedrock, all subsequent arguments resting upon these bases fail. The spatial distribution of the fractures in bedrock is a primary factor in considering groundwater flow characteristics, because it provides the system of openings through which fluids could flow. The ability of the bedrock to convey fluids, the location of the observation wells and the possible depth of penetration by fluid are dependent upon this spatial distribution.

(i) Throughout the negotiating process, I tried to determine the spatial distribution of fractures in the Lockport dolomite by recollection of my work in the Niagara Falls area, by reading Bulletin GW-53 (especially pages 17 and 22 through 27), by analysis of on-site and near-site boring logs and by examining some rock cores myself. These sources do not convey sufficient information to design the best remedial measures. On the other hand, they are sufficient to provide a basis for agreement to perform certain surveys, tests and studies and to tentatively support a purge well system as a possible remedial measure. They

are sufficient to form concepts about remedial measures. In the top few yards of bedrock (say fifteen feet) many bore holes and rock cuts in the Niagara area evince both lateral and vertical fracturing. Below that depth, the rather sparse data sources suggest very few open vertical fractures and a few clusters of bedding-plane fractures. From my own experience, I recall the occurrence of a relatively less permeable zone, at about fifty to sixty feet above the Rochester shale, within the Lockport dolomite, of fine-grained muddy bituminous dolomite beds. I know of no boring logs near the site that have penetrated deep enough to encounter this zone, but I proposed that deep explorations be made to find this zone and to test its ability to act as a natural barrier to downward movement. The boring required under the Agreement should accomplish this purpose.

It is generally agreed that the upper 15 feet of bedrock is very pervious. It would convey water vertically as well as horizontally. Below this upper zone, lateral flow would be more dominant than vertical flow, because the vertical joints have been found to be more tightly closed at depth than at the surface, whereas some bedding plan fractures are partially open throughout the depth of the Lockport formation (see Bulletin GW-53, pages 22 and 23).

(ii) E. Grant Anderson's knowledge of the fractured condition of the Lockport dolomite stems from his experience with the formation as it occurs in the Niagara Escarpment in the Province of Ontario, Anderson Affidavit, item 18. The lithological

and structural details of bedrock vary from one part of a formation to another, across distances. Familiarity with a rock formation in one locale does not familiarize one with that same formation in another area, unless the details are similar. At various times in the 1950s and 1960s, I observed some road cuts and a quarry in that Canadian portion of the escarpment where the dolomite is highly fractured. It is less severely fractured on the American leg of the escarpment, by my own observations. It is less weathered and fractured inland from the gorge. I further have observed, in addition to the geographic variances noted above, a vertical difference in the density of fracture occurrence, as described by Johnston in Bulletin GW-53.

(c) The presence and significance of water-bearing zones and the capability of the bedrock to transmit water are dependent upon the occurrence of fractures in the bedrock.

The hydraulic gradient (that is, the difference in groundwater pressure between 2 points) is another very important factor, because it causes the rate of flow and the direction of flow. These must be determined with a degree of accuracy commensurate with the level of planning of remedial measures.

No estimate of permeability (or hydraulic conductivity), velocity or gradient should carry any weight of argument beyond the hypothetical realm, unless it is based upon on-site, permeability and well behavior tests, actually performed in the field.

(i) The calculations in the Anderson Affidavit, Exhibit B, Section 2, are not based upon sound data. No on-site tests were made by him in order to conclude that "... permeability of the rock will be at least 10^{-4} cm/sec." All calculations and concepts based upon said permeability fail due to this lack of basis.

(ii) The Kleppinger Affidavit exhibits no sound basis for arguments regarding groundwater flow characteristics.

(iii) Johnston's Bulletin GW-53, page 32, warns the reader against laboratory tests as bases for learning groundwater flow characteristics of bedrock. The purpose of Johnston's work, it must be remembered, was to describe the water-supplying ability of the formation in this general area. His work is not sufficiently detailed for the purposes of the instant case.

(iv) The purpose of the Agreement Addendum I, Paragraph C, is to provide sound geotechnical bases for all decisions regarding remedial measures to be employed in the bedrock: to measure the factors, such as velocity, gradient, and permeability, at and near the instant site.

10. All the concerns expressed by Amici were considered and weighed during negotiations. The principal geotechnical issue between the parties on the one side and the Amici Curiae on the other, is their respective willingness to decide upon a particular remedial measure in the absence of geotechnical data sufficient to make that decision. In my opinion it is not wise to recommend

a best alternative at this time, in the absence of sufficient information about the detailed bedrock hydrogeology at the Hyde Park Avenue site. I do support the position taken in the agreement, to learn enough about the hydrogeology by performing surveys and tests before reaching a firm decision as to the best remedial measure.

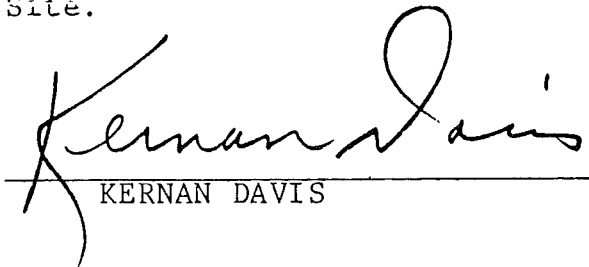
11. The Amici Curiae have provided analyses of groundwater flow direction, fracturing, stratigraphy and permeability of the bedrock which are inapt as bases for the propositions they have proffered. As my analyses have demonstrated, Amici's arguments are therefore so poorly founded that they must fail.

12. The Amici Curiae brief compares a recent Opinion of the Supreme Court of Illinois, in the case of Village of Wilsonville vs. SCA Services, with the instant case. Legal corollaries notwithstanding, the physical difference between the landfill site in Illinois and the Hyde Park Avenue site is so striking as to nullify any comparisons relating to the physical aspects of the sites.

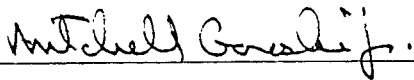
According to the Opinion, the Wilsonville site is situated in an area of rock and soil foreign to New York State. The general geologic profile of that site consists of 10 feet of windblown silt and clay (loess), underlain by 40 to 65 feet of glacial till, underlain by shale. At a depth of 312 feet, half the rock was mined out, so that only pillars of coal remain to prevent land subsidence. Geological expert witnesses warned of

the likelihood of pillar failure and subsequent land subsidence, thereby permitting water to get into the landfill trenches, eventually rise to the surface, overflow and contaminate the ground around the site. The Illinois Court did not disturb that finding.

No such geologic conditions, no similar geologic conditions, exist at the Hyde Park Avenue Site.


KERNAN DAVIS

Sworn to before me this
20th day of July, 1981



MITCHELL GOROSKI, JR.
Notary Public, State of New York
Qualified in Albany County
No. 01-6604360
Commission Expires March 30, 1982

RESUME

KERNAN DAVIS

EDUCATION

1955 University of Buffalo, B.A. in geology and geography
Graduate studies at Pennsylvania State University and Miami
University at Oxford, Ohio
Special Short Courses offered by Massachusetts Institute of
Technology, The Engineer School at Fort Belvoir and the
University of California
Public Administration as a part-time student at the State
University of New York at Albany

MEMBERSHIP OR PARTICIPATION IN PROFESSIONAL SOCIETIES

The Geological Society of America, The American Geophysical
Union, The American Association for the Advancement of Science,
The New York State Geological Association, Capitol District
Geologist, the New York Chapter of the American Institute of
Professional Geologists, American Water Resources Association,
The American Society for Public Administration, The New York
Academy of Sciences

EXPERIENCE

U.S. Army, as a Terrain Analyst for Engineer Technical Intelli-
gence Units in Washington, D.C. and in Alaska
as an Engineering Geologist for the Niagara Power Project, for
the Buffalo District Corps of Engineers, for the U.S. Department

of Agriculture, Soil Conservation Service, New Y.Y. Conservation
Dept. as a Land Examiner for the U.S. Department of the Interior,
Bureau of Land Management in Alaska

Presently employed as an engineering geologist for the NY State
Department of Environmental Conservation, Solid Waste Division,
Hazardous Waste Bureau, Special Projects Unit

PUBLICATIONS

All reports are propriatory and unpublished.

FIELDS OF SPECIALIZATION

Land and Water Resources Management and Planning, with special
emphasis on surficial geology, glacial geology, groundwater
hydrology, geomorphology, geophysics, erosion and sedimentation

STATE OF NEW YORK
COUNTY OF NEW YORK } ss.:

....., being duly sworn, deposes and says
that he is in the office of the Attorney General of the
State of New York, the Attorney for herein. On the
day of, 19 he served the annexed upon the following named persons:

Attorney in the within entitled by depositing a true and correct copy thereof, properly
enclosed in a post-paid wrapper, in a post-office box regularly maintained by the Government of the United States at TWO WORLD
TRADE CENTER NEW YORK, N.Y. 10047 directed to said Attorney at the address within the State designated by
for that purpose.

Sworn to before me this

..... day of, 19

.....
Assistant Attorney General of
the State of New York

Sir. Please take notice that the within is a true copy of duly filed and entered in the office of the Clerk of County, on the day of , 19

Yours, etc.,
ROBERT ABRAMS,
Attorney General,

Attorney For

Office And Post Office Address
Two World Trade Center, New York, N.Y. 10047
To , Esq.

Attorney for

Sir:

Please take notice that the within

will be presented for settlement and signature herein to the Hon. one of the judges of the within named Court, at

in the Borough of day of
City of New York, on the 19 , at M.
Dated, N.Y., , 19

Yours, etc.
ROBERT ABRAMS,
Attorney General,

Attorney For

Office And Post Office Address
Two World Trade Center, New York, N.Y. 10047
To , Esq.

Attorney for

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF NEW YORK

THE UNITED STATES OF AMERICA, &
THE STATE OF NEW YORK,

Plaintiffs,

-against-

HOOKER CHEMICALS & PLASTICS
CORP., et al.

Defendants.

AFFIDAVIT OF KERNAN DAVIS

ROBERT ABRAMS,

Attorney General

Plaintiffs,

Attorney for.....

Office And Post Office Address
Two World Trade Center, New York, N.Y. 10047
Tel. 212-488-3290

Personal service of a copy of

within.....

is admitted this..... day of

..... 19