TONEY ANAYA
GOVERNOR

DENISE D. FORT
DIRECTOR

HEALTH & ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
(505) 984-0020

July 15, 1985

Mr. Alberto A. Gutierrez, President
Geoscience Consultants, Ltd.
500 Copper Avenue, NW
Suite 325
Albuquerque, New Mexico 87102

Case file

Dear Mr. Gutierrez:

I am in receipt of your letter of June 21, 1985 concerning EID's Closing Statement in OCC Case #8224. As you requested, I offer the following clarification of the intent of my statement, "EID suggests to the Commission, that the data supporting the proponents' Geoscience study is simply incredible and untrustworthy." This statement pertains to the facts that:

a. the fifty-three "hydrogeologic investigations" conducted by Geoscience provided almost no data on sites of concern to the OCC;

b. the three "detailed studies" conducted by Geoscience were based on questionable discharge volume data and did not represent "worst-case" sites;

c. Geoscience's treatment of the subject of water chemistry was seriously inadequate; and

d. EID had concerns regarding the accuracy of Geoscience's estimation of hydraulic conductivities for the fifty-three sites studied.

I certainly did not intend to imply that Geoscience falsified data nor that Geoscience's collection of data was done in an unscientific or unprofessional manner. The statement summarized EID's concern that Geoscience's data and its conclusions based on that data were of questionable accuracy, incomplete, and could not support a blanket five barrel per day exemption for discharges of produced water into unlined pits. My particular concerns are as follows:

Geoscience's Fifty-Three "Hydrogeologic Investigations"

These "investigations" consisted of one-page data forms and photographs that were made available in a post-hearing submittal. As discussed on page three of my Closing Statement, many of these fifty-three well sites were inactive, outside of the vulnerable area, had lined pits or tanks, or they produced less than one-half barrel per day of produced water. Hence, Geoscience evaluated few sites of concern to the OCC.

Geoscience's Three Monitoring Sites and Discharge Volume Data

The evidence presented at the hearing and in post-hearing submittals revealed a major discrepancy between the discharge volumes cited by Mr. Hicks and those reported to OCD by Tenneco for two of the three sites studied by Geoscience. Official OCD records indicate zero barrels per day discharge at these locations while Mr. Hicks submitted volumes of three and four barrels per day. The third site, the Amoco site, which even Mr. Hicks admitted receives only one-fourth barrel per day, can hardly be considered a worst case.

Geoscience's Inadequate Water Chemistry

Although Geoscience described its three studies as "detailed," it failed to provide even a simple specific conductance test, which takes only moments to perform. Geoscience relied solely on benzene for its treatment of the subject of water chemistry. Chloride and total dissolved solids have been of concern to the OCC for decades, as have the many other regulated parameters found in produced water. EID has grave reservations about generalizing the behavior of all components of produced water from data gathered only on benzene.

Questionable Hydraulic Conductivity Estimation

Mr. Hicks testified that he calculated hydraulic conductivity at sites by visually inspecting the grain size of the material at the bottom of pits, and comparing them to Freeze and Cherry's correlative chart published in their textbook, Groundwater (1979). The article you cited verifying this method was "Transport of Organic Contaminants in Groundwater" published in Environmental Science & Technology v. 19, No. 5, in May 1985. In that article, the authors estimated that groundwater flow-rate can be estimated to within a factor of ten, if the aquifer is uniform sand and gravel, and if the topography is gentle. EID does not believe such conditions are present throughout the vulnerable area, and we therefore question the

appropriateness of this method for calculating hydraulic conductivity in this area.

You stated in the last sentence of the first paragraph of your letter, "Perhaps if OCD and EID had presented some of their data gathered over their many years of study in the vulnerable area, we would be able to better understand the position of the regulatory agencies." These regulatory agencies collected and submitted into the record a wealth of data. The following chart compares the level of detail of chemical analyses provided by various participants in the proceeding.

	Geoscience	Massud Zaman	EID	OCD
Metals and Trace Elements			X	X
Major Ions & TDS			X	X
Aromatic Purgeables		X	X	X
Benzene	X	X	X	X

As you can see, the analyses provided by EID and OCD were far more complete than those of Geoscience.

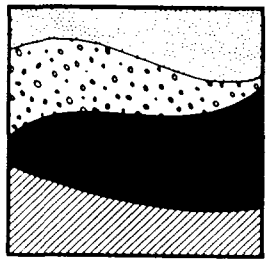
In summary, I stand behind the concerns surrounding Geoscience's data and conclusions which I raised in my Closing Statement. It was not my intent to call into question Geoscience's professional ethics or competency, and I regret that you understood me to have done so.

Sincerely,

JENNIFER J. PRUETT
Division Attorney

cc: Denise Fort, EID Director
Richard Stamets, OCC Chairman

Geoscience Consultants, Ltd.



June 21, 1985

Ms. Jenniffer J. Pruitt, Esq.
Division Attorney
NMEID
P.O Box 968
Santa Fe, New Mexico 87504

RE: Response to NMEID Closing Statement, NMOCC Produced Water Hearing
NMOCC Case # 8224

Dear Ms. Pruitt:

It comes as no surprise that the EID would disagree with conclusions and interpretations of data regarding the small volume exemption provision of NMOCC Case #8224. Geoscience Consultants, Ltd., (who have performed numerous site-specific hydrogeologic and water quality studies in the vulnerable area), other experts in the fields of contamination of ground water by organic species, and industry representatives had hoped to shed some additional light on what you called "the opposite conclusion reached by OCD's and EID's experts who have worked in and studied the vulnerable area and it's characteristics for many years". Perhaps if NMOCD and EID had presented some of their data gathered over their many years of study in the vulnerable area, we would be able to better understand the position of the regulatory agencies.

The purpose of this letter, however, is not to argue the many points in your closing statements which are inaccurate. The purpose of this letter is to bring to your attention one sentence on page 4, which we believe involves, at best, very poor choice of words. On the top of page 4 you state, following a statement about Mr. Hicks' field methods, "EID suggests to the Commission that the data supporting the proponent's Geoscience study is simply incredible and untrustworthy". Upon my reading of that sentence I gain the distinct impression that NMEID is implying to the Commission that the data collected by Geoscience was either falsified or that the studies conducted to collect the data were done in an unscientific and/or unprofessional manner.

500 Copper Avenue N.W. Suite 325, Albuquerque, New Mexico 87102 (505) 842-0001

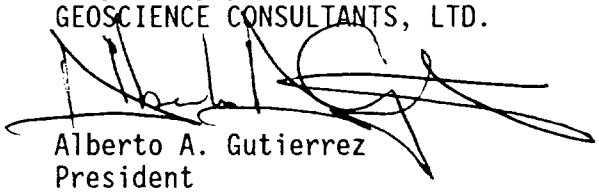
With respect to this issue, I would like to point out to you and especially your technical staff that the usefulness and appropriateness of Mr. Hicks' method of estimating hydraulic conductivity from visual examination of grain size, is verified in an article entitled "Organic Contaminants in Groundwater" which appeared in the May 1985 issue of Environmental Science and Technology written by John Cherry, D. M. McKay and Paul Roberts who are world-renowned experts in the field.

We strongly object to the wording of the portion of your closing statement detailed above which questions our professional ethics and competency. We would like you to clarify the intent of this statement in writing so that we may decide on the appropriate course of action.

We can only hope that in the future (although our respective technical staffs may disagree on technical issues) NMEID will show our experts the same degree of professional courtesy and respect which we have shown NMEID staff by limiting comments to the technical issues without resorting to unfounded and unnecessary slurs.

We look forward to hearing from you.

Very truly yours
GEOSCIENCE CONSULTANTS, LTD.



Alberto A. Gutierrez
President

AAG/pg

cc: R. L. Stamets, Chairman, OCC
D. Fort, Director NMEID

PRUITO1.LTR

TONEY ANAYA
GOVERNOR

DENISE D. FORT
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HEALTH & ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
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May 31, 1985

Mr. Richard L. Stamets
Oil Conservation Commission
P.O. Box 2088
Santa Fe, NM 87501

Re: Oil Conservation Commission Case No. 8224

Dear Mr. Stamets:

Enclosed please find the Environmental Improvement Division's written Closing Statement and proposed Order. As you will recall, EID reserved its Closing Statement at the end of the hearing, in order to have an opportunity to comment on the voluminous post-hearing submittals from witnesses before the Commission. Thank you for your patience in keeping the record open, and in extending to all interested persons the courtesy and time to review thoroughly all evidence and exhibits presented both at and after the hearing before preparing proposed Orders and Closing Statements.

Sincerely,

Jennifer J. Pruett

Jennifer J. Pruett
Division Attorney

JJP:jba

cc: Jeff Taylor, General Counsel, OCD, Santa Fe
W. Thomas Kellahin, Kellahin & Kellahin, Santa Fe
William F. Carr, Santa Fe
W. Perry Pearce, Montgomery & Andrews, Santa Fe

Encl.

STATE OF NEW MEXICO

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION OF NEW MEXICO FOR THE PURPOSE OF CONSIDERING APPLICATION OF THE OIL CONSERVATION COMMISSION UPON ITS OWN MOTION TO DEFINE THE VERTICAL AND AREA EXTENT OF AQUIFERS POTENTIALLY VULNERABLE TO CONTAMINATION BY THE SURFACE DISPOSAL OF PRODUCED WATER, MCKINLEY, RIO ARRIBA, SANDOVAL AND SAN JUAN COUNTIES, NEW MEXICO

Case No. 8224

ENVIRONMENTAL IMPROVEMENT DIVISION'S CLOSING STATEMENT

The charge of the Short Term Produced Water Study Committee was four-fold: 1) to determine what constitutes a vulnerable aquifer, 2) to map the vulnerable aquifer, 3) to determine the probability that unlined pits may contaminate the vulnerable aquifer, and 4) to prepare a recommendation to the Commission for an order addressing the problems identified by the Committee. The Committee completed the first two goals. It's recommendations were not challenged at the hearing, and should be adopted in full as presented to the Commission. However, the Committee found with regard to its third goal that,

> The ultimate disposition of various liquids deposited into unlined pits and a determination of probability an unlined pit may have in contaminating vulnerable aquifers depend on the hydrological, geological, soil and geochemical conditions at the individual pit sites. (RECOMMENDATIONS, WSC Exhibit # 1, p.1).

As a result of the Committee's failure to reach consensus on the probability of contamination from unlined pits, the Committee could not reach a consensus on a small volume blanket exemption for discharges into unlined pits. However, the Committee recommended a number of other exemptions, detailed in Part B of its

Recommendations, which were not challenged at hearing. These exemptions concern pits regulated under other statutory schemes, such as RCRA and NPDES. EID suggests that the Commission adopt these uncontroverted recommendations.

The small volume blanket exemption proved a source of heated debate and conflicting testimony at the hearing. EID submits to the Commission that neither side produced conclusive evidence, either from the laboratory or from the field, which showed that contamination will or will not occur from the use of unlined pits. EID further suggests that the Commission return to the work of the Committee for the response to this lack of conclusive evidence: too many different hydrologic and geologic conditions occur in the vulnerable area for any accurate generalizations to be drawn. Only by a site-by-site analysis can the Commission determine whether small volume exemption will protect groundwater, and thus no blanket exemption is appropriate.

The opponents of any small volume exemption first showed the Commission what components of produced water were of concern, as measured in samples from pits in the vulnerable area. They then, through the use of a simple mixing model, through an infiltration model and by a random walk computer analysis showed that there is every probability that these parameters of concern will reach and degrade groundwater, even where very small volumes are discharged.

Neither opponents nor proponents challenged the Committee's consensus recommendation that unlined pits receiving more than five barrels per day must be banned to protect groundwater. However, the proponents of a small volume exemption suggest an exemption for all volumes under five barrels per day. These proponents promised "real-world" studies and analyses that would clearly contradict the opponents' models and predictions. No such "real-world" studies were presented. The Commission was shown laboratory studies, literature searches and models very

similar to those presented by the opponents which allegedly showed that mechanisms of attenuation would eliminate and prevent any contamination of groundwater from produced water in unlined pits yet the proponents' experts in this area, Drs. Miller and Schultz, have not been to the vulnerable area nor studied its particular produced waters, hydrology or geology in the field. Their opinions that the mechanisms of attenuation will prevent groundwater contamination are less credible than the opposite conclusion reached by OCD's and EID's experts, who have worked in and studied the vulnerable area and its characteristics for many years.

Both sides submitted random walk computer analyses supporting opposite conclusions. It is not surprising that when each side fed the computer its own numbers and data, the computer gave out numbers supporting that side's predictions. However, the proponents claim that the numbers fed in by Mr. Gutierrez are "real-world" data collected at actual field sites. Evaluating Mr. Hicks' data forms for these sites shows the absurdity of this suggestion. Of the 53 data forms which Mr. Hicks made available in a post-hearing submittal, eight represented sites which were never put on line or at which there was no production equipment or no pit. Several were from sites outside the vulnerable area. Excluding those sites and also excluding those sites at which Mr. Hicks noted a tank or liner, only 21 sites remain. Of these, five sites produce one barrel per day of produced water; the other 16 produce less than one-half a barrel per day. Even the opponents of a blanket small volume exemption admit that a half barrel per day may not pose a threat to groundwater. Thus Mr. Hicks' study provides use with almost no data on the sites of concern of the Commission.

In addition, the volume measurements themselves supplied on Mr. Hicks' data forms are not credible. They were not arrived at by scientific "real-world" measurements, but were merely estimated by the operators (who visit sites anywhere

from once monthly to once daily). Hydraulic conductivity for Mr. Hicks' survey was provided by applying visual estimates of the grain size of soil in the pits to a textbook chart. EID suggests to the Commission, that the data supporting the proponents' Geosciences study is simply incredible and untrustworthy.

The suggestion that the study of three sites in the vulnerable area is representative of the 1200 sites located there is ludicrous. Opponents of the small volume exemption have repeatedly asked for the statistical basis for this far-fetched claim, and the proponents have consistently promised to provide one. Not until six days after all post-hearing submittals were to be turned in, and only four days before closing statements and proposed orders are due, has such analysis been forthcoming. EID asks that the Commission not accept such untimely evidence, as neither counsel nor staff have been given adequate time to review and analyze it. Should the Commission decide to accept such evidence, EID would like to point out to the Commission that the analysis addresses only the statistical significance of randomly selecting 53 sites out of a population of 371. The only parameter used in this evaluation is the volume of water reported to be produced by these wells. Justification for the selection of 3 sites for further evaluation is only weakly addressed in the report. The report does not even remotely address statistical analysis of the chemical characteristics of groundwater below 3 sites out of a population of 1200.

In most of the pits visited by Mr. Hicks, he observed parafins and/or hydrocarbons floating on standing water in the pits. Testimony at the hearing raised the concern that without lined pits, any malfunction of the separator will allow large volumes of highly contaminated liquids to be released into the pit. Even the proponents' expert on biodegradation, Dr. Gary Miller, admitted that such an event could overwhelm the mechanisms of attenuation and send the contaminants directly

to groundwater. Accidents can and will occur, and lining these pits will eliminate the possibility of significant contamination from these inevitable malfunctions.

In closing, EID submits that the question before the Commission is not whether contamination is likely from unlined pits of produced water. The bulk of conflicting testimony has shown that a myriad of factors determine whether such contamination will occur. Only a site-by-site analysis can verify the potential for degradation in groundwater. Such studies are prohibitively expensive. The question before the Commission is where should the risk of contamination be placed? EID suggests that the lining of pits is not burdensome to industry, but the risk to the people of New Mexico that any particular site will contaminate groundwater is enormous. Once groundwater contamination occurs, it is tremendously time-consuming and expensive to decontaminate it; groundwater can rarely be returned to its pristine state—some amount of degradation even after treatment and clean up is inevitable. EID believes the Commission should reject the concept of any blanket small volume exemption, or in the alternative, should adopt nothing higher than one-half barrel per day. The permitting process recommended by the Committee provides a mechanism whereby industry may avoid lining pits if it can demonstrate for any particular site that either: 1) the quality of groundwater will not be affected by the produced water, or 2) the soil and geologic characteristics of the site prevent groundwater contamination. Putting the burden on industry to show that any individual pit qualifies for an exemption is entirely appropriate. Such a scheme protects groundwater yet allows industry to avoid lining pits where it is safe to do so, and puts the burden on industry rather than on an already overburdened regulatory agency.

An alternative to the process recommended by the Committee would be the development of a maximum pollutant load for discharges into unlined pits with a minimum depth to groundwater requirement. By such a scheme, industry would be

self-regulating with random checks by OCD. Such a load must consider not only the volume of produced water discharged into the pit, but also a wide range of parameter concentrations. Such a scheme, again, would protect groundwater and would force industry to prove on a site-by-site basis that contamination of groundwater will not occur. Such a site-by-site scheme is mandatory given the wide variety in the vulnerable area of hydrologic and geologic characteristics, volumes of produced waters, and presence and concentration of contaminants.

Respectfully submitted,

for Jennifer J. Pruett
Division Attorney

STATE OF NEW MEXICO

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION OF NEW MEXICO FOR THE PURPOSE OF CONSIDERING APPLICATION OF THE OIL CONSERVATION COMMISSION UPON ITS OWN MOTION TO DEFINE THE VERTICAL AND AREAL EXTENT OF AQUIFERS POTENTIALLY VULNERABLE TO CONTAMINATION BY THE SURFACE DISPOSAL OF PRODUCED WATER IN MCKINLEY, RIO ARRIBA, SANDOVAL AND SAN JUAN COUNTIES, NEW MEXICO.

Case: 8224
Order: R-

ENVIRONMENTAL IMPROVEMENT DIVISION'S
PROPOSED ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing on February 20, 1985, April 3, 1985 and April 22 and 23, 1985 at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico (hereinafter "the Commission").

Now, on this _____ day of June, 1985, the Commission, a quorum being present, having considered the testimony presented and exhibits received at the hearings and being fully advised in the premises,

FINDS THAT:

1. Due public notice having being given as required by law, the Commission has jurisdiction over this cause and the subject matter hereof.

2. The New Mexico Oil and Gas Act in Section 70-2-12.B(15) directs the Commission "to regulate the disposition of water produced or used in connection with the drilling for or producing of oil or gas, or both, and to direct surface or subsurface

disposal of such water in a manner that will afford reasonable protection against contamination with fresh water supplies . . ."

3. The production of oil and natural gas in New Mexico involves the co-production of water (produced water).

4. Constituents of produced water include organic hydrocarbons such as benzene and toluene, chlorides, total dissolved solids, sulfate, heavy metals, arsenic, barium, boron, iron, manganese, cadmium, chromium, lead and selenium; standards for these parameters in discharges to ground water and surface water have been promulgated under the New Mexico Water Quality Act, and under the New Mexico Water Quality Control Commission regulations.

5. The constituents, volume and concentration of produced water fluctuates widely from well to well.

6. In general, the Southeast producing area in Eddy, Chaves, Lea and Roosevelt Counties in New Mexico involves the coproduction of water in higher volumes than does the Northwest producing area in Rio Arriba, Sandoval, San Juan and McKinley Counties.

7. The Oil Conservation Commission has prohibited the disposal into unlined pits of any volume of produced water greater than one barrel per day in the Southeast producing area by an order entered in 1970.

8. Continued unregulation of the disposal of produced water into unlined pits in the Northwest producing area may contaminate ground water.

9. In July, 1984, the Director of the Commission appointed a Short-Term Water Study Committee (hereinafter "the Committee") consisting of representatives from the oil and gas industry, the Oil Conservation Division (hereinafter "OCD") the Environmental Improvment Division, the League of Women Voters, private

environmental groups, concerned citizens, and Indian tribes to study the impact of produced water disposed in unlined pits in the Northwest producing area.

10. The Director asked the Committee to:

a. determine what constitutes a vulnerable aquifer;

b. map the vulnerable aquifer;

c. attempt to determine the probability that unlined pits have or will contaminate the vulnerable aquifer; and

d. prepare a recommendation to OCD for an order addressing any problems identified by the Committee.

11. The Committee held a series of meetings, mapping sessions and field tours to gather data on the geology, hydrology and oil and gas industry in the Northwest producing area, although the Committee neither conducted nor directed any testing or sampling.

12. The Committee reached a consensus on the following definitions and recommendations, which its chairman presented to the Commission at the hearings:

a. In vulnerable areas in San Juan, Rio Arriba, McKinley and Sandoval Counties, oil and gas production operations may contaminate ground or surface water.

b. These vulnerable areas include areas where the depth to ground water is less than 50 feet, the aquifer containing the ground water consists of unconsolidated alluvial fill, and the water is presently used for or could reasonably be presumed to be used for municipal, domestic, industrial, agricultrual or stock watering purposes.

c. An aquifer is defined as a saturated permeable geologic unit (a geological formation, group of formations, or part of a formation) that can transmit significant quantities of water under ordinary hydraulic gradients.

For purposes of this definition, the word significant means that the water from the aquifer is used for or may reasonably be presumed to be useable for municipal, industrial, domestic, agricultural, or stock watering purposes.

d. Vulnerable aquifers are defined as follows:

(1) Unconfined aquifers that are less than 50 feet from the surface, or

(2) Unconfined aquifers in floodplain areas, or

(3) Aquifers in unconsolidated materials.

e. A vulnerable area is an area which lies over or adjacent to a vulnerable aquifer.

f. The following geographic areas are vulnerable areas:

(1) The area within the river valleys of the San Juan, Animas, and La Plata Rivers which is bounded by the topographic line on either side of the river that is 100 vertical feet above the river channel measured perpendicularly to the river channel.

(2) Special areas where ground water is within 50 feet of the ground surface, as follows:

T28N-R 8W, Section 17	T30N-R12W, Section 13
T28N-R11W, Section 18	T30N-R12W, Section 15
T28N-R15W, Section 26	T30N-R12W, Section 27
T29N-R10W, Section 16	T30N-R12W, Section 33
T29N-R12W, Section 24	T30N-R13W, Section 1
T29N-R18W, Section 17	T30N-R15W, Section 6
T29N-R19W, Section 23	T30N-R15W, Section 16
T29N-R19W, Section 30	T30N-R15W, Section 21
T30N-R10W, Section 5	T30N-R16W, Section 29

T30N-R11W, Section 3 T30N-R19W, Section 34

T30N-R11W, Section 7 T31N-R10W, Section 13

T30N-R11W, Section 8 T31N-R11W, Section 35

T30N-R11W, Section 10 T32N-R10W, Section 10

T30N-R11W, Section 19 T32N-R11W, Section 23

T32N-R12W, Section 25

Other areas, discovered subsequently, which are found to have groundwater within 50 feet of the ground surface.

(3) Areas that lie between the rivers and the ditches mentioned below are also special areas:

Highland Park Ditch

Hillside Thomas Ditch

Cunningham Ditch

Farmers Ditch

Halford Independent Ditch

Citizens Ditch

Hammond Ditch

g. A Produced Water Pit is defined as that pit which receives water produced from primary separation in conjunction with the production of crude oil and/or natural gas whether or not such pit is located at the site of production.

h. Ancillary Pits are defined as pits not receiving fluids from primary separation including but not limited to dehydrator pits, tank drain pits, pipeline drip collector pits, blowdown pits, and compressor scrubber pits. Examples are listed below:

(1) Dehydrator Pit: Those pits which normally receive produced water only from the dehydration unit.

(2) Blowdown Pit: Those pits which receive liquid only when a well is blown down.

(3) Tank Drain Pit: Those pits which receive water that is drained from a production storage tank.

(4) Pipeline Drip Collector Pit: Those pits which receive liquids which accumulate in gas pipelines.

(5) Compressor Scrubber Pit: Those pits which receive liquids at the compressor suction in event of a primary separator failure.

i. Disposal of produced water or fluids produced in connection with the production of oil and natural gas, or both, in unlined pits is prohibited, except for disposal of produced water as described herein:

(1) Pits lying outside vulnerable or special areas are exempt from this order.

(2) Ancillary pits within vulnerable or special areas to which the volume of water discharged is no greater than _____ barrel per day are exempted from this order except where the depth to ground water is less than _____ feet in which case all unlined pits are prohibited.

(3) Any pits, ponds, lagoons, or impoundments resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act.

(4) Any pits, ponds, lagoons, or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or NPDES regulations authorized under the Resource Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act.

(5) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan approved and permit issued by the New Mexico Coal Surface Mining Commission under the authority of the Surface Mined Lands Reclamation Act.

13. The Committee could not agree on what, if any, small volume of produced water could be discharged into unlined pits without contaminating ground water in vulnerable aquifers.

14. The Committee recommended that in the event the Commission prohibited the disposal of produced water less than some volume (in barrels per day) into unlined pits, permits nonetheless should be granted at the Oil Conservation Division's discretion, for such disposal based on the depth to ground water beneath such pits and provided that such pits meet the following quality and soil characteristics criteria:

a. Quality Permit: If the operator can demonstrate that the quality of either existing uncontaminated ground water, or produced water is such that the introduction of produced water will not cause degradation of ground water, the unlined pit may be permitted upon application to the NMOCD. The demonstration must include analyses for organic and inorganic parameters as required by the Division.

b. Soil and Geologic Characteristics Permit: If the operator can demonstrate through the use of standard soil analysis parameters (e.g., percolation rates, infiltration rates, particle size/distribution, etc.) that the existing soil and/or underlying geologic stratum exhibit low permeabilities such that the produced water will not cause degradation of the ground water, the unlined pit may be permitted upon application to the NMOCD. This can be accomplished on an areal or site specific basis.

15. The Committee agreed that a compliance schedule of 18 months was a reasonable time period for requiring compliance with its no-pit order, not unduly burdensome to industry.

16. At this time, no cases have been documented which conclusively and directly link an unlined produced water pit to contaminated ground water, although very few field studies seeking this link have been done. The fact that such documentation does not exist does not prove that such contamination does not exist.

17. Expert testimony presenting simple mixing models and sophisticated random walk computer modeling, which models were based on field data collected in the Northwest producing area, demonstrated that the disposal of produced water into unlined pits in the vulnerable area can reasonably be expected to degrade ground water.

18. Most produced water disposed of in unlined pits will enter the subsurface rather than evaporating.

19. The movement of produced water into the subsurface can be quite rapid, and can carry contaminants from produced water to ground water, thus degrading the ground water.

20. Mechanisms of attenuation including volatilization, evaporation, sorption, and biodegradation, can, under some circumstances, slow or reduce the contamination of ground water by organic hydrocarbons in produced water.

21. Even a minor upset at an oil or gas well can release liquid hydrocarbons into the subsurface below unlined pits, which can be expected to overwhelm and eliminate the effects of mechanisms of attenuation.

22. As mechanisms of attenuation are delicate processes which have not been studied in depth relative to their effectiveness in the context of the specific

hydrologic and geologic characteristics of the Northwest producing area, they cannot be reasonably relied on to protect ground water in that area.

23. Evidence from only one field study of produced water disposal sites was presented to the Commission. The sampling was conducted at only three sites, which is not statistically sufficient to be representative of the entire vulnerable area. The study was also grossly inadequate with regard to chemical coverage since not even simple specific conductance measurements were taken. No evidence was presented concerning the volume of produced water disposed of at the three sites, other than estimates which are an insufficient basis on which to conclude the pits themselves, or as representative of all unlined pits, are not and have not contaminated ground water.

24. Witnesses for both opponents and proponents of a "blanket" small volume exemption agreed that disposal of more than five barrels per day of produced water into unlined pits should be prohibited in order to protect ground water.

25. Witnesses for opponents and proponents of a "blanket" small volume exemption disagreed on whether disposal of less than one-half barrel per day of produced water into unlined pits should be prohibited.

IT IS THEREFORE ORDERED THAT:

1. Disposal of produced water in San Juan, Rio Arriba, McKinley, and Sandoval Counties, New Mexico, should henceforth be regulated in such a manner as to afford reasonable protection to fresh water resources.

2. The areas where fresh water is most vulnerable to contamination from unregulated disposal of produced water in the aforementioned counties are those areas where the depth to ground water is less than fifty (50) feet, the aquifer containing the ground water consists of unconsolidated alluvial fill, and the water is

presently used for or is of such quality that it could reasonably be used for municipal, domestic, industrial, agricultural, or stock watering purposes.

3. This area of vulnerable ground water ("vulnerable area") is geographically defined as follows:

a. The area within the river valleys of the San Juan, Animas, and La Plata Rivers which is bounded by the topographic line on either side of the river that is one hundred vertical feet above the river channel measured perpendicularly to the river channel.

b. Parcels outside the above-described area in which ground water is found to be within fifty feet of the ground surface and which also contain oil or gas wells. These areas, referred to as "special areas," are listed below:

T28N-R 8W, Section 17	T30N-R12W, Section 13
T28N-R11W, Section 18	T30N-R12W, Section 15
T28N-R15W, Section 26	T30N-R12W, Section 27
T29N-R10W, Section 16	T30N-R12W, Section 33
T29N-R12W, Section 24	T30N-R13W, Section 1
T29N-R18W, Section 17	T30N-R15W, Section 6
T29N-R19W, Section 23	T30N-R15W, Section 16
T29N-R19W, Section 30	T30N-R15W, Section 21
T30N-R10W, Section 5	T30N-R16W, Section 29
T30N-R11W, Section 3	T30N-R19W, Section 34
T30N-R11W, Section 7	T31N-R10W, Section 13
T30N-R11W, Section 8	T31N-R11W, Section 35
T30N-R11W, Section 10	T32N-R10W, Section 10
T30N-R11W, Section 19	T32N-R11W, Section 23
T32N-R12W, Section 25	

c. Areas that lie between the San Juan, Animas or La Plata Rivers and the ditches mentioned below are also special areas:

Highland Park Ditch

Hillside Thomas Ditch

Cunningham Ditch

Farmers Ditch

Halford Independent Ditch

Citizens Ditch

Hammond Ditch

4. Disposal of water or other fluids produced in connection with the production of oil or gas, or both, onto the surface of the ground or into any pit, pond, lake, depression, draw, streambed, arroyo, or into any watercourse, or into any other place or in any manner as to constitute a hazard to any fresh water supply is hereby prohibited in the vulnerable area as defined in Paragraph (3) above, except as described herein.

a. Pits lying outside vulnerable or special areas are exempt from this order.

b. Pits to which the volume of water discharged is no greater than one-half barrel per twenty-four hour period are exempted from this order.

c. Any pits, ponds, lagoons, or impoundments resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act.

d. Any pits, ponds, lagoons, or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or

NPDES regulations authorized under the Resource Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act.

e. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan approved and permit issued by the New Mexico Coal Surface Mining Commission under the authority of the Surface Mined Lands Reclamation Act.

5. Permits for disposal of more than one-half barrel per day of produced water may be granted at the Oil Conservation Division's discretion provided that the depth to ground water beneath such pits is greater than 10 feet and provided that such pits meet the following quality or soil characteristics criteria:

a. Quality Permit: If the operator can demonstrate that the quality of either existing uncontaminated ground water, or produced water is such that the introduction of produced water will not cause degradation of ground water, the unlined pit may be permitted upon application to the NMOCD. The demonstration must include analysis for organic and inorganic parameters as required by the Division.

b. Soil and Geologic Characteristics Permit: If the operator can demonstrate through the use of standard soil analysis parameters (e.g., percolation rates, infiltration rates, particle size/distribution, etc.) that the existing soil and/or underlying geologic stratum exhibit low permeabilities such that the produced water will not cause degradation of the ground water, the unlined pit may be permitted upon application to the NMOCD.

6. The provisions of this Order shall be effective eighteen months from the date hereinabove set forth.

7. The Commission retains jurisdiction over this matter for entry of additional orders as it deems necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

R.L. STAMETS
Chairman

BEFORE THE OIL CONSERVATION COMMISSION
ENERGY AND MINERALS DEPARTMENT
STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION UPON ITS OWN MOTION TO DEFINE THE VERTICAL AND AREAL EXTENT OF AQUIFERS POTENTIALLY VULNERABLE TO CONTAMINATION BY THE SURFACE DISPOSAL OF PRODUCED WATER IN McKINLEY, RIO ARRIBA, SANDOVAL, AND SAN JUAN COUNTIES, NEW MEXICO

CASE NO. 8224

COMMENTS ON THE HEARING RECORD BY
INTERVENOR CHRIS SHUEY, APPEARING PRO SE

These comments are submitted to the Oil Conservation Commission ("the Commission" or "OCC") by Chris Shuey, an intervenor who appeared for himself during the public hearing held to consider the above-captioned case. The comments are intended only to aid the Commission in reviewing and understanding the testimony pertaining to the Duncan Oil Field Hydrologic Investigation conducted by Mr. Masud Zaman and others, including Intervenor Shuey. A brief section on elements of a proposed order is included at the end of these comments. References to the hearing transcript as presumed to be from the April 3 portion of the hearing, except as otherwise noted.

I. INTERESTS AND STATUS OF THE INTERVENOR

Intervenor Shuey was a member of the Oil Conservation Division's ("the Division" or "OCD") Short Term San Juan Produced Water Study Committee ("the Committee") for the duration of the Committee's activities between July 18, 1984 and January 9, 1985. He attended all meetings of the Committee and its subcommittee on vulnerable aquifer mapping and actively participated in those meetings.

During those meetings, Intervenor Shuey represented Southwest Research and Information Center ("SRIC") by whom he is employed as a research associate for ground water protection. He has represented SRIC in numerous other state and federal regulatory proceedings pertaining to ground water contamination. SRIC, as a not-for-profit educational organization, is dedicated to protecting the quality and quantity of New Mexico's ground water resources.

Intervenor Shuey appeared for himself, and not as a representative of SRIC, during the public hearing on OCC Case No. 8224, because of the Commission's ruling that corporations must be represented by an attorney licensed to practice law in New Mexico. Intervenor Shuey is not an attorney and his employer was not financially able to hire an attorney to represent him at the hearing; therefore, he exercised his constitutional right to represent himself as a taxpayer of the State of New Mexico.

II. FACTUAL BACKGROUND

This proceeding was initiated by the Division after the contamination of a public water supply well in Flora Vista, N.M., was revealed in August 1983. The contamination consisted of oil and grease, phenols and certain metals. A nearby produced water disposal pit was listed as a possible source of the contamination.

In exercising its authority under New Mexico law (Sec. 70-2-12.B.(15), N.M.S.A. 1978) to protect the state's fresh water supplies from contamination resulting from the disposition of water produced or used in connection with the production of oil and natural gas, the Division called a public hearing for June 8, 1984, to determine if the surface disposition of produced water was contaminating fresh water supplies.

Understanding that such a determination would require considerable

scientific study, the Division formed a San Juan Produced Water Study Committee consisting of representatives of its environmental staff, other state agencies including the Environmental Improvement Division, representatives of oil and gas producers in northwest New Mexico, and representatives of environmental and citizen groups.

The Committee agreed at its first meeting on July 18, 1984, after lengthy discussion, to limit its investigation to the existing available data on ground water resources and possible contamination from the disposal of produced water in unlined pits in the four counties of northwest New Mexico. A lack of agency financial resources and time limitations were cited as a reason for the Committee not to conduct site-specific ground water studies around unlined produced water disposal pits.

Over the seven-month period, the Committee developed substantial information on ground water resources in the four-county area, including the location of shallow aquifers (that is, those subsurface water bodies 100 feet or less in depth), the locations of existing ground water use, the locations of existing and past oil and gas development, and the chemistry of produced waters being disposal of unlined pits. The hydrologic information permitted the Committee to identify and define areas of shallow ground water that might be vulnerable to contamination from unlined surface disposal pits. The chemical data permitted the Committee to identify and understand the toxic components of produced water, including a class of hydrocarbons called purgeable aromatic hydrocarbons.

The Committee agreed by consensus to a set of recommendations, which were received into evidence in this proceeding as "Committee Exhibit 1." The recommendations reflect the substantial information base upon which the Committee based its definition of "vulnerable areas." The Committee as a whole

could not agree, however, on an amount of produced water that could be discharged to an unlined surface pit without causing contamination of fresh water resources. As a result, the Committee elected to present its recommendations to the Division without a recommendation for small volume exemptions.

Knowing that the Committee had not investigated ground water conditions around unlined pits in the vulnerable area due to the financial and time limitations discussed above, two members of the Committee agreed independently to conduct such an investigation and present the results of that investigation to the Commission at the hearing. Those individuals were Mr. Masud Zaman, geohydrologist for the Navajo Tribe, Window Rock, Arizona, and Intervenor Shuey. Their investigation spanned two days, February 25 and March 18, 1985. A third member of the Committee, Gary A. Eiceman, Ph.D., of New Mexico State University, agreed to assist in the March 18 phase of the investigation. Being qualified as an expert in geohydrology, Mr. Zaman presented the results of that investigation to the hearing on April 3, 1985.

III. MASUD ZAMAN'S FINDINGS

Mr. Zaman used a slide presentation and 13 exhibits to present the results of his February 25 and March 18 hydrologic investigations at the Duncan Oil Field in Sec. 6, Township 29 North, Range 16 West, San Juan County, New Mexico.

Mr. Zaman explained that he selected the Duncan Oil Field site for his investigations because (1) the site in on the Navajo Indian Reservation and a local chapter of the Tribe had requested the Tribe's assistance in dealing with oil field spills in the area (Transcript at 15, and Zaman Exhibit 1-A), (2) the site was in the vulnerable area as defined by the Committee (Transcript at 26), and (3) the site contained a number of oil wells and produced water disposal pits

(Transcript at 36).

Mr. Zaman testified that he determined that a produced water disposal pit adjacent to Duncan Oil Well 6-11 was unlined because he probed the bottom of the pit and observed no liner (Transcript at 17 and 18). He also testified that he observed a flow of liquid into the pit from a buried separator at the wellhead via a two-inch diameter pipe, and that based on a 24-hour continuous flow, the pit was receiving approximately two barrels of produced water per day (Transcript at 17).

Mr. Zaman testified he dug test pits to determine the depth to ground water at varying distances from the produced water disposal pit on both dates of the investigation (Transcript at 18-22). He presented maps (Zaman Exhibits 5 and 6) showing the locations of those test pits in relation to the produced water pit. He testified that he inspected the study site and its proximity to the flow of the San Juan River and determined that the hypothetic direction of ground water was north-northwest from the produced water pit (Transcript at 22).

Based on water level measurements in the test pits on both dates of the investigation, Mr. Zaman prepared a water level map (Zaman Exhibit 9). The water level map confirmed that ground water flow was north-northwest from the produced water pit (Transcript at 22). Mr. Zaman testified that he assumed the study site was flat because his survey crews were not available on either date (Transcript at 23). He said that "minor variations" in surface elevation of 3 to 6 inches could slightly alter the shape of the contour lines, but not the overall direction of ground water flow as indicated in Exhibit 9 (Transcript at 23 and 43).

Mr. Zaman presented to the Commission Mason jars containing black oily sands he said he collected from test pits on February 25 and March 18. The jars were marked as Zaman Exhibit 11 and entered into evidence. Mr. Zaman opened the jars during his testimony and inferred that the smell in the material in the jars was

the same as the smells he witnessed while digging the test pits in the field (Transcript at 24 and 41). He said those smells resembled the smell of gasoline (Transcript at 19).

Mr. Zaman presented the chemical analyses of samples he took on both dates from the liquid entering the produced water pit, from the liquid in the pit, and from the liquid that entered the test pits (Zaman Exhibit 13). His Exhibit 13 showed analyses for purgeable aromatic hydrocarbons, metals, nitrates and major ions from samples taken February 25 and for purgeable aromatics alone from samples taken March 18.

Mr. Zaman testified that the analyses showed concentrations of benzene above the New Mexico Water Quality Control Commission standard of 10 parts per billion in three of four test pits on February 25, and measured concentrations of ethylbenzene, xylenes, and larger hydrocarbon molecules on the same date. The hearing record shows that such hydrocarbon compounds do not occur naturally (see testimony of David Boyer and Thomas Schultz). While only metaxylene was detected in a test pit sampled by Mr. Zaman on March 18, aliphatic (or "straight-chain") hydrocarbons in concentrations between 100 and 500 ppb were found in samples taken from a test pit on the same date (Zaman Exhibit 13 and Transcript at 31).

Mr. Zaman labeled Total Dissolved Solids (TDS) concentrations from the produced water pit and test pits on Zaman Exhibit 9 and testified that TDS concentrations decreased with distance from the produced water disposal pit. His Exhibits 7 and 8 showed that physical signs of contamination (such as hydrocarbon odors, a black oily staining of sands above the water table, and a black oily film on the water itself) were limited to those test pits down-gradient of the produced water pit. The only exception in the data presented by Mr. Zaman to the conclusion that a plume of contaminants was spreading north-northwest from the produced water disposal pit was a benzene concentration of 100 ppb in an

upgradient test pit on February 25.

As to the possible sources of contamination other than the produced water disposal pit, Mr. Zaman said he inspected the casing of the oil well and observed no signs of leaks at the surface (Transcript at 33). His Exhibit 4 showed that the well was cased with cement for its entire depth of approximately 690 feet (Zaman Exhibit 4, p. 2). Mr. Zaman testified that he observed no reserve pits or mud pits at the site in the location shown on page 6 of his Exhibit 4 (Transcript at 40). According to the exhibit (page 7), no drilling muds were used in completion of the oil well, only water. Mr. Zaman also testified that he observed no leaks in oil pipelines at the study site (Transcript at 40).

Mr. Zaman testified that a small amount (1 milliliter) of cyclohexane, an organic solvent, had been used to rinse the insides of the bottles he used to take the organic samples in during the February 25 phase of the investigation. He stated that the only possible effect the presence of the solvent on the results of the analyses of the samples would be to reduce the reported concentrations of benzene and other purgeable aromatic hydrocarbons.

Based on his investigation at the Duncan Oil Field, Mr. Zaman said he would suggest no unlined pits in the vulnerable area.

IV. DR. EICEMAN'S FINDINGS

Dr. Eiceman, an associate professor of chemistry at New Mexico State University (Transcript at 49), testified as an expert in the chemistry of oil field production at the hearing on April 3, 1985 (Transcript at 49).

Dr. Eiceman testified that he assisted Mr. Zaman and Intervenor Shuey in a hydrologic investigation at the Duncan Oil Field on March 18, 1985 (Transcript at 65). He testified that Test Pits 1, 2, 3, 4, 8 and 9 showed physical signs of

contamination, such as black stained sands and dirt above the water table and black oily film on the water, and that those pits were in the down-gradient direction (north-northwest) from the produced water disposal pit (Transcript at 66 and 70). He further testified that test pits upgradient from the produced water pit (Test Pits 5, 6 and 7) exhibited no such physical signs of contamination.

Dr. Eiceman presented as exhibits gas chromatograms (Eiceman Exhibits 17 through 21) of water samples he collected from the produced water pit and several of the nine test pits. He testified that the chromatograms from the produced water pit samples were similar in shape and pattern to those from the samples of test pit water (Transcript at 67). He stated that benzene, toluene, xylene and alkylated benzenes were present in both produced water and in water from the test pits located down-gradient from the produced water pit (Transcript at 67 and 68). He testified that Test Pits 5, 6 and 7, those test pits which were upgradient of the produced water disposal pit, showed no detectable organic contamination (Transcript at 70).

Dr. Eiceman further testified that volatile hydrocarbons and extractable hydrocarbons were presented in water samples from Test Pit 1, but only volatile hydrocarbons were present in Test Pit 2 (Transcript at 70). Mr. Zaman's Exhibit 9 showed Test Pit 1 75 feet west of the produced water pit and Test Pit 2 150 feet west of the produced water pit. Both locations are down-gradient of the produced water pit.

Dr. Eiceman explained the he observed the concentration of light hydrocarbons (such as benzene) to diminish with distance west, northwest and north of the produced water disposal pit (Transcript at 96) and that those concentrations documented a contaminant plume moving in a direction consistent with that of the ground water flow (Transcript at 97).

Dr. Eiceman presented preliminary calculations showing concentrations of benzene and other purgeable aromatic hydrocarbons in the produced water and water in the test pits (Eiceman Exhibit 22). The calculations, which were based on the chromatograms (Transcript at 78 and 79), showed benzene concentrations in the test pits ranging from just below the regulatory standard of 10 ppb to well above the standard (that is, in the hundreds of parts per billion).

The Commission allowed Dr. Eiceman's exhibits to be received in evidence, but only upon the understanding that they would not be given much weight (Transcript at 98). The objections to the exhibits that were raised by Tenneco's counsel did not include Eiceman Exhibit 22, the calculations of ranges of concentrations in the produced water and water in the test pits at the Duncan Oil Field.

V. MR. MEYERHEIN'S TESTIMONY

Mr. Rick Meyerhein, director of the organics section of the State Laboratory Division, was called as a witness by the Division to attest to the analytical methods used by the State Lab in analyzing samples of produced water gathered by Division staff (Transcript at 99).

Mr. Zaman's Exhibit 13 showed that the samples he collected and had analyzed for organic constitutents had been analyzed by the State Lab. Mr. Meyerhein was asked by counsel for Tenneco and by Intervenor Shuey during cross-examination to comment on the possible effect the solvent cyclohexane could have on organic concentrations in the produced water and test pit water samples taken by Mr. Zaman (Transcript at 106).

In response to those questions, Mr. Meyerhein stated that the U.S. Environmental Protection Agency does not have a standard for cyclohexane in

samples (Transcript at 105), but that rinsing a sample bottle with the solvent was "not unreasonable" to insure that the bottle contained no residual contamination that could affect the reported organic constituents (Transcript at 107).

Asked what effect cyclohexane could have on the organic constitutents reported by the State Lab in Mr. Zaman's samples, Mr. Meyerhein stated that there would be very little effect (Transcript at 106), and if there was, "...the results we reported would be...lower" than reported by the State Lab (Transcript at 110).

VI. TESTIMONY OF DR. THOMAS SCHULTZ

Dr. Thomas Schultz was called as a witness for Meridan Oil Co. to discuss various physical properties that may attenuate or reduce the flow of hazardous substances including hydrocarbons from an unlined produced water into the ground water (Transcript at 144).

Under questioning by Chairman Stamets, Dr. Schultz stated that benzene does not occur naturally in ground water except for perhaps one case near Hobbs. Mr. Stamets then asked, "But in general, if one finds benzene in groundwater as Mr. Zaman has in his pits, then that means that somehow it got there from a disposal pit, a well, something happened to put that benzene in the groundwater" (Transcript at 184). To which Dr. Schultz replied, "Right, if there's no other mechanism, that's correct."

Under later questioning by Intervenor Shuey, Dr. Schultz inferred that the absence of benzene in a test pit water sample does not necessarily mean that benzene is not in the ground water between the test pit and the produced water pit, especially when benzene was detected in the produced water in the unlined

disposal pit:

> Mr. SHUEY: Do you have any reason to believe that benzene in measurable concentrations is not in the groundwater between the produced water pit and Test Pit 1 on the second page of Masud Zaman's Exhibit Thirteen?"
>
> DR. SCHULTZ: It's there at some point in some concentration." (Transcript at 216).

VII. IMPLICATIONS OF MR. ZAMAN'S TESTIMONY FOR THE COMMISSION'S DECISION IN THIS CASE

Mr. Zaman's testimony, and that of Dr. Eiceman, Mr. Meyerhein, and Dr. Schultz as related to Mr. Zaman's evidence, is important for the Commission to consider as it reaches a decision in this case. The significant questions raised by Mr. Zaman's testimony are (a) was contamination of ground water demonstrated? (b) if there was contamination, was an unlined pit the reasonable source of that contamination? and (c) if the pit was the source, to what extent can the Commission rely on the testimony to order a prohibition of less than 5 barrels of produced water per day in unlined pits?

In view of the evidence, Intervenor Shuey submits that Mr. Zaman indeed found ground water contamination and that that contamination could reasonably be connected to the unlined produced water disposal pit. If the Commission agrees, it can use that evidence as substantial support for a rule banning the disposal of 2 barrels of produced water per day.

A. MR. ZAMAN AND DR. EICEMAN SHOWED EVIDENCE OF GROUND WATER CONTAMINATION AT THE DUNCAN OIL FIELD

As shown in Section III of these comments, Mr. Zaman presented data showing concentrations of benzene in ground water that exceed the state standard. Mr. Zaman also presented data showing the presence of other aromatic hydrocarbons and unknown aliphatic hydrocarbons in ground water. The presence of benzene and those

other organic compounds is evidence by itself of contamination, inasmuch as those compounds do not occur naturally. Mr. Boyer and Dr. Schultz have testified that those compounds do not occur naturally.

Dr. Eiceman presented data (Eiceman Exhibit 22) that showed a range of benzene concentrations in ground water, most of which exceeded the state numeric standard. Those concentration ranges were calculated based on analytic results that were produced by accepted laboratory methods of detecting organic compounds in liquids.

Mr. Meyerhein's testimony demonstrated that the presence of cyclohexane in Mr. Zaman's February 25 samples did not significantly alter the reported organic concentrations, and if it did, the concentrations were likely to be greater than reported because of the penchant for benzene being absorbed by the cyclohexane.

B. MR. ZAMAN'S TESTIMONY DEMONSTRATES THAT AN UNLINED PRODUCED WATER PIT CONTAMINATED THE FRESH WATER SUPPLIES OF AN AREA IN NORTHWEST NEW MEXICO

Taken as a whole, Mr. Zaman's testimony supports a conclusion that the unlined produced water pit at Duncan Oil Well 6-11 contaminated shallow ground water in the area of the study. That conclusion can be reached on the basis of several reasons.

First, Mr. Zaman showed, with one exception, a plume of contaminants emanating from the produced water pit and traveling in the same direction as the flow of ground water. The organic constituents, nitrates, and general chemistry data generally showed decreasing concentrations with distance from the pit, except in only three samples.

Dr. Eiceman's data corroborated Mr. Zaman's data. Dr. Eiceman found organic constituents in test pit water very similar to those in produced water in the adjacent unlined pit. Additionally, the concentrations of those constituents

decreased with distance from the produced water pit. Dr. Schultz suggested (Transcript at 216) that benzene had escaped from the produced water pit and was present in the ground water between the produced water pit and the down-gradient test pits.

Second, Mr. Zaman investigated most other possible sources of contamination and concluded that none posed as great a potential for contaminating ground water as did the produced water pit. He testified that the oil well was cased in cement to the producing zone. He testified that he observed no surface spills of petroleum products either from the wellhead, pipelines, or the buried separator. His slides showed no leaks from the backhoe. And his exhibit on the oil well itself (Zaman Exhibit 4) showed that no drilling muds were used to develop the well in September 1975.

Those personal observations and studies of Mr. Zaman have far more weight than Randy Hicks's speculation that some other source than the produced water pit could explain the presence of ground water contamination at the site (see Transcript of April 22 at 122). Mr. Hicks did not visit the Duncan Oil Field nor conduct the visual inspections Mr. Zaman did.

Third, Mr. Zaman brought to the hearing photographic and physical evidence from his investigation. His slides of the study area, the produced water pit, and the physical contamination of sands and water in the test pits on both dates of the investigation were compelling proof of the contamination he found. His Mason jars containing oily black sands extracted from his test pits filled the hearing room with gasoline-like odors -- the same odors Mr. Zaman testified that he smelled in the field.

Mr. Zaman readily admitted that he made some mistakes in his study, but pointed out that those mistakes were not sufficient to alter the analytic results or the hydrologic findings. He had nothing to hide and no reason to hide it

because the facts would speak for themselves. He was willing to let the Commission judge the quality of his study as any "reasonable man" would.

C. THE COMMISSION CAN CONSIDER MR. ZAMAN'S TESTIMONY AS SUBSTANTIAL EVIDENCE IN THIS CASE

If the Commission agrees that Mr. Zaman's study discovered ground water contamination that can reasonably be connected with leakage from an unlined produced water disposal pond, it can use that evidence to support an order banning disposal of less than 5 barrels of produced water per day in unlined disposal pits. The Commission is reminded that Mr. Zaman showed an adverse affect to ground water from a pit receiving at the maximum 2 barrels of produced water daily. Mr. Zaman was convinced, based on his investigation and his years of experience as a geohydrologist with the federal government and now the Navajo Tribe, that the contamination at the Duncan Oil Field was significant enough to warrant his recommendation for no disposal in unlined pits.

Intervenor Shuey suggests that Mr. Zaman's evidence, coupled with the calculations performed by David Boyer and Doug Earp, provides a basis for the Commission to take action to prevent contamination of ground water in the four counties of northwest New Mexico. Contrary to Mr. Kellahin's numerous statements at the beginning and end of the hearing that the Commission only had evidence sufficent to support a ban of 5 barrels or more, the evidence placed in the record by supporters of the Division's position demonstrates clearly that contaminants can move from the surface to the water table under a variety of field conditions, and, at least in one case, they already have.

VIII. CONCLUSIONS

Ground water protection policy in New Mexico and throughout the U.S. has evolved considerably in recent years. As more detailed scientific evidence has accumulated, and additional cases of ground water contamination discovered, regulators have increasingly moved toward a posture of attempting to prevent contamination before it happens.

In this case, the Commission heard extensive testimony about physical and chemical factors that retard or prevent the movement of contaminants from unlined disposal pits into the ground water. Mr. Hicks testified that he believed that the absence of large concentrations of benzene in his monitoring wells confirmed the findings of Dr. Schultz and Dr. Gary Miller regarding attenuation factors and biodegradation (see, for instance, Transcript of April 22 at 155).

Mr. Boyer readily admitted in his testimony his understanding that physical factors work to retard contaminant movement into the ground water. But he also noted that there is great uncertainty about the mechanics of attenuation and biodegradation -- a fact admitted by Dr. Miller and even the authors of some of the papers he referenced -- and that prudent ground water protection ppolicy mandates taking affirmative preventive action before contamination occurs.

Intervenor Shuey has appended to these comments a recent technical paper on organic constituent movement in ground water (Joan M. Newsom, "Transport of Organic Compounds Dissolved in Ground Water," Ground Water Monitoring Review, Spring 1985). As noted by Mr. Boyer, Dr. Schultz and Dr. Miller, biodegradation and other attenuation factors have been found to retard the movement of organic compounds in ground water.

But even in the face of positive evidence, the author makes several cautionary statements, including:

> "In some cases, however, the degradation products could be as toxic or worse than the original compound...Limitations include the difficulty of managing environmental parameters that promote biodegradation and the difficulty in maintaining biodegradation as environmental conditions." (page 34)
>
> "The field conditions under which biodegradation of different compounds is promoted is not well understood." (page 34)
>
> "The mechanisms of adsorption and biodegradation are not well enough understood to model satisfactorily." (page 35)

The author makes a very compelling conclusion for adopting -- as the Commission as the authority to do under the Water Quality Act (74-6-4.D., N.M.S.A. 1978) -- a conservative approach to ground water protection given the uncertainties involved in assessing organic constituent movement in ground water:

> "Although the technology may exist to clean up polluted ground water and pollution sites, the costs are often high. A water policy is needed to encourage prevention and set priorities for what should be cleaned up. The cost of cleanup can be several orders of magnitude larger than that of preventive measures." (page 35)

IX. THE COMMISSION'S ORDER

In fashioning an order based on the hearing record, the Commission should include all of the recommendations of the Water Study Committee including those pertaining to definitions of the vulnerable area and the various types of pits present at oil and natural gas well sites. The Commission should use its best judgment in reaching a decision on the amount of produced water that can safely be disposed of in unlined pits.

The undersigned wishes to congratulate the Division and the Commission on its response to the potential problem of ground water contamination from unlined disposal pits, and promises to continue to be involved in the matter as the agency

pursues additional technical and field studies.

Respectfully submitted,

Chris Shuey
1804 Silver SE
Albuquerque, NM 87106

ATTACHMENT 1

Transport of Organic Compounds Dissolved in Ground Water

by Joan M. Newsom

Abstract

Organic compounds, such as trichloroethylene (TCE) and chlorobenzene, that have been found in drinking water supplies are of public concern because they are possibly carcinogenic. These substances can now be routinely detected in trace amounts with gas chromatograph mass spectrometers. There are some polar organic compounds, which are not detectable individually by common methods and therefore little is known about them.

The transport of organic compounds is more difficult to predict than the flow of ground water because:

- Trace amounts of pollutants are difficult to measure
- Transport is complicated if the compound is partitioned into several phases
- The concentration of organics in ground water may vary due to aquifer heterogeneity and other hydrologic factors
- Reactions with other organic compounds and reactions with the aquifer material (such as adsorption) may affect the mobility of the organics
- Biodegradation may also affect net transport.

Adsorption is a factor in the attenuation of non-polar organics in aquifers with significant organic content (>0.1 percent organic carbon). The organic material adsorbs the non-polar organic chemicals. The mobility of a pollutant in such an aquifer depends on at least two parameters: the levels of dissolved organic matter and the content of organic carbon in the aquifer material. The partition coefficient of the chemical pollutant between the aquifer and water is commonly calculated as a function of the organic content of the aquifer and the partition coefficient between octanol and water.

Field and laboratory results reported in the literature indicate that the following organic compounds may be biodegradable under aerobic conditions: alkyl benzenes and chlorobenzenes. Under anaerobic conditions halogenated aliphatics, alkyl benzenes, several pesticides and phenolic compounds may be biodegradable. Halogenated aliphatics appear not to degrade under aerobic conditions and non-chlorinated aromatics and chlorobenzenes appear not to degrade under anaerobic conditions. Alkyl benzenes biodegrade more rapidly than their halogenated counterparts.

Introduction

Pollution of ground water by organic compounds is an important area of public concern, and hydrogeologists are increasingly required to evaluate hydrocarbon contamination in the subsurface. The methods of analysis have improved in recent years such that concentrations of less than one microgram per liter (μg/L) can be determined. The ability to measure more organic compounds, especially polar organics, will increase the number of different contaminants detectable in water.

Some of the organic compounds found in water are believed to be harmful in trace amounts. The health risks of the synthetic organics, however, are difficult to determine mainly because of the uncertainty in extrapolating the results of laboratory carcinogen tests on lab animals to humans. The health risks are not likely to become known very rapidly. References on health aspects of synthetic organics are found in Pearson (1982a, 1982b), and Merian and Zander (1982).

Man-made hydrocarbons are used in a wide range of industries and in household products. They are for the most part a product of technology used since the 1940s. Their solubility in non-polar substances and poor solubility in water account for their common and widespread use as degreasers. Trichloroethylene (TCE) is used, for example, to clean oil from industrial machines, to wash oils from airport runways, and to remove grease from clothes in dry cleaning.

Definitions

Hydrocarbon compounds, also called organic compounds, are composed of hydrogen and carbon. Aliphatic hydrocarbons are a group of hydrocarbons in which the carbon atoms are joined to form open chains. Aromatic hydrocarbons usually have structures that contain at least one benzene ring. Monocyclic aromatics, such as alkyl benzenes, have one ring. Polynuclear hydrocarbons possess more than one ring. This class of hydrocarbons can be divided into two groups. In the first, the rings are fused, which means at least two carbon atoms are shared between adjacent rings, e.g., naphthalene. In the second group, the aromatic rings are joined directly or through a chain of at least one carbon atom, e.g., biphenyl.

Many of the organic pollutants are halogenated;

that is, they contain halogen atoms in their molecular structure. Chlorine, bromine and fluorine are the most common halogens. Examples of halogenated aliphatics found in ground water include: trichloroethylene ($C1CH{:}CC1_2$, commonly abbreviated TCE), which contains two carbon atoms joined by a double bond; 1,1,1-trichloroethane (CH_3CC1_3), which contains two carbon atoms joined by a single bond; and tetrachloroethylene ($C1_2C{:}CC1_2$, commonly abbreviated PCE), which contains two carbon atoms joined by a double bond. Trihalomethanes (THMs) are a subgroup of the halogenated aliphatics that contain three halogens in the methane (CH_4) molecular structure. Examples include chloroform or trichloromethane ($CHC1_3$), bromoform or tribromomethane ($CHBr_3$), and dibromochloromethane ($CHBr_2C1$). Halogenated aromatics found in ground water include: chlorobenezene ($C1C_6H_5$), dichlorobenezene ($C1_2C_6H_4$, abbreviated in this paper, DCB), and trichlorobenzene ($C1_3C_6H_3$, abbreviated in this paper, TCB).

Hydrocarbon compounds can also be generally divided into polar and non-polar groups. Polar molecules are electrically neutral molecules with concentrations of negative charge in one part of the molecule and of positive charge in another, producing an electric dipole.

Occurrence of Organic Pollutants in Ground Water

The extent of ground water pollution by organic compounds is difficult to estimate both for a given aquifer and in general. Specific studies are difficult to compare because of variations in analytical sensitivity and differences among the compounds studied. Even for a given aquifer, the extent of ground water pollution by organic compounds can only be estimated because such a small fraction of the ground water is usually sampled.

There are many sources of organic pollution. Contaminants may reach the aquifer by way of precipitation, by seepage of pesticides and herbicides from the surface, from pollutants in sanitary landfills, waste storage ponds, polluted streams and lakes, and from accidentally or deliberately spilled material. Organic pollution is found both in industrial areas and in rural areas.

Man-made compounds pose a ground water pollution problem in industrialized countries. One or two percent of ground water supplies in the United States are polluted based on estimates of point sources, but only a fraction of these are contaminated primarily by organic pollutants (Pye and Patrick 1983). The compounds that occur most frequently in ground water in the United States are the trihalomethanes (THMs), which are the halogenated organics produced by chlorination of water containing humic materials (Bouwer et al. 1981). The problem of THMs, such as chloroform, has received considerable attention beginning in 1974 and the maximum contaminant level allowed by the EPA is 100 μg/L total THMs (Cotruvo 1981).

The extent of ground water pollution by organics in the Netherlands was measured by sampling all 232 ground water pumping stations in the Netherlands between 1976 and 1978. The samples from 54 of the 232 locations, 25 percent of the locations, contained concentrations >0.1 μg/L of chlorinated hydrocarbons with 1 or 2 carbons (e.g., TCE) (Zoeteman et al. 1981). The Netherlands is at the end of the Rhine River and receives pollutants from countries upstream. The compounds detected most frequently at concentrations greater than 0.01 μg/L in Dutch ground water include: TCE (67 percent), chloroform (60 percent), tetrachloromethane (43 percent), PER (19 percent), and 1,1,1-trichloroethane (17 percent). These compounds are on the Environmental Protection Agency list of priority pollutants. The concentrations at higher levels (>10μg/L) could always be associated with a specific source, i.e., local waste dumping. Concentrations at low levels (0.01 to 0.1 μg/L) may be due to volatile organics in rain water. Levels of substances such as chloroform and TCE are less than 1 μg/L in rain water in the Netherlands.

Measurements of Organic Pollutants

Accurate measurements of the concentrations of organic pollutants in ground water are essential for understanding the behavior of the pollutants in aquifers. The problems of sampling an aquifer are especially severe for volatile organics, which are easily lost to the atmosphere (e.g., Pankow et al. 1984). Problems can arise from the type of well construction and the type of casing used. A study of the leaching of trace organics (0.5 ppb naphthalene and 0.5 ppb p-dichlorobenzene) into water from five common plastics used in well casing showed the following results: Teflon® (no leaching detected), nonglued PVC (0 to 0.1 ppb), Polyethylene (0.1 ppb), Polypropylene (0.5 ppb), glued PVC (0.5 ppb), and Tygon (1.0 ppb) (Curran and Tomson 1983).

Analytical results may be suspect because of the difficulty of analyzing water for trace concentrations of organics. In a comparison of analyses among certified private, state and university labs, large variations were reported even for relatively simple measurements of total dissolved solids (Keith et al. 1983). The following procedures were used to control the analytical precision and accuracy during an extensive investigation of a PCB spill site (Roberts, Cherry and Schwartz 1982). The concentrations of PCBs were determined by several analytical techniques. A standard with PCB concentrations similar to the samples being analyzed was run approximately every ten samples. Blanks were run during a switch from analysis of high PCB concentrations to low concentrations to ensure that the residual response of the system had returned to background levels.

The occurrence of some polar organic compounds in ground water has been much less studied than that of non-polar organic compounds. Very little is known about their health risk or their occurrence because they cannot be easily isolated and measured. The group parameter TOX (total organic halogen) provides a measure of the total amount of halogen in organic compounds and is determined by concentrating the organics by adsorption, and measuring halogen concentrations by titration, specific ion electrodes, or microcoulometer. TOX analyses are both relatively simple and quick compared to gas chromatography. The more polar, non-volatile and high molecular weight halogenated hydrocarbons presently can be detected by TOX and not by GC/MS (Jeckel and Roberts 1980). Field studies have shown that the TOX concentration is several times larger than the sum of halogenated organic compounds by gas chromatographic determination (Roberts, Schreiner and Hopkins 1982).

Transport Processes

Advection and Dispersion

The mechanisms of advection and dispersion have an important control on the transport of organic pollutants. Total solute flow in porous media is composed of the portion that travels with the average ground water flow (advection) and the portion that deviates from the average ground water flow (dispersion). Dispersion causes a dilution of the solute concentration and a spreading of the contaminated area. Seen as a plot of concentration vs. the time to reach an observation point, dispersion causes the S-shaped breakthrough curve to broaden. The characteristic length of the porous medium, which is known as the dispersivity length, when multiplied with the ground water velocity, has been shown in the lab to yield the dispersion coefficient. This coefficient is used to determine the flux due to dispersive effects (Anderson 1979).

There are two types of dispersion: dispersion that occurs at the pore scale (microdispersion) and dispersion that occurs at the field scale due to aquifer heterogeneity (macrodispersion). Microdispersion is usually of not much significance for transport in relatively fast-flowing ground water. On the other hand, microdispersion and molecular diffusion are important in underground waste isolation site studies. Macrodispersion is significant due to the heterogeneity of the aquifer (e.g., Sudicky et al. 1983).

Lab dispersivity measurements do not agree with dispersivity measurements determined by field tracer tests because of scale factors. Lab measurements of dispersivity values for calculating microdispersion consist of determining breakthrough times at the outlet of cylindrical columns packed with porous media and then using the solute transport equation to determine dispersivity values. The field measurements of longitudinal dispersivity (in the direction of flow), which are on the order of 10 to 100m, are at least three orders of magnitude larger than lab measurements, 10^{-4} to 10^{-2}m (Anderson 1979). Field tracer tests show that longitudinal dispersivity is not constant for a given aquifer, but increases as the distance between the injection and observation well is increased. At some point, dispersivity stops increasing. This increase in dispersivity with increased travel distance or travel time of the solute is referred to as the scale effect in the literature (e.g., Molz 1983; Sudicky et al. 1983).

The cause of the variable dispersivity is the heterogenity of the aquifer, leading to anisotropic distributions of horizontal hydraulic conductivity. Field data indicate that most compounds prefer to travel through more permeable pathways, such as through gravel lenses. The variation in concentration due to heterogeneity of the aquifer causes the distribution of the compound in a horizontal sense to sometimes deviate from the theoretical plume shape derived for homogeneous aquifer characteristics (e.g., Sudicky et al. 1983).

The problem of aquifer heterogeneity is as important on a vertical scale as on a horizontal scale. Field data have shown that when chemicals enter the aquifers do not mix to the full vertical extent of the ground water and are influenced by aquifer heterogeneities and density effects (Sudicky et al. 1983; Rea and Upchurch 1980; Schwartz et al. 1982). Even though some of the data in these studies are for ions and not organic compounds, one would expect the principles to apply.

Organic pollutants dissolved in water [illegible] from the Glatt River into the upper approximately 9m of a 20m thick Quaternary glaciofluvial valley fill aquifer composed of sand and gravel (Schwarzenbach et al. 1983). The contaminated water was detected several kilometers from the Glatt River in the upper half of the aquifer, while water in the lower half originated from less polluted sources. Monitoring of a PER-spill in glacial deposits in Michigan showed that the PER (density = 1.62 g/cm^3 at 20 C), which was well below saturation, migrated downward as it traveled away from the source (Minsley 1983).

Adsorption

Most aquifers have less than 0.1 percent organic content. Quantitative relationships have not been well established between sorption and the controlling factors, although the specific surface area and the nature of the mineral surface influence the degree of sorption. Some adsorption of non-polar organic compounds was experimentally observed in columns containing materials that contain no organic carbon, such as clean sand, limestone and montmorillonite clay (Schwarzenbach and Westall 1981a). Sand and gravel aquifers are likely to contain insignificant amounts of organic matter, although this parameter is usually not measured. The aquifer near the Glatt River in Switzerland, for example, contains less than 0.1 percent organic content (Schwarzenbach et al. 1983). The retention of hexachlorobenzene, for example, was small between the aquifer next to the Glatt River and observation wells, which are up to 120m away from the river, despite the fact that hexachlorobenzene has a high log Kow of 6.06, and therefore, would be expected to be strongly retained in an aquifer with significant carbon content. The mobility of hexachlorobenzene indicates the low sorption capacity of sandy gravel aquifers with insignificant organic content (Schwarzenbach et al. 1983).

Aquifers comprised of deposits where former living matter is likely to have accumulated, such as from peat deposits, slow-moving streams, lakes or bogs, tend to have significant organic content. Studies have shown that at least 0.1 percent carbon content in the aquifer (0.001 g of organic carbon per gram sorbent) is needed for carbon adsorption to be significant (e.g., Schwarzenbach and Westall 1981a). Instead of solubility, the octanol:water partition coefficient (Kow) is often used as a measure of the partitioning of pollutants between water and organic phases. The Kow is the ratio of the concentration of a compound in octanol, a readily available alcohol that is relatively non-polar, to that in water. An inverse correlation between log Kow values (ranging between 1 and 6) and log solubility values, ranging between -3 to 5 in mg/L, has been found for non-polar organic compounds (Mackay 1980; Zoeteman et al. 1981). Kow values are also used to predict the partitioning behavior of compounds into soil that contains organic matter, as well as into the fat bodies of fish and other biota. Measured values of Kow can be found in: Chiou, Porter and Schmedding (1983); Banerjee, Yalkowsky and Valvani (1980); Kenaga and Goring (1980); and Hutzinger (1982); and estimated Kow values are found in Hansch and Leo (1979); and Leo, Hansch and Elkins (1971). In addition, chemical properties of organic compounds can be found in Verscheuren (1983), Hutzinger (1982, 1980), Weast and Astle (1982).

An example from California illustrates how the order of breakthrough of several organic compounds correlated with solubility and Kow such that the compounds that appear first have the highest solubility and lowest Kow. The order of appearance at an observation well 11 m downstream from the injection well from first to last to appear was: chloride, chloroform, bromoform and dibromochloroform, 1,1,1-trichloroethane and chlorobenzene (Roberts, Schreiner and Hopkins 1982).

In another example from western Canada, TCB concentrations increased relative to that of PCB with depth as shown by the increase in the 1,2,4-TCB/PCB ratio from 0.02 in the surface fill to 0.19 in the underlying Regina clay (Roberts, Cherry and Schwartz 1982). The log Kow of 1,2,4-TCB is 4.05 (Leo, Hansch and Elkins 1971) while that of 2,4,5,2',4',5'-PCB is 6.72 (Schwarzenbach and Westall 1981a). The increased mobility of TCB is reflected by the lower Kow. Other indications of greater mobility are higher solubility, lower molecular weight and fewer chlorine atoms in the molecular structure in TCB compared with PCB.

Useful relationships have been found between the adsorption behavior of a pollutant and its Kow value and the organic content of an aquifer. Preliminary work indicates that the partitioning behavior of a pollutant and its residence time can be calculated for aquifers containing sufficient organic material. Karickhoff et al. (1979) demonstrated that the degree to which a compound is adsorbed in a soil, as measured by the partition coefficient (Kp), depends on the Kow and the "fraction organic content" (foc) of the soil by the relation:

$$Kp = 0.63\ foc\ (Kow) \qquad (1)$$

The equation was developed by examining the adsorption of 10 organic pollutants, whose log Kow ranged from 2 to 6, in river and pond sediments whose foc ranged from 0.1 to 3.3 percent. This equation applies when the pollutant concentration is less than half of the solubility limit in water. Based on surface and aquifer sediments, whose foc is greater than 0.001, Schwarzenbach and Westall (1981a) derived a similar equation:

$$Kp = 3.2\ foc\ (Kow^{0.72}) \qquad (2)$$

This equation is also valid only for low concentrations of the pollutant. Means et al. (1980) derived a similar equation for PAHs. Figure 1 illustrates the relationship described by Equation 2 for four chlorinated benzenes with different Kow coefficients. The equations establish the similar dependence of the parameters foc and Kow on the partition coefficient between soil containing organic matter and water. These equations apply only for non-polar substances in material with greater than 0.1 percent carbon. Kow provides a better estimate of sediment-water partitioning than does solubility, which gives at best an order of magnitude estimate of the partitioning behavior of a chemical in the organic fraction of the sediment medium (Karickhoff et al. 1979).

Schwarzenbach and Westall (1981a) found that more than 85 percent of the adsorption of the pollutants took place on particles of size less than 0.125mm (fine sand) and Karickhoff et al. (1979) observed that most of the adsorption took place on the particle fraction smaller than 0.05mm (silt or clay). More organic

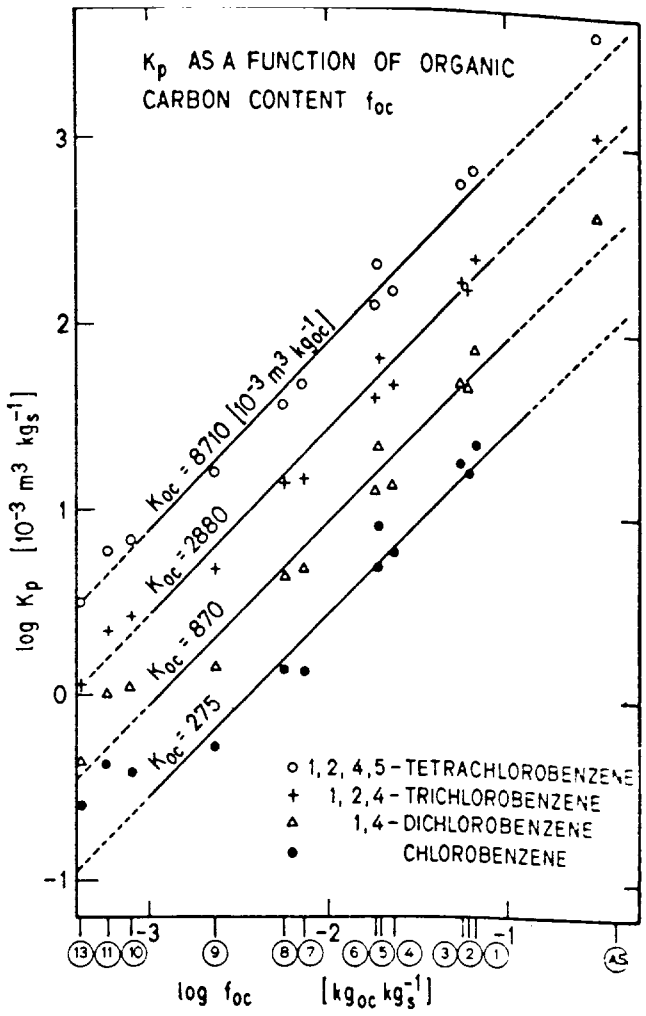

Figure 1. The sorbent to water partition coefficient (Kp) as a function of organic carbon fraction (foc) for four chlorobenzenes (Schwarzenbach and Westall 1981b). Koc is the partition coefficient based on organic content and Koc = Kp/foc. The circled symbols indicate the sorbents on which the data were obtained: AS, activated sludge; 1, 4, sea sediments (coastal zone); 2, detritus 3 5 lake sediments; 6, 8, river sediments; 7, 9, 10, 11, 13, aquifer material.

compounds were sorbed on the finer particle size fraction of sediments than on the coarse fraction principally because of the higher organic content as well as the larger surface area. Differences in sorption between silt and clay fractions depend on differences in foc rather than in sediment size (Karickhoff et al. 1979). Organic compounds also partition onto dissolved organic matter, such as fulvic and humic acids, such as in organic-rich water in landfill leachates (Cherry et al. 1984).

A pollutant that is adsorbed travels slower than the water containing the pollutant. The travel time of the solute divided by the travel time of the fluid is known as the retardation factor or the relative residence time (tr), which based on Equation 1 is:

$$tr = 1 + 0.63\ foc\ (Kow)\ \rho/\epsilon$$

where

ρ = average bulk density (g/cm^3)
ϵ = soil void fraction (unitless)

(Roberts, Reinhard and Valocchi 1982)

A comparison among tr values, which are dimensionless, calculated from the equation and those derived from the field show that tr values diverge for increasing values of Kow. The tr values are 5 (field) and 6 (equation) for chloroform; 36 (field) and 41 (equation) for chlorobenzene; and greater than 200 (field) and 140 (equation) for 1,4-DCB (McCarty et al. 1981). Kow values for these three compounds are 93, 692, and 2,400 respectively and the calculations are based on an average bulk density of 2 g/cm^3, $\epsilon = 0.22$, and foc = 1 percent carbon (McCarty et al. 1981). Schwarzenbach et al. (1983) derived a similar equation but did not make a comparison with field results.

The common method of modeling the effects of sorption on solute transport is to assume that the solute and sorbent react in instant equilibrium, i.e., no kinetic effects, that the ratio of the sorbed solute to the solute dissolved in water is constant, i.e., linear isotherm, and that adsorption and desorption is a reversible process. The above equations are based on these assumptions.

Formulas for the calculation of limiting kinetic effects, non-linear isotherms and unequal sorption/-desorption behavior are given in Miller and Weber (1984). Kinetic effects are important when the ground water velocity is too fast to allow equilibrium and the above equations are no longer valid. The ground water flow rate (approximately 0.014 cm/s) close to the Glatt River during storm water events was probably fast enough for kinetics to affect the transport of pollutants in the aquifer. Kinetic effects are also important when contaminants are newly introduced to a ground water system and when spike or plug contamination sources are appropriate. Under these conditions less material is sorbed onto the aquifer media and the material that is not sorbed travels farther. Kinetic effects were observed in column experiments when water containing chlorinated benzenes flowed through a column at a rate of 0.01 cm/s (Schwarzenbach and Westall 1981a, 1981b), which is well within the range of typical ground water velocities. The breakthrough times were faster than the breakthrough times of the same column experiment conducted at a velocity of less than 0.001 cm/s. The results of the column experiment at the slower rate (0.001 cm/s) matched those of an 18-hour long equilibrium batch experiment indicating that sorption equilibrium occurred at the slower rate.

Although numerous studies have shown that trace levels of dissolved organic compounds follow linear isotherms, one exception are trace levels of PCBs (Cherry et al. 1984). Non-linear isotherms are most likely to occur when the concentration of the dissolved solute nears the solubility limit. For example, at low concentrations (well below the solubility limit) pesticides showed linear isotherms, but at high concentrations several organic pesticides have very non-linear isotherms (Cherry et al. 1984).

An important source of data on adsorption is the treatment of waste water by artificial recharge of an aquifer. The advantage of studies on waste water recharge is that the rate and length of time that a contaminant was injected or allowed to infiltrate into the aquifer is known, in contrast to most pollution studies.

In one study, approximately 92 percent of the organics were removed from the waste water (Tomson et al. 1979). The highest initial concentration was only 4.05 μg/L and the range in final concentrations was between 0.1 to 1 μg/L. Most removal rates for the 11 classes of compounds studied were between 90 to 100 percent, which included chloroaromatics and alkoxyaromatics, alkyl benzenes, naphthalenes, alcohols, ketones, indoles and indenes. Those groups whose removal rate was below 90 percent include the alkylphenols (85 percent), alkanes (71 percent), and chloroalkanes (70 percent) and phthalates (2 percent). The phthalates was the only group not to exhibit a dramatic decrease in concentration, and it was concluded the observed decline of only 2 percent was in error. A study of dune infiltration in northern Holland actually showed a dramatic increase in phthalate concentration (Piet et al. 1981). Perhaps PVC tubing contamination influenced the phthalate concentrations in both cases.

Adsorption and volatilization were thought to be the significant transport mechanisms for the pollutants studied by Tomson et al. (1981). Biodegradation had a minimal impact for two reasons: (1) The injected fluid was effluent from an activated sludge plant and compounds that easily biodegrade would not have been present. (2) Biodegradation does not occur for low pollutant concentrations. Tomson found that in the lab sewage bacteria reduced 2,3-dimethylnaphthalene from 1.3 mg/L to 40 μg/L in one day and that there was no further degradation for several days.

Under equilibrium conditions the net ratio of the rates of adsorption and desorption do not change and the reaction is said to be reversible. Sorption was reversible in several column studies (Schwarzenbach and Westall 1981a; Karickhoff et al. 1979). The reversibility of the reactions indicated that the initial removal of the compounds from solution was due to sorption and not to other factors such as biodegradation, which would cause the amount removed to be greater than the amount desorbed. A study by Horzempa and Di Toro (1983), however, showed that sorption of PCBs is not readily reversible under field conditions. The amount of sorption correlated with sediment surface area and organic content. The sorption effects were not felt to be attributable to biodegradation because PCBs are not readily biodegraded.

The restoration of aquifers depends upon the ability to remove contaminants adsorbed onto the subsurface material. One method is to flush the aquifer via injection and extraction wells. If the ground water velocity is too fast for equilibrium to be established, the concentration of the pollutant in ground water will decrease below the equilibrium concentration. Once the flushing stops, equilibrium conditions may become established and the concentration of dissolved pollutants may increase as desorption takes place. In such a case, the concentration of the pollutant at the extraction well decreases as the aquifer is flushed and then increases when the flushing is stopped. In addition to desorption during flushing as an important mechanism, the concentrations may also be affected by biodegradation rates of adsorbed, in-phase and dissolved pollutants.

Polar organics appear to be more mobile than non-polar organics, as shown by a study in an aquifer with significant amounts of organic carbon because they are poorly retained in the organic material in the soil (Roberts, Schreiner and Hopkins 1982). Piet et al. (1981) also found that the polar compounds were not as well adsorbed as non-polar compounds in soil column experiments using 50cm-long columns of soil composed of peat and sand layers. Those non-polar chlorine organics that were retained include: nitro-

benzene, nitrotoluene and chloronitrobenzene. Similarly, studies with granulated activated carbon (GAC) exhibit less adsorption of the polar organics than the non-polar organics.

Biodegradation

Biodegradation is the breakdown of chemical compounds by microorganisms and is controlled by such environmental parameters as temperature, pH, dissolved oxygen, Eh, salinity, nutrients, competing organisms, toxicity to organisms, and the concentrations of the organisms and compounds. Lab studies have shown that under steady-state conditions a pollutant must be present in concentrations of milligrams per liter to be broken down directly by microorganisms (McCarty et al. 1981). In a similar study it was found that the pollutant concentration must be at least 100 μg/L to sustain a microbe population (Wilson and McNabb 1983). If the pollutant concentrations are not sufficiently high to sustain the microorganisms biodegradation will not occur (Kobayashi and Rittman 1982). Sewage bacteria reduced 2,3-dimethylnaphthalene from 1.3 mg/L to 40 μg/L and no further reduction was observed for several days (Tomson et al. 1981). A lower limit for biodegradation of 10 μg/L has also been found by Wilson and McNabb (1983). Trace levels of a compound can sometimes be broken down as a secondary result of the breakdown of another compound, which is present at much higher concentrations (Rittmann et al. 1980; McCarty et al. 1979).

Biodegradation depends on essential metabolic requirements, such as oxygenated water for aerobic processes. Metabolism can deplete the oxygen or other metabolic requirements in ground water at pollutant concentrations greater than 1,000 to 10,000 μg/L (Wilson and McNabb 1983). Thus, pollutants at high concentrations may be only partially degraded when oxygen is depleted.

Results of lab and field biodegradation studies under aerobic and anaerobic conditions for different classes of organic pollutants are presented below. Most of the priority pollutants have been shown to be biodegradable under laboratory conditions (Kobayashi and Rittman 1982). This does not, however, mean that these pollutants are necessarily biodegradable under field conditions. Aerobic conditions generally occur in the unsaturated zone and may be found below the water table at shallow depths as well as at great depths (Winograd and Robertson 1982).

Halogenated Aliphatics. Field and lab results show that several halogenated aliphatics may biodegrade slowly under anaerobic conditions, but not under aerobic conditions. CH_2Cl_2 does, however, degrade under aerobic conditions (R. Schwarzenbach, personal communication 1983). Halogenated aliphatics at low concentrations in treated waste water decreased in concentration when injected into a coastal aquifer in California (Roberts, Schreiner and Hopkins 1982). THMs degraded 10 times faster than the other halogenated aliphatics although the rate of anaerobic degradation was slow for both. The THMs concentration declined from 100μg/L to less than 0.1 μg/L at a rate of 0.03 per day. The decline was attributed to anaerobic biodegradation and not adsorption because the sorption capacity of the aquifer was saturated before the injection experiment began. Batch culture tests in the lab supported the field results that THMs degrade at low concentrations under anaerobic conditions (Bouwer et al. 1981). Similarly, the ... bromodichloromethane degraded slowly under anaerobic conditions of a shallow fluvial aquifer in Oklahoma (Wilson and Enfield 1983). Halogenated aliphatics that have been reported to biodegrade under anaerobic lab conditions include: TCE, trichlorethane, methyl chloride, chloroethane, dichlorobromoethane, vinylidiene chloride, PER, methylene chloride and the THMs chloroform, dibromochloromethane, bromodichloromethane (Kobayashi and Rittman 1982).

No degradation was observed in studies of several compounds under anaerobic conditions, but the rate of degradation may have been too slow to be detected during the period of investigation. Bouwer et al. (1981) observed THMs but not TCE or PER to biodegrade in batch culture tests in the lab under anaerobic conditions. Wilson et al. (1983) did not observe degradation below the water table for several aliphatics: 1,2-dichloroethane, 1,1,2-trichlorethane, TCE or PER, but the period of study may not have been long enough to observe slow rates of degradation. Slow rates of degradation, therefore, cannot be ruled out. Similarly, Schwarzenbach et al. (1983) observed that TCE, PER, 1,1,1-trichloroethane, and hexachlorethane were persistent in the aquifer up to several kilometers away from the river, but the wide error bars on their figures may not rule out slow rates of degradation.

The decomposition of halogenated aliphatics under aerobic lab or field conditions has not been observed. No significant degradation of halogenated aliphatics (THMs, TCE, PER) was found under aerobic lab conditions (Bouwer et al. 1981; Bouwer and McCarty 1984). The persistance of chloroform, under aerobic conditions was reported in a study of ground water recharge, a study of chloroform passage through GAC columns, a study of bank filtration in Germany and a study of waste water percolation in soil columns (Bouwer et al. 1981). Wilson et al. (1983) in a field study in Oklahoma did not observe degradation of several halogenated aliphatics, 1,2-dichloroethane, 1,1,2-trichloroethane, TCE, or PER, above the water table.

Alkyl benzenes. Alkyl benzenes are known to degrade under aerobic conditions and may degrade under anaerobic conditions. Field observations show that toluene degraded rapidly in a shallow aquifer composed of flood-plain sediments in Oklahoma both above and below the water table (Wilson and Enfield 1979; Wilson et al. 1983). Schwarzenbach et al. (1983) observed a sharp decrease in non-halogenated compounds transported from the Glatt River to any of the ground water observation wells, the closest being 2.5m from the river. The alkyl benzenes included: toluene, 1,3-dimethyl benzene, and other 2 and 3 carbon benzene isomers. Aerobic respiration and nitrification occurred predominantly in the first few meters of infiltration, thus supporting the theory that the decrease in concentration was caused by biological processes under aerobic conditions. The biological processes that removed the organic compounds were efficient, considering the short residence time between the river and the closest well and the small retardation factors of the compounds. The decline was observed at different temperature throughout the year, including 5°C in winter. Alkyl benzenes degrade quicker than halogenated aromatics under aerobic conditions, probably because of the breaking of the halogen bond for halogenated aromatics is relatively slow.

Naphthalene and methyl-naphthalene also decreased in concentration but the decrease in

on the results of Ehrlich et al. (1982). Ehrlich et al. (1982) observed that naphthalene did not biodegrade under anaerobic conditions, but was slightly sorbed. Bouwer and McCarty (1984) observed that several non-chlorinated aromatics are removed under aerobic but not anaerobic conditions.

Chlorobenzenes. Chlorobenzenes have been observed to degrade under aerobic but not anaerobic conditions (e.g., Bouwer and McCarty 1984). The chlorobenzenes, 1,4-DCB, 1,2,4-TCB and 1,2,3-TCB decomposed under aerobic conditions in the aquifer near the Glatt River, and are suggested to have degraded to chlorinated phenols and catechols (Schwarzenbach and Westall 1981b). The rate of decrease was slower than for the alkyl aromatics, perhaps because the breaking of the halogen bond slows the process (Schwarzenbach et al. 1983). Halogenated aromatics do not degrade under anaerobic conditions. The concentrations of 1,4-DCB did not decrease in July and August of 1979, 1980 and 1981 between the river and 5m from the river, as it did the rest of the year because conditions were anaerobic during these summer months and the compounds did not decompose. During the rest of the year the conditions were aerobic and the chlorobenzenes decomposed. Chlorobenzenes in another Swiss study persisted for at least seven years under anaerobic conditions (Giger and Schaffner 1981). Chlorobenzenes (1,4-DCB, 1,2,4-TCB and 1,2,3-TCB) decomposed above, but not below the water table in a shallow fluvial aquifer in Oklahoma (Wilson et al. 1983). The failure of chlorobenzene to decompose in autoclaved (i.e., sterilized) lab samples established microorganisms as the likely agent of destruction.

Pesticides. Lab studies on sewer sludge indicated that pesticides such as lindane degraded more quickly under active anaerobic lab conditions than under corresponding aerobic conditions, probably due to bacteria (Hill and McCarty 1967). DDT, for example, converted rapidly to DDD under anaerobic conditions, but persisted as DDT under aerobic conditions of several mg/L of dissolved oxygen. Similarly, more than 20 species of bacteria were found to reductively dechlorinate DDT under anaerobic conditions, whereas aerobic conditions apparently did not promote dechlorination (Kobayashi and Rittman 1982). Other pesticides that were dehalogenated under anaerobic conditions in lab culture tests include: toxaphane by bacteria, lindane by soil bacteria and parathion by bacteria (Kobayashi and Rittman 1982). These lab results indicate that pesticides are easier to break down under anaerobic than under aerobic conditions. The breakdown process is relatively easy once the halogen bond is broken.

Phenolic compounds have been shown to biodegrade under anaerobic conditions in an aquifer composed of glacial drift material in Minnesota (Ehrlich et al. 1982). Methane and CO_2 were formed by the anaerobic bacteria breaking down the phenolic compounds. Lab studies supported the field results, and also indicated that principally biodegradation and not sorption account for the decline in concentration (Ehrlich et al. 1982). Glass column experiments showed that chlorophenols can biodegrade under aerobic conditions (Zullei 1981).

Biodegradation is an appealing cleanup method because expensive cleanup methods could be avoided and the pollutant is destroyed rather than transferred atmosphere via air stripping. In some cases, however, the degradation products could be as toxic or worse than the original compound. Management of some of the parameters that affect biodegradation, such as nitrate supply, may allow biodegradation to occur in situ in the vadose zone or aquifer. Limitations include the difficulty of managing environmental parameters that promote biodegradation and the difficulty in maintaining biodegradation as environmental conditions change.

Geological Considerations

The detailed structure and mineralogic composition of aquifers is critical to the transport of pollutants. One example is a PCB spill in a glacial till area in western Canada (Schwartz et al. 1982; Roberts, Cherry and Schwartz 1982). Between 6,800 and 21,000 liters of transformer oil containing PCBs and chlorobenzenes were spilled at a transformer plant. The PCBs traveled mainly in-phase because of the low solubility of PCBs (0.05 mg/L). The laboratory-determined conductivities of the till zone, between 10^{-5} and 10^{-9} cm/s, are too low to explain the observed vertical migration. Vertical movement is primarily through fractures in the clay, silt and till units, as indicated by the high PCB concentrations measured on fracture surfaces. Tritium was also found along fracture surfaces and used to calculate the rate of solute migration. This rate is a minimum because, unlike PCBs, some of the small tritium atoms diffuse into the sedimentary units. The geological units also have a low organic content, 0.2 to 0.9 percent carbon, minimizing the role of organic carbon in absorbing the PCBs.

Conclusions and Recommendations

Although progress is being made in understanding how organic compounds travel in the subsurface, large gaps and unknown important parameters exist. Several recommendations are given below on areas that need research.

- Some polar organic compounds are not commonly detectable by present methods. They appear to be persistent in ground water, able to travel significant distances and be resistant to degradation. Perhaps the increased ability to identify these polar organics will provide a better understanding of this type of contamination. Group parameter methods, such as TOX, may be attractive compliments to the commonly used GC/MS method because of the lower cost and because the measurements include classes of compounds, e.g., polar halogenated organics in the case of TOX, which are not readily identifiable individually.
- In cases where the aquifer might contain sufficient carbon for adsorption to be significant, the empirical relationships that have been developed may be useful for determining the partitioning behavior of organic pollutants. Further study of the effect of grain size, organic content, solute concentrations, dissolved organic matter and other controls on adsorption will help clarify how solutes are transported.
- Some elements, such as N, S, or P-compounds, when injected into pollution plumes may promote microbial degradation. The field conditions under which biodegradation of different compounds is promoted is not well understood. The phase in which the pollutant biodegrades might also be considered, i.e., dissolved in water, in-phase, or adsorbed onto the

matrix.

- More work is needed to determine how flushing of an aquifer via injection and extraction wells affects those pollutants sorbed onto aquifer or soil material. Travel of solutes in-phase during flushing, such as droplets within the water, may be an important mechanism.

Ground water flow models in porous media are useful for understanding a flow regime and for planning the placement of wells. Solute transport models assume constant dispersivity values and the solute is assumed to be dissolved, which in some cases may not be reasonable assumptions. Resolution problems with numerical models may occur in some cases, such as for modeling trace concentrations of a solute, high concentration gradients, or radial flow from a pulse on a rectangular grid. The mechanisms of adsorption and biodegradation are not well enough understood to model satisfactorily. The effects of such mechanisms will probably be lumped together in models because their effects will be difficult to separate in practice.

Although the technology may exist to clean up polluted ground water and pollution sites, the costs are often high. A water policy is needed to encourage prevention and set priorities for what should be cleaned up. The cost of cleanup can be several orders of magnitude larger than that of preventive measures. Monitoring of areas containing organic compounds has begun only recently, and as monitoring continues the understanding of solute transport will improve.

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STATE OF NEW MEXICO
DEPARTMENT OF ENERGY AND MINERALS
OIL CONSERVATION DIVISION

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OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE No. 8224

APPLICATION OF THE OIL CONSERVATION
COMMISSION UPON ITS OWN MOTION TO
DEFINE THE VERTICAL AND AREAL EXTENT OF
AQUIFERS POTENTIALLY VULNERABLE TO
CONTAMINATION BY THE SURFACE DISPOSAL
OF PRODUCED WATER, McKINLEY, RIO ARRIBA,
SANDOVAL, AND SAN JUAN COUNTIES,
NEW MEXICO.

SUMMARY MEMORANDUM OF OCD STAFF

INTRODUCTION

This case was called by the Commission on its own motion to determine whether fresh water resources in the San Juan Basin of New Mexico are vulnerable to contamination by the surface disposal of produced water from oil and gas operations. If such threats of contamination are found to exist, the Commission has the duty to take action to regulate such disposal.

This hearing process was convened under the mandate contained in the Commission's "Enumeration of Powers" found

at NMSA 70-2-12(15) (1978), which provides that the Commission is authorized to "... direct surface or subsurface disposal of [produced] water in a manner that will afford reasonable protection against contamination of fresh water supplies..." While some of the testimony and other evidence presented at the hearing of this case relates to regulations and standards promulgated pursuant to the Water Quality Act, NMSA 74-6-1 et. seq. (1978), it was emphasized in testimony that in this particular situation the requirements set forth in the regulations of the New Mexico Water Quality Control Commission are referred to only as standards and the hearing was not called pursuant to any authority contained in the Water Quality Act.

It is clear from the evidence introduced at the hearing on this matter that some of the components of produced water are toxic, (Boyer, Tr. 2/20/85, P. 58-60), while others, if introduced into ground water, will result in its degradation. No witness disputed this evidence. Moreover, the introduction of these substances into ground water designated by the State Engineer as "fresh water resources" in quantities that would cause the ground water to exceed water quality standards is strictly prohibited in other situations. Sections 3-101 and 3-103 (A) and (B), Water Quality Control Commission Regulations. So even though this hearing was not called pursuant to the OCC's delegated power to enforce Water Quality Control Regulations, any

contemplated action should be viewed in light of these regulations and the water quality standards contained therein.

The evidence is also clear that much of the produced water that is dumped into unlined pits in Northwest New Mexico necessarily goes directly into the ground. (Boyer, Tr. 2/20/85, P. 69-71, Baca, Tr. 2/20/85, P. 148). And because of the shallow depth to ground water and the alluvial, unconsolidated nature of the soils in the San Juan Basin, most of the water that is absorbed into the ground eventually reaches the ground water.

Given this essentially uncontroverted evidence, the primary question to be addressed by the Commission prior to entering an order in this case concerns the final disposition of organic hydrocarbons and dissolved minerals (TDS) contained in this produced water. Testimony by the opponents of a "no-pit" rule that disposal of produced water onto the ground will have no adverse consequences to ground water is simply not credible. Although several industry witnesses were produced in an attempt to disarm the concern expressed by the Commission in initiating this case, none of them controverted the evidence produced by the Division that produced water contains toxic substances and that such water, if put into unlined pits, enters the ground and mixes with ground water. And in spite of the fact that industry

representatives testified that because of the action of various mechanisms of attenuation, deleterious substances in the produced water do not contaminate ground water supplies, their own studies clearly showed high levels of benzene, a constituent of produced water that does not occur naturally in ground water, contaminating areas under produced water pits (Geoscience Exhibit 3, see especially results of monitoring Tenneco's Eaton A-1E).

Following is a brief synopsis of the relevant evidence. It demonstrates conclusively that the unregulated disposal of produced water should cease.

I. SUBSTANTIAL EVIDENCE WAS PRESENTED REGARDING THE POTENTIAL FOR GROUND WATER CONTAMINATION BY ORGANIC CONTAMINANTS

Modeling using acceptable hydrologic methods has shown the potential for ground water pollution by organic contaminants. In particular, "Random Walk" simulations which include a retardation factor for sorption show levels of benzene exceeding standards at a distance from the source. Standards are exceeded at all discharges of five barrels per day and at most intermediate values of discharge down to one-half barrel per day. Other than dilution, the mechanisms of attenuation (volatilization, sorption, evaporation and biodegradation) have not been shown to be effective at all places under all circumstances. This is especially true for biodegradation which requires the presence of oxygen or long adaptation times to be effective. Therefore, the potential for ground water contamination by volatile organic hydrocarbons cannot be discounted. Given the toxicity of the contaminants and health concerns related thereto, and the concommitant potential for ground water contamination, the Commission should protect ground water by limiting discharges of produced water into unlined pits to no more than one-half barrel per day. Since ancillary pits receive similar fluids, especially in the event of separator malfunction, or where separators are not present, discharges to such pits should also be limited to one-half barrel per day.

II. TESTIMONY IS CLEAR AS TO THE IMPORTANCE OF THE VADOSE ZONE AS AN ATTENUATION MECHANISM

Witnesses for both sides testified as to the importance of the vadose zone in preventing contamination of ground water from organics in the produced water discharge. Mr. Boyer mentioned in his direct testimony that the likelihood of volatilization is greater in the vadose zone than in the ground water (Boyer, Tr. 2/20/85, p. 84).

In their direct testimony, industry representatives also referred frequently to the importance of the vadose zone as a major attenuation mechanism. Dr. Schultz discussed the importance to organic volatilization of partially saturated flow and the air space in the pores. He testified that aromatics are volatilized into the soil gas and transferred to the atmosphere. This is one of the removal mechanisms of attenuation (Schultz, Tr. 4/3/85, p. 152-155). To have soil gas aid in volatilization, unsaturated or partially saturated flow must occur in the vadose zone (Schultz, Tr. 4/3/85, p. 169, 180-182).

Dr. Miller's testimony also emphasized the importance of the vadose zone. The percentage rate of aromatic hydrocarbon degradation in the unsaturated zone is eight times greater than in saturated material (Miller, Tr. 4/22/85, p. 23). Miller felt that there was concern if the pit was in ground water since degradation processes that

occur in the unsaturated zone would not be present to provide adequate safety to ground water quality (Miller, Tr. 4/22/85, p. 68).

Since benzene and toluene are most rapidly degraded under aerobic conditions (Miller, Tr. 4/22/85, p.22) and these conditions are most always prevalent in the vadose zone, this zone must be maintained. Miller also stated that recent studies indicate that toluene and possibly benzene degrade in anaerobic conditions (Miller, Tr. 4/22/85, p. 26). Nevertheless, the OCD staff maintains that aerobic conditions must be maintained to ensure maximum possible benzene mineralization.

The most active zone of degradation is immediately beneath the pit for a depth of about one foot, but that thickness has to be protected from ground water interception of the pit bottom (Miller, Tr. 4/22/85, Tr. p. 69). Under cross-examination, Dr. Miller stressed the importance of preserving the vadose zone between the pit and the water table, and stated that direct introduction of produced water into ground water utilized as drinking water would take away the safety margin and be the worst case (Miller, Tr. 4/22/85, Tr. pp. 94, 104-105).

Since pits are commonly five to eight feet in depth at well sites, depth to ground water would have to be deeper to

provide the necessary vadose zone protection advocated by both OCD and industry witnesses. Seasonal ground water variations due to the rise in river levels, or percolating irrigation waters, can cause ground water levels to move up or down several feet during a year. Frequent large discharges can move unsaturated or partially saturated conditions toward saturation and cause ground water mounding. Therefore, to provide the necessary vadose zone protection, unlined pits in areas where the depth to ground water is less than ten feet should be prohibited. Since pits and trenches dug to bury piping require use of mechanical equipment, the presence of water at depths up to ten feet can be easily ascertained. Therefore this determination will not pose any additional burden on industry.

III. RESULTS OF TDS STUDY

Values of total dissolved solids (TDS) found in produced water in the San Juan Basin are generally less than in Southeast New Mexico. Modeling using the Random Walk program shows that discharges of 10,000 mg/l salts do not significantly increase TDS levels at low discharge volumes (OCD post hearing submittal 5/23/85). Discharge volumes of one-half bbl/day did not cause large increases for any of the simulations using the range of hydraulic conductivities found in alluvium in the area (25-2500 ft/day). Discharges of five barrels per day, however, caused unacceptable increases at all hydraulic conductivity ranges. The increases were judged unacceptable because the discharges would cause the NM WQCC ground water standard of 1000 mg/l TDS to be exceeded when added to existing concentrations in the vulnerable area. Intermediate discharge volumes at 10,000 mg/l TDS may or may not pose a problem depending on the availability of sufficient ground water flow to allow mixing and dilution.

Since the affect on ground water quality cannot be determined with sufficient accuracy without site specific hydrogeological information being available, the Commission should allow a maximum blanket discharge of up to one-half barrel per day to provide necessary ground water protection.

Since TDS is a composite of individual contaminants, some of which can cause health or other problems, limiting TDS discharges should also mitigate most problems caused by individual contaminants (i.e. chloride, sulfate, and others).

IV. THE VALIDITY OF THE HYDROLOGIC INVESTIGATION PERFORMED ON THREE PITS IN THE VULNERABLE AREA IS QUESTIONABLE

In his testimony, Mr. Hicks asserts that his studies of three well sites show that small volume discharges are not a threat to ground water. Even if the drilling and sampling results of the site investigations are assumed correct, these results should not be interpreted as being representative of the entire vulnerable area population of 1300 wells, or of the sample of 300 wells of Amoco and Tenneco. The reason is that these three locations were evaluated and chosen from a list of 21 sites. The 21 sites were chosen separately and apparently prior to the selection of the 50 to 60 wells chosen at random from the Amoco/Tenneco population of 300. Even though some of the 21 sites were also listed in the random selection of 50-60 wells, the selection of the 21 apparently was not random and cannot be considered a representative random sample (Hicks, Tr. 4/22/85, pp. 127, 130).

At the three monitoring sites selected, volumes of water produced were stated by Mr. Hicks as being three and four barrels per day for the Tenneco wells and one-fourth barrel per day for the Amoco well. Official OCD records (Form C-115) show, however, that the Tenneco sites in question <u>never</u> have produced water from any of Dakota, Mesaverde, and Chacra completion intervals. The Amoco well has OCD-reported volumes similar to the one-fourth barrel

per day shown in the report. Therefore, if the volumes of water produced by the Tenneco wells and utilized in the Geoscience study are high and not representative of actual site discharges, this could explain the low values of benzene found in the pits and ground water. If this is the case, the modeling and conclusions presented by Mr. Hicks that wells discharging three to four bbls/day do not represent a hazard to ground water are completely invalid.

Mr. Hicks stated that Pictured Cliffs wells do not have produced water pits or separator pits since no water is produced (Hicks, Tr. 4/22/85, p. 136, and Exhibit 3). Review of OCD records show, however, that such wells represent about one-third of the 45 wells in the vulnerable area with production of five bbls/day or more of produced water. Therefore, they are an important factor contributing to water discharges in the vulnerable areas and cannot be ignored.

OCD SUMMARY

The following conclusions can be drawn from the testimony:

1. Certain aromatic organic contaminants (especially benzene) have high potential to contaminate ground water when discharged even in small volume quantities with produced water. The mechanisms of attenuation, especially biodegradation, cannot be counted on to provide protection at all times and in all locations and situations. Therefore blanket small volume discharges not exceeding one-half barrel per day should not be allowed to unlined produced water and ancillary pits.

2. Both OCD and industry testimony stressed the importance of the vadose zone in attenuation of the organic contaminants. Especially necessary is the presence of air in pore spaces to allow volatilization and biodegradation to occur. To provide the necessary buffer zone, and because pit depths are on the order of five to eight feet, discharges to unlined pits should be prohibited where ground water is at a depth of ten feet or less.

3. From the standpoint of total dissolved solids, discharges of five barrels per day at concentrations of

10,000 mg/l TDS also cause the New Mexico Water Quality standard to be exceeded. Limiting the discharge to unlined pits to one-half barrel per day will provide the necessary TDS protection and mitigate deleterious effects of other contaminants which are TDS components.

4. The study conducted by GeoScience Consultants is inconclusive because the three sites chosen for intensive study cannot be considered representative of vulnerable area conditions, and because of discrepancies in the volumes of water actually discharged at two of the sites.

Since the Oil and Gas Act requires the reasonable protection of fresh water from contamination by such activities, the limits recommended by the Division in its proposed order will provide such protection and are necessary and prudent.

CONCLUSION

The opponents to regulation of produced water disposal have made much of the fact that no water wells have been proven to have been contaminated by produced water. Tenneco, in its Memorandum of Law filed herein even goes so far as to assert that "...we have yet to experience the first confirmed case of contamination of ground water by the use of unlined surface production pits" (at p.24). Clearly, the facts in this case contradict this statement. Tenneco's own witnesses showed concentrations of benzene in ground water underlying surface pits. (Geoscience Exhibit 3). In fact, one of Mr. Hick's own samples exceeded ground water standards for benzene as set by the New Mexico Water Quality Control Commission (Geoscience, Exhibit 3, relating to Tenneco's Eaton A-1E well).

The mandate of the Commission is not to protect only existing water wells. It is to protect all fresh water resources with potential for future use. Other states have not been so reticent or tardy in protecting water resources. Both Oklahoma and Texas have had "no-pit" rules for many years. Yet the opponents of regulation of produced water in New Mexico vow a fight to the finish. Do they really believe that New Mexico regulators are so uninformed and intimidated as to continue to permit such an obviously

outdated practice as totally unregulated surface disposal of produced water? Oklahoma has had a "no-pit" order since 1969. Disposal in unlined pits is allowed only upon a conclusive showing that surface or subsurface water will not be polluted (See Oklahoma regulations attached hereto). Such a burden is almost impossible to meet. Consequently, surface disposal is almost non-existent. Texas has a similar rule. (See Texas Railroad Commission Regulations attached hereto).

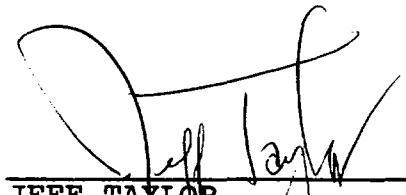
The producers make many arguments as to why no rule should be adopted. Tenneco claims that imposition of a "no-pit" rule would entail an unconstitutional taking of private property because in the past it has operated its wells without having to line pits and no regulation to date has referenced the possibility that at some future time pits might be required to be lined. (Tenneco Oil Company's Memorandum of Law and Arguments, p. 18). This argument is patently ridiculous. Simply because an entity has not been required to take preventative measures in the past does not mandate that, given proper notice and due process, it cannot be required to take those measures at a future time. If Tenneco's position were the law, virtually no advance in human health and safety or environmental regulation would be possible because government would be required to absorb the entire cost of such improvements through legal proceedings claiming unconstitutional takings.

The water resources of New Mexico are a scarce and valuable natural resource, much like petroleum. And while the cost of the two is not now comparable, if fresh water resources are not protected for future use, water may eventually come too expensive for many uses.

In New Mexico, approximately 95% of water used for domestic purposes is ground water. This is due primarily to the fact that such little surface water exists in comparison to other areas of the country. Because we are so dependent upon ground water, it is necessary that adequate measures be taken to protect existing supplies. The staff of the OCD believes that its recommendations regarding disposal of produced water are best suited to guarantee protection of these fresh water resources. We have presented a case which demonstrates that produced water, which contains toxic contaminants, is now disposed of in Northwest New Mexico by being dumped into unlined surface pits. Much of this water is absorbed into the ground where it eventually reaches and combines with ground water. In small quantities, this degrades existing fresh water supplies. In larger quantities, it leads to contamination.

The Commission has an obligation to protect fresh water resources. In order to carry out this duty, the Commission must prohibit unregulated disposal of produced water except in quantities of less than one-half barrel. Any other

action would be to ignore the evidence produced at the hearings in this matter, including that of the opponents to regulations.



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RAILROAD COMMISSION OF TEXAS
OIL AND GAS DIVISION

MACK WALLACE Chairman
BUDDY TEMPLE Commissioner
JAMES E. (JIM) NUGENT Commissioner

J. H. MOSBACHER P.E.
Director
JERRY W. MALLICAN
Director of Underground Injection Control

1124 S. IH 35 — CAPITOL STATION — P. O. DRAWER 12967 — AUSTIN, TEXAS 78711

NOTICE OF RULE ADOPTION

The following is a copy of amended Statewide Rule 8 relating to Water Protection (16 TAC §3.8) as amended by the Railroad Commission of Texas on March 5, 1984. These amendments will go into effect on May 1, 1984.

William H. Barnes
Legal Counsel
Underground Injection Control

An Equal Opportunity Employer

§ 3.8. Water Protection.

(a) Definitions. The following words and terms, when used in this section, shall have the following meanings, unless the context clearly indicates otherwise:

(1) Basic sediment pit -- Pit used in conjunction with a tank battery for storage of basic sediment removed from a production vessel or from the bottom of an oil storage tank. Basic sediment pits were formerly referred to as burn pits.

(2) Brine pit -- Pit used for storage of brine which is used to displace hydrocarbons from an underground hydrocarbon storage facility.

(3) Collecting pit -- Pit used for storage of saltwater prior to disposal at a tidal disposal facility, or pit used for storage of saltwater or other oil and gas wastes prior to disposal at a disposal well or fluid injection well. In some cases one pit is both a collecting pit and a skimming pit.

(4) Completion/workover pit -- Pit used for storage or disposal of spent completion fluids, workover fluids, and drilling fluid, silt, debris, water, brine, oil scum, paraffin, or other materials which have been cleaned out of the well bore of a well being completed or worked over.

(5) Drilling fluid disposal pit -- Pit, other than a reserve pit, used for disposal of spent drilling fluid.

(6) Drilling fluid storage pit -- Pit used for storage of drilling fluid which is not currently being used but which will be used in future drilling operations. Drilling fluid storage pits are often centrally located among several leases.

(7) Emergency saltwater storage pit -- Pit used for storage of produced saltwater for limited period of time. Use of the pit is necessitated by a temporary shutdown of a disposal well or fluid injection well and/or

associated equipment, by temporary overflow of saltwater storage tanks on a producing lease, or by a producing well loading up with formation fluids such that the well may die. Emergency saltwater storage pits may sometimes be referred to as emergency pits or blowdown pits.

(8) Flare pit -- Pit which contains a flare and which is used for temporary storage of liquid hydrocarbons which are sent to the flare during equipment malfunction but which are not burned. A flare pit is used in conjunction with a gasoline plant, natural gas processing plant, pressure maintenance or repressurizing plant, tank battery, or a well.

(9) Fresh makeup water pit -- Pit used in conjunction with drilling rig for storage of water used to make up drilling fluid.

(10) Gas plant evaporation/retention pit -- Pit used for storage or disposal of cooling tower blowdown, water condensed from natural gas, and other wastewater generated at gasoline plants, natural gas processing plants, or pressure maintenance or repressurizing plants.

(11) Mud circulation pit -- Pit used in conjunction with drilling rig for storage of drilling fluid currently being used in drilling operations.

(12) Reserve pit -- Pit used in conjunction with drilling rig for collecting spent drilling fluids; cuttings, sands, and silts; and wash water used for cleaning drill pipe and other equipment at the well site. Reserve pits are sometimes referred to as slush pits or mud pits.

(13) Saltwater disposal pit -- Pit used for disposal of produced saltwater.

(14) Skimming pit -- Pit used for skimming oil off saltwater prior to disposal of saltwater at a tidal disposal facility, disposal well, or fluid injection well.

(15) Washout pit -- Pit located at truck yard, tank yard, or disposal facility for storage or disposal of oil and gas waste residue washed out of trucks, mobile tanks, or skid-mounted tanks.

(16) Water condensate pit -- Pit used in conjunction with a gas pipeline drip or gas compressor station for storage or disposal of fresh water condensed from natural gas.

(17) Generator -- Person who generates oil and gas wastes.

(18) Carrier -- Person who transports oil and gas wastes generated by a generator. A carrier of another person's oil and gas wastes may be a generator of his own oil and gas wastes.

(19) Receiver -- Person who stores, handles, treats, reclaims, or disposes of oil and gas wastes generated by a generator. A receiver of another person's oil and gas wastes may be a generator of his own oil and gas wastes.

(20) Director -- Director of the Oil and Gas Division or his staff delegate designated in writing by the Director of the Oil and Gas Division or the commission.

(21) Person -- Natural person, corporation, organization, government or governmental subdivision or agency, business trust, estate, trust, partnership, association, or any other legal entity.

(22) Affected person — Person who, as a result of the activity sought to be permitted, has suffered or may suffer actual injury or economic damage other than as a member of the general public.

(23) To dewater -- To remove the free water.

(24) To dispose -- To engage in any act of disposal subject to regulation by the commission including, but not limited to, conducting, draining, discharging, emitting, throwing, releasing, depositing, burying, landfarming, or allowing to seep, or to cause or allow any such act of disposal.

(25) Landfarming -- A waste management practice in which oil and gas wastes are mixed with or applied to the land surface in such a manner that the waste will not migrate off the landfarmed area.

(26) Oil and gas wastes -- Materials to be disposed of or reclaimed which have been generated in connection with activities associated with the exploration, development, and production of oil or gas or geothermal resources, or activities associated with underground storage of hydrocarbons. The term oil and gas wastes includes, but is not limited to, saltwater, other mineralized water, sludge, spent drilling fluids, cuttings, waste oil, spent completion fluids, and other liquid, semi-liquid, or solid waste material.

(27) Oil field fluids -- Fluids to be used or reused in connection with activities associated with the exploration, development, and production of oil or gas or geothermal resources, or activities associated with underground storage of hydrocarbons. The term oil field fluids includes, but is not limited to, drilling fluids, completion fluids, surfactants, and chemicals used to detoxify oil and gas wastes.

(28) Pollution of surface or subsurface water -- The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any surface or subsurface water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

(29) Surface or subsurface water -- Groundwater, percolating or otherwise, suitable for domestic or livestock use, irrigation of crops, or industrial use, and lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Gulf of Mexico inside the territorial limits of the state, and all other bodies of surface water,

natural or artificial, inland or coastal, fresh or salt, navigable or nonnavigable, and including the beds and banks of all watercourses and bodies of surface water, that are wholly or partially inside or bordering the state or inside the jurisdiction of the state.

(b) No pollution. No person conducting activities subject to regulation by the commission may cause or allow pollution of surface or subsurface water in the state.

(c) Exploratory wells. Any oil, gas, or geothermal resource well or well drilled for exploratory purposes shall be governed by the provisions of statewide or field rules which are applicable and pertain to the drilling, safety, casing, production, abandoning, and plugging of wells.

(d) Pollution control.

(1) Prohibited disposal methods. Except for those disposal methods authorized for certain wastes by paragraph (3) of this subsection or subsection (e) of this section, or disposal methods permitted pursuant to § 3.9 of this title (relating to Disposal Wells) or § 3.46 of this title (relating to Fluid Injection into Productive Reservoirs) (Rules 9 or 46), no person may dispose of any oil and gas wastes by any method without obtaining a permit to dispose of such wastes. The disposal methods prohibited by this paragraph include, but are not limited to, the unpermitted discharge of oil field brines, geothermal resource waters, other mineralized waters, or drilling fluids into any watercourse or drainageway, including any drainage ditch, dry creek, flowing creek, river, or any other body of surface water.

(2) Prohibited pits. No person may maintain or use any pit for storage of oil or oil products. Except as authorized by paragraph (4) of this subsection, no person may maintain or use any pit for storage of oil field fluids, or for storage or disposal of oil and gas wastes, without obtaining a

permit to maintain or use the pit. A person is not required to have a permit to use a pit if a receiver has such a permit, if the person complies with the terms of such permit while using the pit, and if the person has permission of the receiver to use the pit. The pits required by this paragraph to be permitted include, but are not limited to, the following types of pits: saltwater disposal pits; emergency saltwater storage pits; collecting pits; skimming pits; brine pits; drilling fluid storage pits (other than mud circulation pits); drilling fluid disposal pits (other than reserve pits or slush pits); washout pits; and gas plant evaporation/retention pits. If, after the effective date of this subsection, a person maintains or uses a pit for storage of oil field fluids, or for storage or disposal of oil and gas wastes, and the use or maintenance of the pit is neither authorized by paragraph (4) or (7)(C) of this subsection nor permitted, then the person maintaining or using the pit shall backfill and compact the pit in the time and manner required by the director. Prior to backfilling the pit, the person maintaining or using the pit shall, in a permitted manner or in a manner authorized by paragraph (3) of this subsection, dispose of all oil and gas wastes which are in the pit.

(3) Authorized disposal methods.

(A) Fresh water condensate. A person may, without a permit, dispose of fresh water which has been condensed from natural gas and collected at gas pipeline drips or gas compressor stations, provided the disposal is by a method other than disposal into surface water of the state.

(B) Inert wastes. A person may, without a permit, dispose of inert and essentially insoluble oil and gas wastes including, but not limited to, concrete, glass, wood, and wire, provided the disposal is by a method other than disposal into surface water of the state.

(C) Low chloride drilling fluid. A person may, without a permit, dispose of the following oil and gas wastes by landfarming, provided the wastes are disposed of on the same lease where they are generated, and provided the person has the written permission of the surface owner of the tract where landfarming will occur: water base drilling fluids with a chloride concentration of 3,000 milligrams per liter (mg/l) or less; drill cuttings, sands, and silts obtained while using water base drilling fluids with a chloride concentration of 3,000 milligrams per liter (mg/l) or less; and wash water used for cleaning drill pipe and other equipment at the well site.

(D) Other drilling fluid. A person may, without a permit, dispose of the following oil and gas wastes by burial, provided the wastes are disposed of at the same well site where they are generated: water base drilling fluids which had a chloride concentration in excess of 3,000 milligrams per liter (mg/l) but which have been dewatered; drill cuttings, sands, and silts obtained while using oil base drilling fluids or water base drilling fluids with a chloride concentration in excess of 3,000 milligrams per liter (mg/l); and those drilling fluids and wastes allowed to be landfarmed without a permit.

(E) Completion/workover pit wastes. A person may, without a permit, dispose of the following oil and gas wastes by burial in a completion/workover pit, provided the wastes have been dewatered, and provided the wastes are disposed of at the same well site where they are generated: spent completion fluids, workover fluids, and the materials cleaned out of the well bore of a well being completed or worked over.

(F) Effect on backfilling. A person's choice to dispose of a waste by methods authorized by this paragraph shall not extend the time allowed for backfilling any reserve pit, mud circulation pit, or completion/workover pit whose use or maintenance is authorized by paragraph (4) of this subsection.

(4) Authorized pits. A person may, without a permit, maintain or use reserve pits, mud circulation pits, completion/workover pits, basic sediment pits, flare pits, fresh makeup water pits, and water condensate pits on the following conditions:

(A) Reserve pits and mud circulation pits. A person shall not deposit or cause to be deposited into a reserve pit or mud circulation pit any oil field fluids or oil and gas wastes other than the following:

(i) drilling fluids, whether fresh water base, saltwater base, or oil base;

(ii) drill cuttings, sands, and silts separated from the circulating drilling fluids;

(iii) wash water used for cleaning drill pipe and other equipment at the well site;

(iv) drill stem test fluids; and

(v) blowout preventer test fluids.

(B) Completion/workover pits. A person shall not deposit or cause to be deposited into a completion/workover pit any oil field fluids or oil and gas wastes other than spent completion fluids, workover fluids, and the materials cleaned out of the well bore of a well being completed or worked over.

(C) Basic sediment pits. A person shall not deposit or cause to be deposited into a basic sediment pit any oil field fluids or oil and gas wastes other than basic sediment removed from a production vessel or from the bottom of an oil storage tank. Although a person may store basic sediment in a basic sediment pit, a person may not deposit oil or free saltwater in the pit. The total capacity of a basic sediment pit shall not exceed 50 barrels. The area covered by a basic sediment pit shall not exceed 250 square feet.

(D) Flare pits. A person shall not deposit or cause to be deposited into a flare pit any oil field fluids or oil and gas wastes other than the hydrocarbons designed to go to the flare during upset conditions at the well, tank battery, or gas plant where the pit is located. A person shall not store liquid hydrocarbons in a flare pit for more than 48 hours at a time.

(E) Fresh makeup water pits. A person shall not deposit or cause to be deposited into a fresh makeup water pit any oil field fluids or oil and gas wastes.

(F) Water condensate pits. A person shall not deposit or cause to be deposited into a water condensate pit any oil field fluids or oil and gas wastes other than fresh water condensed from natural gas and collected at gas pipeline drips or gas compressor stations.

(G) Backfill requirements.

(i) A person who maintains or uses a reserve pit, mud circulation pit, fresh makeup water pit, completion/workover pit, basic sediment pit, flare pit, or water condensate pit shall dewater, backfill, and compact the pit according to the following schedule:

(I) Reserve pits and mud circulation pits which contain fluids with a chloride concentration of 6,100 milligrams per liter (mg/l) or less and fresh makeup water pits shall be dewatered, backfilled, and compacted within one year of cessation of drilling operations.

(II) Reserve pits and mud circulation pits which contain fluids with a chloride concentration in excess of 6,100 milligrams per liter (mg/l) shall be dewatered within 30 days and backfilled and compacted within one year of cessation of drilling operations.

(III) All completion/workover pits used when completing a well shall be dewatered within 30 days and backfilled and compacted with 120 days of

well completion. All completion/workover pits used when working over a well shall be dewatered within 30 days and backfilled and compacted within 120 days of completion of workover operations.

(IV) Basic sediment pits, flare pits, and water condensate pits shall be dewatered, backfilled, and compacted within 120 days of final cessation of use of the pits.

(V) If a person constructs a sectioned reserve pit, each section of the pit shall be considered a separate pit for determining when a particular section should be dewatered.

(ii) A person who maintains or uses a reserve pit, mud circulation pit, fresh makeup water pit, or completion/workover pit shall remain responsible for dewatering, backfilling, and compacting the pit within the time prescribed by clause (i) of this subparagraph (G), even if the time allowed for backfilling the pit extends beyond the expiration date or transfer date of the lease covering the land where the pit is located.

(iii) The director may require that a person who uses or maintains a reserve pit, mud circulation pit, fresh makeup water pit, completion/workover pit, basic sediment pit, flare pit, or water condensate pit backfill the pit sooner than the time prescribed by clause (i) of this subparagraph (G) if the director determines that oil and gas wastes are likely to escape from the pit or that the pit is being used for improper disposal of oil and gas wastes.

(iv) Prior to backfilling any reserve pit, mud circulation pit, completion/workover pit, basic sediment pit, flare pit, or water condensate pit whose use or maintenance is authorized by this paragraph (4), the person maintaining or using the pit shall, in a permitted manner or in a manner

authorized by paragraph (3) of this subsection, dispose of all oil and gas wastes which are in the pit.

(5) Responsibility for disposal.

(A) Permit required. No generator or receiver may knowingly utilize the services of a carrier to transport oil and gas wastes if the carrier is required by this rule to have a permit to transport such wastes but does not have such a permit. No carrier may knowingly utilize the services of a second carrier to transport oil and gas wastes if the second carrier is required by this rule to have a permit to transport such wastes but does not have such a permit. No generator or carrier may knowingly utilize the services of a receiver to store, handle, treat, reclaim, or dispose of oil and gas wastes if the receiver is required by statute or commission rule to have a permit to store, handle, treat, reclaim, or dispose of such wastes but does not have such a permit. No receiver may knowingly utilize the services of a second receiver to store, handle, treat, reclaim, or dispose of oil and gas wastes if the second receiver is required by statute or commission rule to have a permit to store, handle, treat, reclaim, or dispose of such wastes but does not have such a permit. Any person who plans to utilize the services of a carrier or receiver is under a duty to determine that the carrier or receiver has all permits required by the Oil and Gas Division to transport, store, handle, treat, reclaim, or dispose of oil and gas wastes.

(B) Improper disposal prohibited. No generator, carrier, receiver, or any other person may improperly dispose of oil and gas wastes or cause or allow the improper disposal of oil and gas wastes. A generator causes or allows the improper disposal of oil and gas wastes if:

(i) the generator utilizes the services of a carrier or receiver who improperly disposes of the wastes, and

(11) the generator knew or reasonably should have known that the carrier or receiver was likely to improperly dispose of the wastes and failed to take reasonable steps to prevent the improper disposal.

(6) Permits.

(A) Standards for permit issuance. A permit to maintain or use a pit for storage of oil field fluids or oil and gas wastes may only be issued if the commission determines that the maintenance or use of such pit will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface waters. A permit to dispose of oil and gas wastes by any method, including disposal into a pit, may only be issued if the commission determines that the disposal will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface water. A permit to maintain or use any unlined pit, other than an emergency saltwater storage pit, for storage or disposal of oil field brines, geothermal resource waters, or other mineralized waters may only be issued if the commission determines that the applicant has conclusively shown that use of the pit cannot cause pollution of surrounding productive agricultural land nor pollution of surface or subsurface water, either because there is no surface or subsurface water in the area of the pit, or because the surface or subsurface water in the area of the pit would be physically isolated by naturally occurring impervious barriers from any oil and gas wastes which might escape or migrate from the pit. Permits issued pursuant to this paragraph will contain conditions reasonably necessary to prevent the waste of oil, gas, or geothermal resources and the pollution of surface and subsurface waters. A permit to maintain or use a pit will state the conditions under which the pit may be operated, including the conditions under which the permittee shall be required to dewater, backfill, and compact the pit. Any permits issued pursuant to this paragraph may contain requirements

concerning the design and construction of pits and disposal facilities, including requirements relating to pit construction materials, dike design, liner material, liner thickness, procedures for installing liners, schedules for inspecting and/or replacing liners, overflow warning devices, leak detection devices, and fences. However, a permit to maintain or use any lined pit for storage or disposal of oil field brines, geothermal resource waters, or other mineralized waters will contain requirements relating to liner material, liner thickness, procedures for installing liners, and schedules for inspecting and/or replacing liners.

(B) Application. An application for a permit to maintain or use a pit or to dispose of oil and gas wastes shall be filed with the commission in Austin. The applicant shall mail or deliver a copy of the application to the appropriate district office on the same day the original application is mailed or delivered to the commission in Austin. A permit application shall be considered filed with the commission on the date it is received by the commission in Austin. When a commission-prescribed application form exists, an applicant shall make application on the prescribed form according to the instructions on such form. The director may require the applicant to provide the commission with engineering, geological, or other information which the director deems necessary to show that issuance of the permit will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface water.

(C) Notice. The applicant shall give notice of the permit application to the surface owner of the tract upon which the pit will be located or upon which the disposal will take place. When the tract upon which the pit will be located or upon which the disposal will take place lies within the corporate limits of an incorporated city, town, or village, the applicant shall

also give notice to the city clerk or other appropriate official. Where disposal is to be by discharge into a watercourse other than the Gulf of Mexico or a bay, the applicant shall also give notice to the surface owner of each waterfront tract between the discharge point and 1/2 mile downstream of the discharge point except for those waterfront tracts within the corporate limits of an incorporated city, town, or village. When one or more waterfront tracts within 1/2 mile of the discharge point lie within the corporate limits of an incorporated city, town, or village, the applicant shall give notice to the city clerk or other appropriate official. Notice of the permit application shall consist of a copy of the application together with a statement that any protest to the application should be filed with the commission within 15 days of the date the application is filed with the commission. The applicant shall mail or deliver the required notice to the surface owners and the city clerk or other appropriate official on or before the date the application is mailed or delivered to the commission in Austin. If in connection with a particular application the director determines that another class of persons, such as offset operators, adjacent surface owners, or an appropriate river authority, should receive notice of the application, the director may require the applicant to mail or deliver notice to members of that class. If the director determines that, after diligent efforts, the applicant has been unable to ascertain the name and address of one or more persons required by this subparagraph (C) to be notified, then the director may authorize the applicant to notify such persons by publishing notice of the application. The director shall determine the form of the notice to be published. The notice shall be published once each week for two consecutive weeks by the applicant in a newspaper of general circulation in the county where the pit will be located or the disposal will take place. The applicant shall file proof of publication with the commission in Austin.

(D) Protests and hearings. If a protest from an affected person is made to the commission within 15 days of the date the application is filed, then a hearing shall be held on the application after the applicant requests a hearing. If the director has reason to believe that a person entitled to notice of an application has not received such notice within 15 days of the date an application is filed with the commission, then the director shall not take action on the application until reasonable efforts have been made to give such person notice of the application and an opportunity to file a protest to the application. If the director determines that a hearing is in the public interest, a hearing shall be held. A hearing on an application shall be held after the commission provides notice of hearing to all affected persons, or other persons or governmental entities, who express an interest in the application in writing. If no protest from an affected person is received by the commission, the director may administratively approve the application. If the director denies administrative approval, the applicant shall have a right to a hearing upon request. After hearing, the hearings examiner shall recommend a final action by the commission.

(E) Modification, suspension, and termination. A permit granted pursuant to this paragraph (6), or a renewal permit granted pursuant to paragraph (7) of this subsection, or a permit which has been issued by the commission prior to the effective date of this subsection but which does not expire pursuant to paragraph (7) of this subsection, may be modified, suspended, or terminated by the commission for good cause after notice and opportunity for hearing. A finding of any of the following facts shall constitute good cause:

(i) pollution of surface or subsurface water is occurring or is likely to occur as a result of the permitted operations;

(ii) waste of oil, gas, or geothermal resources is occurring or is likely to occur as a result of the permitted operations;

(iii) the permittee has violated the terms and conditions of the permit or commission rules;

(iv) the permittee misrepresented any material fact during the permit issuance process;

(v) the permittee failed to give the notice required by the commission during the permit issuance process;

(vi) a material change of conditions has occurred in the permitted operations, or the information provided in the application has changed materially.

(F) Emergency permits. If the director determines that expeditious issuance of the permit will prevent or is likely to prevent the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface water, the director may issue an emergency permit. An application for an emergency permit to use or maintain a pit or to dispose of oil and gas wastes shall be filed with the commission in the appropriate district office. Notice of the application is not required. If warranted by the nature of the emergency, the director may issue an emergency permit based upon a verbal application, or the director may verbally authorize an activity before issuing a written permit authorizing that activity. An emergency permit is valid for up to 30 days, but may be modified, suspended, or terminated by the director at any time for good cause without notice and opportunity for hearing. Except when the provisions of this subparagraph (F) are to the contrary, the issuance, denial, modification, suspension, or termination of an emergency permit shall be governed by the provisions of subparagraphs (A) - (E) of this paragraph.

(G) Minor permits. If the director determines that an application is for a permit to store only a minor amount of oil field fluids or to store or dispose of only a minor amount of oil and gas waste, the director may issue a minor permit provided the permit does not authorize an activity which results in waste of oil, gas, or geothermal resources or pollution of surface or subsurface water. An application for a minor permit shall be filed with the commission in the appropriate district office. Notice of the application shall be given as required by the director. The director may determine that notice of the application is not required. A minor permit is valid for 30 days, but a minor permit which is issued without notice of the application may be modified, suspended, or terminated by the director at any time for good cause without notice and opportunity for hearing. Except when the provisions of this subparagraph (G) are to the contrary, the issuance, denial, modification, suspension, or termination of a minor permit shall be governed by the provisions of subparagraphs (A) - (E) of this paragraph.

(7) Existing permits and pits.

(A) Existing permits. Each permit to maintain or use a lined or unlined pit for storage or disposal of oil field brines, geothermal resource waters, or other mineralized waters, which has been issued by the commission prior to the effective date of this subsection (d), shall expire 180 days after the effective date of this subsection. Every other permit to store oil field fluids or oil and gas wastes or to dispose of oil and gas wastes, which permit has been issued by the commission prior to the effective date of this subsection (d), shall remain in effect until modified, suspended, or terminated by the commission pursuant to paragraph (6)(E) of this subsection. The permits which will expire pursuant to this paragraph (7) include, but are not limited to,

permits for the following types of pits: saltwater disposal pits, emergency saltwater storage pits, skimming pits, and brine pits.

(B) Renewal permits. Any person holding a permit scheduled to expire pursuant to subparagraph (A) of this paragraph may apply to the commission for renewal of the permit. If a person makes timely and sufficient application for renewal of a permit, then, notwithstanding the provisions of subparagraph (A) of this paragraph, the permit shall not expire until final commission action renewing or denying renewal of the permit. An application for renewal of a permit shall be filed with the commission in Austin within 180 days of the effective date of this subsection. No notice of the application is required. The director may administratively approve an application for renewal of a permit. No hearing shall be held on an application for renewal of a permit unless the applicant requests a hearing or the director determines that a hearing is necessary. No renewal permit will be issued unless the standards for permit issuance stated in paragraph (6)(A) of this subsection have been met.

(C) Operating existing unpermitted pits. If, as of the effective date of this subsection, a person is maintaining or using a pit, which is required by this subsection to be permitted but which was not required to be permitted prior to the effective date of this subsection, then the person maintaining or using the pit may continue to maintain or use the pit for 180 days after the effective date of this subsection. If a person makes timely and sufficient application for a permit to maintain or use such an existing but unpermitted pit, then the person may continue to use the pit until final commission action denying the permit. An application for a permit shall be considered timely if it is filed with the commission within 180 days of the effective date of this subsection. The issuance or denial of the permit shall be governed by the provisions of paragraph (6) of this subsection. The

unpermitted pits, whose use or maintenance is authorized by this subparagraph (C), include, but are not limited to, the following types of pits: drilling fluid storage pits, gas plant evaporation/retention pits, and washout pits.

(D) Backfilling existing pits. If, as of the effective date of this subsection, a person is maintaining or using a basic sediment pit which does not meet the 50 barrel size limitation of paragraph (4)(C) of this subsection, then that person shall dewater, backfill, and compact the pit or rebuild the pit to comply with the 50 barrel size limitation within 180 days of the effective date of this subsection. Any person who, as of the effective date of this subsection, is maintaining or using a lined or unlined pit for storage or disposal of oil field brines, geothermal resource waters, or other mineralized waters, which pit was permitted prior to the effective date of this subsection, shall dewater, backfill, and compact the pit within 270 days of the effective date of this subsection unless the person applies for a renewal permit pursuant to subparagraph (B) of this paragraph. If a person applies for a renewal of a permit to maintain or use a lined or unlined pit for storage or disposal of oil field brines, geothermal resource waters, or other mineralized waters, the director may extend the time for dewatering, backfilling, and compacting the pit to up to 90 days after final commission action denying renewal of the permit. If, as of the effective date of this subsection, a person is maintaining or using a pit, which is required by this subsection to be permitted but which was not required to be permitted prior to the effective date of this subsection, then the person maintaining or using the pit shall dewater, backfill, and compact the pit within 270 days of the effective date of this subsection unless the person applies for a permit to maintain or use the pit within the 180-day period allowed by subparagraph (C) of this paragraph. If a person applies for such a permit to maintain or use a previously unpermitted pit, the director may

extend the time for dewatering, backfilling, and compacting the pit to up to 90 days after final commission action denying issuance of the permit. The director may require that pits required to be backfilled by this subparagraph be dewatered, backfilled, and compacted sooner than the time prescribed by this subparagraph if the director determines that oil and gas wastes are likely to escape from the pit or that the pit is being used for improper disposal of oil and gas wastes.

(e) Pollution prevention (reference Order Number 20-59,200, effective May 1, 1969).

(1)-(4) (No change.)

(f) Saltwater haulers.

(1)-(2) (No change.)

(g) Record keeping.

(1) Produced water. When produced water is hauled by truck from the lease where it is produced to an off-lease disposal facility, the person producing the water shall keep, for a period of two years from the date of water production, the following records:

(A) identity of the property from which the produced water is hauled;

(B) identity of the commission-approved disposal facility to which the produced water is delivered;

(C) name, address, and permit number (WHP No.) of saltwater hauler transporting the water from producing lease to disposal facility; and

(D) volume of produced water transported each day from producing lease to disposal facility by saltwater hauler.

(2) Retention of run tickets. A person may comply with the requirements of paragraph (1) of this subsection by retaining run tickets or

other billing information created by the saltwater hauler, provided the run tickets or other billing information contain all the information required by paragraph (1).

(3) Examination and reporting. The person keeping any records required by this subsection (g) shall make the records available for examination and copying by members and employees of the commission during reasonable working hours. Upon request of the commission, the person keeping the records shall file such records with the commission.

(h) Penalties. Violations of this section may subject a person to penalties and remedies specified in Title 3 of the Texas Natural Resources Code and any other statutes administered by the commission. The certificate of compliance for any oil, gas, or geothermal resource well may be revoked in the manner provided in § 3.68 of this title (relating to Pipeline Connection and Severance) (Rule 73) for violation of this section.

☐ New Application
☐ Application for Renewal

RAILROAD COMMISSION OF TEXAS
Oil and Gas Division

Application for Permit to Maintain and Use a Pit

Form H-11
May 1984
Comply with Instructions on Reverse Side

1. Operator's Name (As shown on Form P-5, Organization Report)	2. RRC Operator No.	3. RRC Dist. No.	4. County of pit site

5. Operator's Address (Street, City, State and Zip Code)

6. Name of Lease, Project or Facility of Pit Location | 7. RRC Oil Lease No. or 8. RRC Gas ID No.

9. Pit Location

- Section _____ Block _____ Survey _____ Abstract No. A- _____
- Location is _____ miles _____ (direction) from _____ (nearest town)

10. a. Is pit bottom below ground level?
☐ Yes ☐ No
b. Artificial liner?
☐ Yes ☐ No
c. If lined, equipped with a leak detection system?
☐ Yes ☐ No

11. Name and Address of Surface Owner

12. Are wastes or fluids from operations other than your own?
☐ Yes ☐ No

13. Type of pit (refer to item F of instructions)

14 a. Describe land use surrounding pit location:

b. Is land surrounding pit location productive agricultural land?
☐ Yes ☐ No

15. a. Briefly explain the need for this pit:

15. b. Type of waste or fluid:

15. c. Chloride concentration: _____ mg/l

16. Pit is
☐ Proposed ☐ Existing
If existing, date constructed _____

17. Dikes
a. Height above ground level _____ feet Width at base _____ feet
b. Are dikes designed to keep wastes or fluids in the pit? ☐ Yes ☐ No
c. Are dikes designed to keep stormwater runoff out of the pit? ☐ Yes ☐ No
d. Source of Dike Material: ☐ Excavated from pit ☐ Adjacent borrow pit
☐ Off-site excavation (describe material):

18. Pit capacity (barrels)
_____

19. Inside pit dimensions two feet below top of dike
Length _____ feet Width _____ feet
Depth:
from ground level to deepest point _____ feet

20. Wastes or fluids are transported to pit by (check all that apply):
☐ Contract Hauler ☐ Applicant's truck ☐ Pipe ☐ Other: _____

21. a. Distance to nearest water well within one-mile of pit
_____ feet

21. b. Depth of this water well
_____ feet

22. Depth to shallowest fresh water _____ feet
Source of information:
☐ measured/observed ☐ well owner ☐ electric log ☐ TDWR

23. Have you included all attachments required by the Instructions on the reverse side of this form?

CERTIFICATE

I declare under penalties prescribed in Sec. 91.143, Texas Natural Resources Code, that I am authorized to make this report, that this report was prepared by me or under my supervision and direction, and that data and facts stated therein are true, correct, and complete, to the best of my knowledge.

_____
Signature

_____
Name of Person (type or print) Title

Telephone _____ Date _____
Area Code Number

• RRC DISTRICT USE ONLY •

Application Information Review

Date received _____
Date inspected _____
Inspector _____

☐ Location ☐ Liner ☐ Agricultural Land ☐ Dimensions
☐ Grade Construction ☐ Type Pit ☐ Capacity ☐ Dikes ☐ Waste Transport

Comments:

• RRC AUSTIN USE ONLY •

Date received _____ Pit code _____ Pit type _____ Permit no. _____ Permit date _____

Instructions to Pit Application

Authority: Statewide Rule 8, Water Protection

A. File the application, including all attachments, with the Railroad Commission, Oil and Gas Division, P.O. Drawer 12967, Capitol Station, Austin, Texas 78711. On the same day file one copy of the application and its attachments with the appropriate District Office. This form is not required for a minor permit.

B. Notify the surface owner of the land where the pit will be located by mailing or delivering a copy of the application form, both front and back, but excluding the attachments. If the land where the pit is proposed is within corporate limits, also notify the city clerk or other appropriate city official. If application is for renewal of an existing permit, notice is not required.

C. Attach a plat showing the size of the lease or tract and the location of the pit within the lease or tract. Give approximate perpendicular distance to nearest intersecting lease/unit lines and section/survey lines. To avoid confusion, distinguish between the two sets of lines. Indicate scale on this plat.

D. Attach a county highway map (scale: 1" = 4 miles) showing the location of the pit. County highway maps are available from the Texas Department of Highways and Public Transportation, P. O. Box 5051, Attn: Map Distribution File D-10, Austin, TX 78763.

E. If application is for renewal of a permit for an existing pit, attach a copy of your current authority to use the pit.

F. Identify the type of pit in item 13 using one of the following as defined in Statewide Rule 8(a): Emergency Saltwater Storage Pit, Collecting Pit, Gas Plant Evaporation/Retention Pit, Brine Pit (located at underground hydrocarbon storage facilities only), Saltwater Disposal Pit, Skimming Pit, Washout Pit, Drilling Fluid Disposal Pit, Drilling Fluid Storage Pit, or other (specify in item 13 and explain in item 15a).

G. Attach a drawing of two perpendicular, sectional views of the pit showing the pit bottom, sides, dikes and the natural grade. For an existing pit, dimensions below fluid level may be approximated. If the pit length and width are irregular, include a top view to show pit dimensions and dike widths. Indicate scale on all views.

H. **If pit is lined,** attach data on liner material, thickness, and installation procedures.

I. Attach an identification and description of the soil or subsoil that will make up the pit bottom and sides. The information shall describe the soil by typical name, appropriate proportion of grain sizes, texture, consistency, moisture condition, and other pertinent characteristics. (Example: clayey silt, slightly plastic, small percentage of fine sand, firm and dry in place.) Identify the source of soil information. Information on how to classify soils is available from the District Office or Austin Office upon request. If application is for renewal of a permit for an existing emergency saltwater storage pit or a lined pit with a leak detection system, this attachment is not required.

J. **If pit is equipped with a leak detection system,** attach engineering design drawing of the pit and leak detection system.

K. **If lined pit is not equipped with a leak detection system,** describe procedures for periodic maintenance and determining liner integrity, including any special monitoring.

L. **If pit is an emergency salt water storage pit,** attach justification for pit size based on water production, lease water storage capacity, and anticipated well or equipment shut-down time.

Note: The Director of the Oil and Gas Division may require the applicant to provide the Commission with any additional engineering, geological, or other information which the Director deems necessary to show that issuance of the permit will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface water.

Protests and hearings.

An affected person may file a protest to the application and request a hearing. Any protest to the application should be filed with the Commission in Austin within fifteen days of the date the application is filed with the Commission. Any such protest shall be made in writing and shall include (1) the name, mailing address, and phone number of the person making the protest; and (2) a brief description of how the protestant would be adversely affected by the granting of the permit. If the Commission determines that a valid protest has been received, or that a hearing would be in the public interest, a hearing will be held after the issuance of proper and timely notice of the hearing by the Commission. If no protest is received within fifteen (15) days of receipt of the application in Austin, the application may be processed administratively.

CHAPTER III FIELD OPERATIONS

RULE 3-100 POLLUTION ABATEMENT

RULE 3-101 PROHIBITION OF POLLUTION

(a) All operators, contractors, drillers, service companies, pipepulling and salvaging contractors, or other persons shall at all times conduct their operations and drill, equip, operate, produce, plug and abandon all wells drilled for oil or gas, service wells or exploratory wells (including seismic, core and stratigraphic holes) in a manner that will prevent pollution and the migration of oil, gas, salt water or other substance from one stratum into another, including any fresh water bearing formation. Pollution of surface or subsurface fresh water by deleterious substances used in connection with the exploration, drilling, producing, refining, transporting or processing of oil or gas is hereby prohibited.

(b) Sections 305, 306, 307 and 308 of Title 52, Oklahoma Statutes Annotated, governing the drilling, operation and plugging of oil and gas wells in workable coal beds are hereby adopted as rules of the Commission as fully as if set out verbatim herein.

RULE 3-102 ADMINISTRATION AND ENFORCEMENT OF RULES

The Manager of Pollution Abatement shall supervise and coordinate the administration and enforcement of these rules under the direction of the Director of Conservation and the Commission.

RULE 3-103 COOPERATION WITH OTHER AGENCIES

(a) These rules shall not be construed as modifying the rights, obligations or duties of any person under any law of this State, or under any order, rule or regulation of the Oklahoma Water Resources Board, State Department of Health, Oklahoma Wildlife Conservation Commission, State Board of Agriculture, Department of Pollution Control, or any other agency of this State with respect to the pollution of fresh water.

(b) Whenever a written complaint against any person is filed with the Commission, alleging pollution as prohibited by Rule 3-101, the Manager of Pollution Abatement shall immediately initiate such action as may be necessary or appropriate to abate the pollution.

RULE 3-104 PITS AND TANKS

(a) Pits and tanks for drilling mud or deleterious substances used in the drilling, completion and recompletion of wells shall be constructed and maintained so as to prevent pollution of surface and subsurface fresh water.

(b) Deleterious fluids other than fresh water drilling fluids that were used in drilling or workover operations, which are displaced or produced in well completion or stimulation procedures such as from

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fracturing, acidizing. swabbing, drill stem tests, and any other well stimulation process, shall be collected into a plastic lined pit of at least 30 mil, or metal tank and maintained separate from above-mentioned drilling fluids to allow for separate and legal disposal. (3-30-82)

RULE 3-105 SURFACE AND PRODUCTION CASING

(a) Owners, operators and drilling contractors shall comply with Rule 3-206, "Drilling and Casing Procedures" and Rule 3-301, "Approval of Enhanced Recovery Injection Wells or Disposal Wells". (3-16-81)

(b) In the event a rupture, break or opening occurs in the surface or production casing, the owner, operator or drilling contractor shall take immediate action to repair it, and shall report the occurence to the appropriate District Office or the Manager of Pollution Abatement.

RULE 3-106 FRACTURE AND ACIDIZING

In the completion of an oil, gas, injection, disposal or service well, where acidizing or fracture processes are used, no oil, gas or deleterious substances shall be permitted to pollute any surface and subsurface fresh water.

RULE 3-107 SWABBING AND BAILING

In swabbing, bailing or purging a well, all deleterious substances removed from the bore hole shall be placed in adequate pits or tanks, and no such substances shall be permitted to pollute any surface and subsurface fresh water.

RULE 3-108 PRODUCING OIL AND GAS WELLS

All wellhead connections, surface equipment and tank batteries shall be maintained at all times so as to prevent leakage of oil, gas, salt water or other deleterious substances.

RULE 3-109 OIL STORAGE

Oil storage tanks shall be constructed so as to prevent leakage; and dikes or walls, where necessary, shall be constructed so as to prevent oil or deleterious substances from polluting surface and sub-surface water.

RULE 3-110 USE OF EARTHEN PITS

RULE 3-110.1 USE OF ON-SITE EARTHEN PITS

(a) An earthen pit serving only the lease or unit on which it is located is defined as an on-site pit. An on-site earthen pit used for the handling, storage or disposal of any deleterious substance produced, obtained, or used in connection with the drilling or

operation of wells, shall be constructed of, or sealed with, an impervious material, and shall be used and operated at all times so as to prevent any escape of any deleterious substance. (4-2-81)

(b) No on-site earthen pit shall be constructed, enlarged, reconstructed, or used until the District Office has issued a written permit for its use and assigned a permit number. The operator shall file Form 1014, in triplicate, with the appropriate District Office. When approved, one copy will be returned to the operator as a permit which shall bear the permit number assigned. The operator shall post a waterproof sign bearing the name of the operator and the permit number within twenty-five (25) feet of the pit. (4-2-81)

(c) Every on-site earthen pit not having a permit and permit number shall be emptied and leveled. (4-2-81)

(d) Paragraph (b) and (c) above, shall not apply to:

(1) An emergency pit constructed solely to prevent escape of substances. Provided, an emergency pit shall not be constructed in pervious soil unless lined, and shall never be used for the storage of any substance. (4-2-81)

(2) A circulating, frac or reserve mud pit used in drilling, deepening, testing, reworking or plugging a well while such operations are in progress. Each reserve pit shall be leveled within twelve (12) months after drilling operations cease. One six-month extension may be granted by the District Manager for reasonable cause. Each circulating pit shall be emptied and leveled within sixty (60) days after the drilling operations cease. Each fracture pit shall be emptied and leveled within sixty (60) days after completion of fracture operations. Provided, however, upon application, notice and hearing, and not less than ten (10) days notice by restricted mail to the occupying owner or tenant of the land upon which the pit is located, and for good cause shown, reasonable extensions of the times set out above may be granted. (4-2-81)

(3) A burn pit used solely to burn waste oil or other flammable material. Provided, a burn pit shall never be used for storage of any substance. (4-2-81)

(e) Notice of construction of an on-site emergency pit or burn pit shall be filed, in triplicate, with the appropriate District Office on Form 1014. The appropriate District Office shall be notified in writing of each use of an emergency pit. (4-2-81)

(f) No on-site earthen pit shall be constructed or maintained so as to receive outside runoff water and the fluid level of each earthen pit shall be maintained at all times at least eighteen (18) vertical inches below the lowest point of the embankment. (3-30-82)

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(g) The appropriate District Office shall be notified in writing whenever an on-site earthen pit is abandoned. (4-2-81)

RULE 3-110.2 USE OF OFF-SITE EARTHEN PITS

(a) Any earthen pit not defined in Rule 3-110.1 is defined as an off-site earthen pit. An off-site earthen pit used for the handling, storage or disposal of any deleterious substance produced, obtained, or used in connection with the drilling or operation of wells, shall be constructed of, or sealed with, an impervious material, and shall be used and operated at all times so as to prevent any escape of any deleterious substance. (3-30-82)

(b) No off-site earthen pit shall be constructed, enlarged, reconstructed, or used until the District Office has issued a written permit for its use and assigned a permit number. The operator shall file Form 1014, in triplicate, with the appropriate District Office. When approved, one copy will be returned to the operator as a permit which shall bear the permit number assigned. The operator shall post a waterproof sign bearing the name of the operator and the permit number within twenty-five (25) feet of the pit. If Form 1014 is not approved by the appropriate District Office, or if a protest is received at the district level, the operator may file an application for hearing with the Commission, which shall be set for hearing. (4-2-81)

(c) Notice that an application has been filed with the Commission shall be published by the applicant in a newspaper of general circulation and published in the county in which the pit is located and not less than ten (10) days notice by restricted mail to the occupying owner or tenant of the land upon which the pit is located. The applicant shall file proof of publication prior to the hearing. (4-2-81)

(d) Every off-site earthen pit not having a permit and permit number shall be emptied and leveled. (4-2-81)

(e) Every off-site earthen pit shall be completely enclosed by a permanent woven wire fence of at least four (4) feet in height. (4-2-81)

(f) No off-site earthen pit shall be constructed or maintained so as to receive outside runoff water and the fluid level of each earthen pit shall be maintained at all times at least eighteen (18) vertical inches below the lowest point of the embankment. (3-30-82)

(g) The appropriate District Office shall be notified in writing whenever an off-site earthen pit is abandoned. (4-2-81)

(h) The provisions of Rule 3-110.2 shall not apply to an off-site reserve pit used for primary drilling operations. (4-2-81)

(i) Use of off-site earthen pits designed specifically for disposal of deleterious substances from more than one well site shall meet the additional following requirements: (3-30-82)

(1) No off-site earthen pit shall be constructed or maintained so as to receive outside runoff water and the fluid level in the off-site earthen pit shall be maintained at all times at least twenty-four (24) vertical inches below the lowest point of the embankment. (3-30-82)

(2) No off-site earthen pit shall be constructed in the 100 year flood plain of any drainage basin. (3-30-82)

(3) No off-site earthen pit shall contain fluids with a chloride content greater than 3500 MG/L. (3-30-82)

(4) No off-site earthen pit shall contain a soil seal less than 12 inches thick with the co-efficient of permeability no greater than 10^{-7} cm/sec. If a Bentonite seal is to be used, the Bentonite shall be mixed to form the previously mentioned permeability requirement into the soil to a uniform depth of at least 6 inches. (3-30-82)

(5) Two test borings shall be drilled to a minimum depth of 25' below the bottom of the earthen pit, and to be located outside of and near the low elevation side of the pit. The borings shall be submitted with the application to demonstrate the subsurface profile of the proposed pit. (3-30-82)

(6) Any earthen pit that contains deleterious substances shall be lined so as to prevent contamination of the fresh water. The type of liner proposed shall be approved by the Commission's District Manager and Manager of Pollution Abatement. (3-30-82)

(7) Written certification that the seal was provided and constructed in accordance with Commission-approved specifications shall be furnished by the supplier, project engineer, or independent soils laboratory. (3-30-82)

(8) All off-site earthen pits shall be filled and leveled within one (1) year after abandonment. (3-30-82)

(9) No abandoned mines or strip pits shall be used for disposal of oilfield waste unless the geology and hydrology demonstrate that such disposal will not contaminate the fresh water of the state. (3-30-82)

(10) No off-site earthen pit shall contain deleterious substances unless the geology and hydrology demonstrate that such disposal will not contaminate the fresh water of the state. (3-30-82)

RULE 3-110.3 AGRICULTURAL USE OF OIL FIELD WASTE PROHIBITED

Any spreading and/or soil farming of oil field drilling waste shall be prohibited.

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RULE 3-111 REFINING AND PROCESSING OF OIL AND GAS

(a) All deleterious substances obtained or used in the processing and refining of oil and gas shall be disposed of in a manner that will prevent the pollution of fresh water.

(b) Chemicals, gasolines, oils and other deleterious substances shall be stored, where necessary, in tanks or containers of a material and of a construction and in a manner that will prevent the escaping, seepage, or draining of such liquids into any fresh water.

RULE 3-114 PROTECTION OF MUNICIPAL WATER SUPPLIES

The Commission, upon application of any municipality or other governmental subdivision, may enter an order establishing special field rules within a defined area to protect and preserve fresh water and fresh water supplies.

RULE 3-120 INSPECTION AND ENFORCEMENT

RULE 3-121 INFORMAL COMPLAINTS

If, upon information or inspection, it is found that an operator, processor, refiner, or transporter of oil or gas is violating any rule or order of the Commission or causing damage or pollution to any oil or gas formation, surface or underground fresh water, the Conservation Division shall cause an investigation to be made and shall file a written administrative complaint, in duplicate, on Form 1036, and one copy of Form 1036 shall be delivered or mailed to the operator. If, upon subsequent inspection it is determined that the operator has taken the corrective actions specified the complaint shall be dismissed; otherwise, formal application will be made to the Commission for an order shutting down the lease or well, and for any other appropriate remedy; pending the outcome of the final determination of the Commission on the formal application, any District Manager shall, after an on-site inspection, have the authority to shut down those operations where conditions appear obvious that surface or underground pollution is occurring. (4-2-81)

RULE 3-200 DRILLING AND DEVELOPMENT

RULE 3-201.1 OPERATORS AGREEMENT, FINANCIAL STATEMENT, ETC.

(a) Each person who drills or operates any well within the State of Oklahoma for the exploration, development or production of oil or gas, or as an injection or disposal well, shall furnish his agreement in writing to plug the well at the time and in the manner prescribed by the Rules and Regulations of the Commission and the laws of the State of Oklahoma. The agreement shall provide that if the Commission determines that he has neglected, failed or refused to plug any well in compliance with the Commission's Rules and Regulations, he will forfeit or pay to the State, through the

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STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION ON ITS OWN MOTION TO DEFINE THE VERTICAL AND AREAL EXTENT OF AQUIFERS POTENTIALLY VULNERABLE TO CONTAMINATION BY THE SURFACE DISPOSITION OF WATER PRODUCED IN CONJUNCTION WITH THE PRODUCTION OF OIL AND GAS IN McKINLEY COUNTY, RIO ARRIBA, SANDOVAL AND SAN JUAN COUNTIES, NEW MEXICO.

CASE NO. 8224

Order No. R-

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing on June 7, 1984, and February 22, April 3, 22, and 23, 1985, at Santa Fe, New Mexico before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this _____ day of June, 1985, the Commission, a quorum being present, and having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS THAT:

(1) Due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) In the process of producing oil or gas, or both, in San Juan, McKinley, Rio Arriba and Sandoval Counties, New Mexico, various amounts of water is also produced, which is permitted to be disposed of on the surface of the ground or into unlined disposal pits.

(3) This produced water often contains high concentrations of chlorides and other minerals as well as organic hydrocarbons such as benzene and toluene.

(4) Unregulated disposal of produced water containing organic hydrocarbons or high levels of dissolved minerals onto the surface of the ground or into unlined pits may endanger fresh water supplies in the vicinity of such disposal.

(5) Section 70-2-12B(15) NMSA (1978) of the Oil and Gas Act mandates the Oil Conservation Commission "to regulate the disposition of water produced or used in connection with the drilling for or producing of oil or gas, or both, and to direct surface or subsequent disposal of such water in a manner that will afford reasonable protection against contamination of

fresh water supplies..." The Director of the Oil Conservation Division, after the initial hearing in this case, appointed a Committee to evaluate the impact of oil and gas operations on the ground and surface waters in San Juan, Sandoval, McKinley, and Rio Arriba Counties, New Mexico. The Committee was comprised of representatives from the oil and gas industry, the Oil Conservation Division, the Environmental Improvement Division, the League of Women Voters, environmental organizations, and

(6) The Committee was assigned the following tasks:

A. Determine what constitutes a vulnerable aquifer;

B. Map the vulnerable aquifer;

C. Attempt to determine the probability unlined pits may have in contaminating the vulnerable aquifers; and

D. Prepare a recommendation to the OCD for an order which will address the problems identified by the committees.

(7) The Committee made its report at the hearing held on February 22, 1985. Among the Committees findings and recommendations were the following:

A. There are areas in San Juan, Rio Arriba, McKinley, and Sandoval Counties, New Mexico, where ground or surface water may be vulnerable to contamination by oil and gas production operations.

B. The vulnerable areas include these areas where the depth to ground water is less than fifty (50) feet, the aquifer containing the ground water consists of unconsolidated alluvial fill, and the water is presently used for or is of such quality that it could reasonably be used for municipal domestic, industrial, agricultural or stock watering purposes.

C. The vulnerable area is geographically defined as those portions of the San Juan, Animas, and La Plata River Valleys that are bounded by a topographic line on either side of the river, which lines are 100 vertical feet above the river channel measured perpendicularly to the river channel.

D. Vulnerable areas lying outside this described area are referred to as special areas and consist of the following described parcels, all

of which have water production from less than 50 feet in depth:

T28N-R 8W, Sec. 17	T30N-R12W, Sec. 13
T28N-R11W, Sec. 18	T30N-R12W, Sec. 15
T28N-R15W, Sec. 26	T30N-R12W, Sec. 27
T29N-R10W, Sec. 16	T30N-R12W, Sec. 33
T29N-R12W, Sec. 24	T30N-R13W, Sec. 1
T29N-R18W, Sec. 17	T30N-R15W, Sec. 6
T29N-R19W, Sec. 23	T30N-R15W, Sec. 16
T29N-R19W, Sec. 30	T30N-R15W, Sec. 21
T30N-R10W, Sec. 5	T30N-R16W, Sec. 29
T30N-R11W, Sec. 3	T30N-R19W, Sec. 34
T30N-R11W, Sec. 7	T31N-R10W, Sec. 13
T30N-R11W, Sec. 8	T31N-R11W, Sec. 35
T30N-R11W, Sec. 10	T32N-R10W, Sec. 10
T30N-R11W, Sec. 19	T32N-R11W, Sec. 23
	T32N-R12W, Sec. 25

E. Those areas that lie between the aforementioned rivers and irrigation ditches are also classified as Special Areas. These are defined more specifically as follows.

F. Disposal of produced water or fluids produced

in connection with the production of oil and natural gas, or both, into unlined pits is prohibited, except for the following:

1. Pits lying outside vulnerable or special areas are exempt from this order.

2. Any pits, ponds, lagoons, or impoundments resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act.

3. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or NPDES regulations authorized under the Resource Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act.

4. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan approved and permit issued by the New Mexico Coal Surface Mining

Commission under the authority of the Surface Mined Lands Reclamation Act.

(8) The Committee, although agreeing that an order regulating the use of produced water and ancillary pits in San Juan, Rio Arriba, McKinley, and Sandoval Counties was needed, was unable to agree on whether such an order should have exemptions based on a well- by-well analysis, or a "blanket" exclusion of wells producing small quantities of water. The Committee was also unable to agree on a minimum depth to ground water for continued use of unlined pits.

(9) Expert testimony by Division staff and others indicates that because of the high soil permeabilities and shallow ground water in the vulnerable area, unregulated disposal of produced water onto the surface of the ground or into unlined pits can reasonably be expected to lead to contamination of fresh water resources.

(10) Although various mechanisms of attenuation, such as evaporation, volatilization, sorption, dissolution, and biodegradation can be expected to degrade some of the organic hydrocarbons contained in produced water, these mechanisms cannot be reasonably relied on in all situations and in all areas to protect fresh water resources from contamination in the vulnerable area.

(11) Expert testimony by Division staff and others indicates that discharge of not more than one-half barrel per day of produced water and other fluids will provide reasonable protection of fresh water provided that depth to ground water is at least ten feet.

IT IS THEREFORE ORDERED THAT:

(1) Disposal of produced water in San Juan, Rio Arriba, McKinley, and Sandoval Counties, New Mexico, should henceforth be regulated in such a manner as to afford reasonable protection to fresh water resources.

(2) The areas where fresh water is most vulnerable to contamination from unregulated disposal of produced water in the aforementioned counties are those areas where the depth to ground water is less than fifty (50) feet, the aquifer containing the ground water consists of unconsolidated alluvial fill, and the water is presently used for or is of such quality that it could reasonably be used for municipal, domestic, industrial, agricultural, or stock watering purposes.

(3) This area of vulnerable ground water ("vulnerable area") is geographically defined as follows:

a. The area within the river valleys of the

San Juan, Animas, and La Plata Rivers which is bounded by the topographic line on either side of the river that is one hundred vertical feet above the river channel measured perpendicularly to the river channel.

b. Parcels outside the above-described area in which ground water is found to be within fifty feet of the ground surface and which also contain oil or gas wells. These areas, referred to as "special areas," are listed below:

T28N-R 8W, Sec. 17	T30N-R12W, Sec. 13
T28N-R11W, Sec. 18	T30N-R12W, Sec. 15
T28N-R15W, Sec. 26	T30N-R12W, Sec. 27
T29N-R10W, Sec. 16	T30N-R12W, Sec. 33
T29N-R12W, Sec. 24	T30N-R13W, Sec. 1
T29N-R18W, Sec. 17	T30N-R15W, Sec. 6
T29N-R19W, Sec. 23	T30N-R15W, Sec. 16
T29N-R19W, Sec. 30	T30N-R15W, Sec. 21
T30N-R10W, Sec. 5	T30N-R16W, Sec. 29
T30N-R11W, Sec. 3	T30N-R19W, Sec. 34
T30N-R11W, Sec. 7	T31N-R10W, Sec. 13
T30N-R11W, Sec. 8	T31N-R11W, Sec. 35
T30N-R11W, Sec. 10	T32N-R10W, Sec. 10
T30N-R11W, Sec. 19	T32N-R11W, Sec. 23
	T32N-R12W, Sec. 25

C. Areas that lie between the San Juan, Animas or La Plata Rivers and the ditches mentioned below are also special areas:

Highland Park Ditch
Hillside Thomas Ditch
Cunningham Ditch
Farmers Ditch
Halford Independent Ditch
Citizens Ditch
Hammond Ditch

(4) Disposal of water or other fluids produced in connection with the production of oil or gas, or both, onto the surface of the ground or into any pit, pond, lake, depression, draw, streambed, arroyo, or into any watercourse, or into any other place or in any manner as to constitute a hazard to any fresh water supply is hereby prohibited in the vulnerable area as defined in Paragraph (3) above, except as described herein.

a. Those wells whose produced water or ancillary pit receives no more than one-half barrel of water in any twenty-four hour period are exempt from this order unless depth to ground water is less than ten feet.

b. Any pits, ponds, lagoons, or impoundments

resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act.

c. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or NPDES regulations authorized under the Resource Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act.

d. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan approved and permit issued by the New Mexico Coal Surface Mining Commission under the authority of the Surface Mined Lands Reclamation Act.

(5) Transportation and disposal of produced water from a point within the vulnerable area to a point outside the vulnerable area shall be made only after approval by the Division.

(6) The provisions of this order shall be effective twelve months from the date hereinabove set forth.

(7) Jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

50 YEARS
1935 - 1985

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

May 23, 1985

Mr. R. L. Stamets
Oil Conservation Commission
P.O. Box 2088
Santa Fe, NM 87501

Re: OCC Case No. 8224,
Request Post-Hearing
Documents

Dear Mr. Stamets:

Please find enclosed two copies of the proposed pit registration form submitted as a post-hearing document.

In addition, results of the pollutant load limit simulations for Total Dissolved Solids (TDS) from the "Random Walk" model run by Mr. David Boyer of the OCD are shown below. Since initial concentrations were on the order of 10,000 mg/l TDS and quantity of discharge is known, further interpretation can be made from this information for total salt load limits. Results were judged acceptable/unacceptable based on whether total TDS exceeded 1,000 mg/l (NM WQCC standard) for an initial uncontaminated ground water TDS of 725 mg/l (average from "Hydrogeology of the Aztec Quadrangle, San Juan County, NM", Bureau of Mines Hydrologic Sheet #1). The simulations were run using the same aquifer conditions presented previously for benzene except the Retardation Coefficient was set equal to 1 foot instead of 7.

K (ft/day)	Q (bbl/day)	RANGE OF MAXIMUM TDS INCREASE AND DISTANCE FROM PIT	DISCHARGE TO UNLINED PIT?
25	5	1293 to 2247 PPM at 0 to 50 feet	Unacceptable
25	1	292 to 494 PPM at 10 to 20 feet	Unacceptable
25	1/2	175 to 213 PPM at 10 to 60 feet	Acceptable
100	5	562 to 1123 PPM at 20 to 200 feet	Unacceptable

100	1	112 to 210 PPM at 10 to 160 feet	Acceptable
100	1/2	-	Acceptable
250	5	162 to 499 PPM at 20 to 150 feet	Unacceptable
250	1	-	Acceptable
250	1/2	-	Acceptable
2500	5	367 PPM at 20 feet	Unacceptable
2500	1	-	Acceptable
2500	1/2	-	Acceptable

I hope that this information is useful to the Commission in making its decision in this matter. The Division's proposed order and brief summarizing legal and factual issues should be filed by the end of the month.

Sincerely,

Jeff Taylor
General Counsel

cc: W. Thomas Kellahin, Esq. - w/enc.
Kellahin and Kellahin
P.O. Box 2265
Santa Fe, NM 87504

Jennifer Pruitt, Esq., - w/enc.
Environmental Improvement Division
P.O. Box 968
Santa Fe, New Mexico 87501

William F. Carr, Esq. - w/enc.
Attorney at Law
P.O. Box 2208
Santa Fe, NM 87501

Perry Pearce, Esq. - w/enc.
Montgomery Law Firm
P.O. Box 2307
Santa Fe, New Mexico 87501

OCD DRAFT 5/22/85

PIT REGISTRATION FORM

OPERATOR:
(List Information for only those pits operated by you at the lease)

WELL AND LEASE NAME:
LOCATION:

	PRIMARY PIT[1]	AUXILLARY PIT(s)[2] PIT 1	PIT 2	PIT 3
USE:	PRODUCED WATER			

DIMENSIONS:
(LxWxD, Ft.)

DISCHARGE:
(Bbl/day)

HOW MEASURED:
(Choose One)
Counter?
Flowmeter?
Other?
(Specify)

VOLUME PER DUMP:

DATE LAST
MEASURED:

CONDUCTIVITY & TEMP.
OF DISCHARGES
TO PIT (Mmhos, ^{o}C):

PIT DISPOSITION:
(Choose One)
Unlined?
Lined? (Show
type of lining)
Tank? (Show
type fo tank)

DEPTH TO
GROUND WATER:

MEASURED OR
ESTIMATE:

1) If no primary pit is present or if discharge is to an ancillary pit, indicate which ancillary pit received produced water.

2) Ancillary pits include blowdown pits, dehydrator pits, tank drain pits, pipeline drip pits, etc. (Use separate sheet if needed)

OCD DRAFT 5/22/85

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	PRIMARY PIT[1]	AUXILLARY PIT(s)[2] PIT 1	PIT 2	PIT 3
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50 YEARS

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

1935 - 1985

TONEY ANAYA
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

May 23, 1985

Mr. R. L. Stamets
Oil Conservation Commission
P.O. Box 2088
Santa Fe, NM 87501

Re: OCC Case No. 8224,
Request Post-Hearing
Documents

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In addition, results of the pollutant load limit simulations for Total Dissolved Solids (TDS) from the "Random Walk" model run by Mr. David Boyer of the OCD are shown below. Since initial concentrations were on the order of 10,000 mg/l TDS and quantity of discharge is known, further interpretation can be made from this information for total salt load limits. Results were judged acceptable/unacceptable based on whether total TDS exceeded 1,000 mg/l (NM WQCC standard) for an initial uncontaminated ground water TDS of 725 mg/l (average from "Hydrogeology of the Aztec Quadrangle, San Juan County, NM", Bureau of Mines Hydrologic Sheet #1). The simulations were run using the same aquifer conditions presented previously for benzene except the Retardation Coefficient was set equal to 1 foot instead of 7.

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I hope that this information is useful to the Commission in making its decision in this matter. The Division's proposed order and brief summarizing legal and factual issues should be filed by the end of the month.

Sincerely,

Jeff Taylor
General Counsel

cc: W. Thomas Kellahin, Esq. - w/enc.
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Montgomery Law Firm
P.O. Box 2307
Santa Fe, New Mexico 87501

OCD DRAFT 5/22/85

PIT REGISTRATION FORM

OPERATOR:
(List Information for only those pits operated by you at the lease)

WELL AND LEASE NAME:
LOCATION:

	PRIMARY PIT[1]	AUXILLARY PIT(s)[2] PIT 1	PIT 2	PIT 3
USE:	PRODUCED WATER			

DIMENSIONS:
(LxWxD, Ft.)

DISCHARGE:
(Bbl/day)

HOW MEASURED:
(Choose One)
Counter?
Flowmeter?
Other?
(Specify)

VOLUME PER DUMP:

DATE LAST
MEASURED:

CONDUCTIVITY & TEMP.
OF DISCHARGES
TO PIT (Mmhos, ^{o}C):

PIT DISPOSITION:
(Choose One)
Unlined?
Lined? (Show
type of lining)
Tank? (Show
type fo tank)

DEPTH TO
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2) Ancillary pits include blowdown pits, dehydrator pits, tank drain pits, pipeline drip pits, etc. (Use separate sheet if needed)

MONTGOMERY & ANDREWS
PROFESSIONAL ASSOCIATION
ATTORNEYS AND COUNSELORS AT LAW

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May 24, 1985

HAND DELIVERED

RECEIVED
MAY 2 1985
OIL CONSERVATION DIVISION

Richard L. Stamets, Chairman
New Mexico Oil Conservation
Commission
Post Office Box 2088
Santa Fe, New Mexico 87504-2088

Re: OCC Cause No. 8224

Dear Dick:

Enclosed is a copy of a proposed order in the No-Pit case. This proposed draft is submitted to you on behalf of Meridian Oil Inc., El Paso Natural Gas Company and Giant Industries, Inc.

The provisions of the proposed rule contained within this proposed order are substantially those contained in the draft rule submitted to you by the short-term Water Study Committee.

Thank you in advance for your consideration of these matters.

Sincerely,

W. Perry Pearce

WPP:dml
Enclosure

cc: Joe Rush (w/enclosure)
Meridian Oil, Inc.

William F. Lorang (w/enclosure)
El Paso Natural Gas Company

Carlos Guerra, Esquire (w/enclosure
Giant Industries, Inc.

Jeff Taylor, Esquire (w/enclosure)
Water Study Committee

W. Thomas Kellahin, Esquire (w/enclosure)
Tenneco

Gary L. Paulson, Esquire (w/enclosure)
Amoco Production Company

William F. Carr, Esquire (w/enclosure)
Northwest Pipeline & Amoco Production Company

Thomas L. Wright, Esquire (w/enclosure)
El Paso Natural Gas Company

STATE OF NEW MEXICO
DEPARTMENT OF ENERGY AND MINERALS
OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE: 8224
ORDER R-

APPLICATION OF THE OIL
CONSERVATION COMMISSION UPON
ITS OWN MOTION, TO DEFINE THE
VERTICAL AND AREAL EXTENT OF
AQUIFERS POTENTIALLY VULNERABLE
TO CONTAMINATION BY THE SURFACE
DISPOSAL OF PRODUCED WATER,
MCKINLEY, RIO ARRIBA, SANDOVAL
AND SAN JUAN COUNTIES, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing on February 20, 1985, April 3, 1985 and April 22 and 23, 1985, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this _____ day of _____, 1985, Commission, a quorum being present, having considered the testimony presented and the evidence received at the hearings and being fully advised in the premises;

FINDS:

1. That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

2. That this case was originally docked for hearing by an Oil Conservation Division hearing examiner on June 7, 1984.

3. That the hearing of June 7, 1984 was continued to July 18, 1984 at which time an informal conference of interested parties was held. Parties from the OCD, the New Mexico Environmental Improvement Division, private environmental groups, concerned citizens, Indian tribes, and representatives of the oil and gas industry attended this conference and participated in discussions relating to the possible contamination of underground waters by the use of unlined pits for the disposal of water processed or used in connection with the drilling for or production of oil or gas or both.

4. As a result of that conference, the OCD established short-term and long-term study committees. The goals of the Short-Term Water Study Committee were to:

   a) determine what constitutes a vulnerable aquifer;

   b) map the vulnerable aquifer;

   c) attempt to determine the probability unlined pits may have in contaminating the vulnerable aquifers; and

   d) prepare a recommendation to the OCD for an order which will address the problems identified by the committee.

5. That the Short-Term Water Study Committee held a series of meetings, mapping sessions and field tours in order to accomplish its goals.

6. A hearing was called by the Commission on February 20, 1985 to consider the recommendations of the Short-Term Water Study Committee. This recommendation reported in part that:

   > It has been determined that in San Juan, Rio Arriba, McKinley and Sandoval Counties in the State of New Mexico, there are areas where ground or surface water may be vulnerable to contamination by oil and gas production operations. Those vulnerable areas include areas where the depth to groundwater is less than 50 feet, the aquifer containing the groundwater consists of unconsolidated alluvial fill, and the water is presently used for or could reasonably be presumed

to be used for municipal, domestic, industrial, agricultural or stock watering purposes.

7. That as a result of this determination the Short-Term Water Study Committee had defined and mapped "vulnerable areas" and "special areas" in which particular care needed to be exercised in the use of unlined pits for the disposal of water produced or used in connection with the drilling for or producing of oil or gas or both in the four (4) counties.

8. That the committee reached agreement and recommends that in accordance with the presently applicable federal standard unlined pits in the vulnerable area that receive five (5) barrels per day or more should be taken out of service within eighteen (18) months following the entry of an order directing that those pits be properly lined or properly abandoned.

9. That the Short-Term Water Study Committee agrees and recommends that:

   a) Pits lying <u>outside</u> vulnerable or special areas be exempt from this order.

   b) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act be exempt from this order.

   c) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or NPDES regulations authorized under the Resource Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act be exempt from this order.

   d) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan approved and permit issued by

the New Mexico Coal Surface Mining Commission under the authority of the Surface Mined Lands Reclamation Act be exempt from this order.

10. That the committee agreed and recommended that permits be granted for the use of unlined pits in the vulnerable area for any pit for which the operator makes either of the following showings:

    a) Quality Permit: If the operator can demonstrate that the quality of either existing uncontaminated groundwater, or produced water is such that the introduction of produced water will not cause degradation of the groundwater, the unlined pit may be permitted upon application to the NMOCD. The demonstration must include analysis for organic and inorganic parameters as required by the Division.

    b) Soil and Geologic Characteristics Permit: If the operator can demonstrate through the use of standard soil analysis parameters (e.g., percolation tests, infiltration rates, particle size/distribution, etc.) that the existing soil and/or underlying geologic stratum exhibit low permeabilities such that the produced water will not cause degradation of the groundwater, the unlined pit may be permitted upon application to the NMOCD. This can be accomplished on an aerial or site specific basis.

11. That the committee could not agree and made no recommendation to the Commission as to whether or not small volume unlined pits should be allowed to continue to be used in the vulnerable area and special areas.

12. That there are "mechanisms of attenuation" which tend to greatly reduce the quantity of contaminants contained in produced water or tend to retard the movement of these contaminants and thereby tend to provide additional protection to the potentially vulnerable underground water resources. That these mechanisms include: flash volitilization which

eliminates volatile organics prior to their reaching the disposal pit; evaporation and volatilization from the pit which eliminates volatile organics prior to their penetrating the surface of the ground; partially saturated flow which acts to retard the velocity of the flow through the area between the surface and the water table; evaporation and volatilization from the soil which acts to eliminate volitle organics during their presence in the partially saturated zone; sorption which acts to retard the flow of contaminants; and, biodegradation which tends to mineralize organic contaminants entirely.

13. That field test data from several sites representative of the types of conditions expected to be encountered in the vulnerable and special areas indicate that these small volume pits do not cause the New Mexico Water Quality Control Standards be exceeded despite the fact that some simple or uncalibrated modeling efforts to project the incidence of contamination indicate that the contamination should be present.

14. That the more sophisticated and more accurate modeling technique model was presented in this case was calibrated to reflect the actual field results of a set of representative wells in the vulnerable area, this model indicates that water quality standards would not be exceeded by the use of small volume unlined pits at these other well locations.

15. That the cost of lining small volume pits would represent a substantial expense in relation to the production of many wells and might cause the premature abandonment of some wells with resultant waste of the natural resource and injury to correlative rights.

16. That there is insufficient evidence to support a finding that it is necessary to prohibit the use of small volume unlined pits in the vulnerable area in order to afford reasonable protection against contamination of fresh water supplies designated by the State Engineer.

17. That the recommendations of the Short-Term Water Study Committee should be adopted and that any produced water pit which receives five (5) barrels per day or less of produced water and any ancillary pit which receives one barrel per day or less of water or fluids should be exempt from the coverage of this order.

IT IS THEREFORE ORDERED:

(1) That Special Rules and Regulations governing the use of unlined pits for the disposal of produced water in the vulnerable and special areas of McKinley, Rio Arriba, Sandoval and San Juan Counties, New Mexico are hereby promulgated as follows:

SPECIAL RULES AND REGULATIONS FOR THE USE OF UNLINED PRODUCED WATER DISPOSAL PITS IN MCKINLEY, RIO ARRIBA, SANDOVAL AND SAN JUAN COUNTIES, NEW MEXICO.

RULE 1 DEFINITIONS:

1. Aquifer: An aquifer is a saturated permeable geologic unit (a geological formation, group of formations, or part of a formation) that can transmit significant quantities of water under ordinary hydraulic gradients.

   For purposes of this definition, the word significant means that the water from the aquifer is used for or may reasonably be presumed to be usable for municipal, industrial, domestic, agricultural, or stock watering purposes.

2. Vulnerable Aquifer: For the purpose of this order the following are defined as vulnerable aquifers:

   a) Unconfined aquifers in which the static water level is less than 50 feet from the surface, or

   b) Unconfined aquifers in floodplain areas, or

   c) Aquifers in unconsolidated materials.

3. Vulnerable Area: An area which lies over or adjacent to a vulnerable aquifer and is defined as an area within the river valleys of the San Juan, Animas, and La Plata Rivers which is bounded by the topographic line on either side of the river that is 100 vertical feet above the river channel measured perpendicularly to the river channel.

4. Special Areas: Areas outside of the vulnerable area in which ground water is subsequently found to be within 50' of the ground surface. Special areas presently identified are listed below:

a) Sections

T28N-R 8W, Section 17	T30N-R12W, Section 13
T28N-R11W, Section 18	T30N-R12W, Section 15
T28N-R15W, Section 26	T30N-R12W, Section 27
T29N-R10W, Section 16	T30N-R12W, Section 33
T29N-R12W, Section 24	T30N-R13W, Section 1
T29N-R18W, Section 17	T30N-R15W, Section 6
T29N-R19W, Section 23	T30N-R15W, Section 16
T29N-R19W, Section 30	T30N-R15W, Section 21
T30N-R10W, Section 5	T30N-R16W, Section 29
T30N-R11W, Section 3	T30N-R19W, Section 34
T30N-R11W, Section 7	T31N-R10W, Section 13
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T30N-R11W, Section 10	T32N-R10W, Section 10
T30N-R11W, Section 19	T32N-R11W, Section 23
	T32N-R12W, Section 25

b) Areas that lie between the rivers and the ditches mentioned below are also special areas:

Highland Park Ditch
Hillside Thomas Ditch
Cunningham Ditch
Farmers Ditch
Halford Independent Ditch
Citizens Ditch
Hammond Ditch

5. Produced Water Pit: That pit which receives water produced from primary separation in conjunction with the production of crude oil and/or natural gas whether or not such pit is located at the site of production.

6. Ancillary Pit: Those pits not receiving fluids, from primary separation including but not limited to dehydrator pits, tank drain pits, pipeline drip collector pits, blowdown pits and compressor scrubber pits. Examples are listed below:

a) Dehydrator Pit: Those pits which normally receive produced water only from the dehydration unit.

b) Blowdown Pit: Those pits which receive liquid only when a well is blown down.

c) Tank Drain Pit: Those pits which receive water that is drained from a production storage tank.

d) Pipeline Drip Collector Pit: Those pits which receive liquids which accumulate in gas pipelines.

e) Compressor Scrubber Pit: Those pits which receive liquids at the compressor suction in event or primary separator failure.

RULE 2 PROHIBITIONS

Disposal of produced water or fluids produced in connection with the production of oil and natural gas, or both, in unlined pits is prohibited, except for disposal of produced water specifically exempted herein.

RULE 3 EXEMPTIONS

The provisions of this order shall not apply to:

1. Pits lying outside vulnerable or special areas in McKinley, Rio Arriba, Sandoval and San Juan Counties, New Mexico.

2. Produced water pits lying within the vulnerable or special areas which receive five (5) barrels or less per day of produced water.

3. Unlined ancillary pits within the vulnerable or special areas which receive one (1) barrel or less per day of produced water.

4. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act.

5. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or NPDES regulations authorized under the Resources Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act.

6. Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan approved and permit issued by the New Mexico Coal Surface Mining Commission under the authority of the Surface Mined Lands Reclamation Act.

RULE 4 PERMITS

Upon application to and approval by the NMOCD, unlined produced water pits which receive more than five (5) barrels per day and those ancillary pits which receive more than one (1) barrel per day that are within the vulnerable area or special

areas may be permitted under this order based on the following criteria and after satisfying either a. or b. below.

a) Quality Permit: If the operator can demonstrate that the quality of either existing uncontaminated groundwater, or produced water is such that the introduction of produced water will not cause degradation of the groundwater, the unlined pit may be permitted upon application to the NMOCD. The demonstration must include analysis for organic and inorganic parameters as required by the Division.

b) Soil and Geologic Characteristics Permit: If the operator can demonstrate through the use of standard soil analysis parameters (e.g., percolation tests, infiltration rates, particle size/distribution, etc.) that the existing soil and/or underlying geologic stratum exhibit low permeabilities such that the produced water will not cause degradation of the groundwater, the unlined pit may be permitted upon application to the NMOCD. This can be accomplished on an aerial or site specific basis.

RULE 5 COMPLIANCE SCHEDULE

Any operator currently disposing of produced water into a pit which would be prohibited or would require permitting under these rules shall have a period of eighteen (18) months from the date of this order within which to cease such disposal or receive a permit for such disposal.

RULE 6 AMENDMENTS

Prior to any application for amendment of the definitions of vulnerable area or special areas contained herein shall be heard and the OCD shall reconvene a committee similar to the Short Term Water Study Committee to discuss the proposed amendment and attempts shall be made to fully advise all interested parties of the context of such application.

(2) That jurisdiction of this cause is retained for the entry of such further order as the commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION

RICHARD L. STAMETS
CHAIRMAN

ED KELLEY
MEMBER

JIM BACA
MEMBER

Jason Kellahin
W. Thomas Kellahin
Karen Aubrey

KELLAHIN and KELLAHIN
Attorneys at Law
El Patio - 117 North Guadalupe
Post Office Box 2265
Santa Fe, New Mexico 87504-2265

Telephone 982-4285
Area Code 505

May 9, 1985

RECEIVED
MAY [illegible]
OIL CONSERVATION DIVISION

Mr. Richard L. Stamets
Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87504

"Hand Delivered"

Re: Commission Case 8224
Produced Water Hearing
San Juan Basin

Dear Mr. Stamets:

I have had an opportunity to review the proposed order I submitted to the Commission at the hearing of the referenced case and find that certain proposed findings are contrary to the substantial evidence. Accordingly, I hereby withdraw the first proposed order and submit therefore the enclosed First Revised Proposed Order.

The original proposed order in Findings 15 and 17 and in Rule 2 and 3 assume that the risk of possible contamination to ground water is greater within 15 feet of the bottom elevation of the major river beds in the vulnerable area. That assumption is directly contrary to Tenneco's evidence at the hearing.

You will recall that Mr. Hick's exhibit for the Water Table elevation at the McCoy site shows a pit elevation of 5449.8 and the elevation of the Animas River at 5448.2 feet or a difference of only 1.6 feet. Also the Payne site pit elevation and the elevation of the San Juan River are within 15 feet.

Thus, the originally proposed findings which would have precluded small volume unlined produced water pits close to the river are not supported by the hydrologic testimony and accordingly are hereby withdrawn.

Very truly yours,

W. Thomas Kellahin

WTK:ca
Enc.

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STATE OF NEW MEXICO
DEPARTMENT OF ENERGY AND MINERALS
OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE: 8224
ORDER R-

APPLICATION OF THE OIL CONSERVATION
COMMISSION UPON ITS OWN MOTION, TO
DEFINE THE VERTICAL AND AREAL EXTENT
OF AQUIFERS POTENTIALLY VULNERABLE
TO CONTAMINATION BY THE SURFACE
DISPOSAL OF PRODUCED WATER, MCKINLEY,
RIO ARRIBA, SANDOVAL AND SAN JUAN
COUNTIES, NEW MEXICO.

TENNECO OIL COMPANY'S FIRST REVISED REQUESTED ORDER FOR THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing on February 20, 1985, and April 3-4, 1985, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission".

NOW, on this _____ day of _____, 1985, the Commission, a quorum being present, having considered the evidence and being fully advised in the premises;

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That on June 7, 1984, the Oil Conservation Division, hereinafter called "the Division", in OCD Case 8224 called a public hearing to consider the prohibition of disposal of produced water on the surface of the ground in the San Juan Basin of New Mexico.

(3) That Division Case 8224 was again called for public hearing on July 18, 1984, at which time the Division established a water study committee composed of various members of the industry, of the Environmental Improvement Division, of the Oil Conservation Division staff and environmental groups and concerned citizens.

(4) That the Division appointed Water Study Committee held meetings on July 18, August 2, October 17, November 29, 1984, and January 9, 1985.

(5) That at the Commission hearing on February 20, 1985, the Water Study Committee submitted to the Commission its Report which was introduced as Commission Exhibit (1).

(6) That the disposal of produced water into unlined surface pits in the San Juan Basin has not contaminated ground or surface waters in Northwest New Mexico.

(7) That there are areas in San Juan, Rio Arriba, McKinley and Sandoval Counties, New Mexico, where ground or surface water may be vulnerable to possible contamination by oil & gas production.

(8) That the vulnerable area was defined by the Water Study Committee from using available water well data, 100 yr. flood hazard maps, topographic maps.

(9) That those vulnerable areas include areas where the depth to ground water is less than fifty feet, the aquifer containing the ground water consists of unconsolidated alluvial fill and the water is presently used for or has a reasonable future use for municipal, domestic, industrial, agricultural, or stock watering purposes as defined by the State Engineer.

(10) That the vulnerable area was defined as that area which lies over or adjacent to a vulnerable aquifer and includes those portions of the San Juan, Animas, and La Plata River valleys which are bounded by the topographic line on either side of the river that is 100 vertical feet above the river channel measured perpendicularly to the river channel.

(11) That Special Areas were also identified which fell outside of the "vulnerable area" but which had water well records indicating water production from less than 50' and oil and gas production within the same section.

(12) That the Water Study Committee has developed proposed definitions for a vulnerable area and for special areas which are fair and reasonable and should be adopted by the Commission into special rules and regulations.

(13) That within the vulnerable area, there are some 1,200 producing oil and gas wells and some 300 known water wells.

(14) That within the vulnerable area there is limited data available concerning the risk, if any, that the disposal of produced water into unlined surface pits has upon ground or surface water.

(15) That any contamination of ground water in the vulnerable area from the disposal of produced water into unlined surface pits, if it occurs, will most likely be from the disposal of large volumes of produced water in excess of 5 barrels a day.

(16) That until and unless quantification of such risk becomes possible, the disposal in the vulnerable area or in any special area of produced water into unlined surface pits at rates that exceed 5 barrels a day for a produced water pit and exceed 1 barrel a day for an ancillary pit may constitute a hazard to fresh water supplies and such disposal rates should be prohibited.

(17) That currently available data fails to provide substantial evidence that there is contamination or risk of contamination from the continued disposal of produced water into unlined surface pits in the vulnerable area at rates of 5 barrels a day or less for a produced water pit and of 1 barrel a day or less for any ancillary pit.

(18) That the small volume disposal rates defined in Finding Paragraph (16) above are so insignificant as to present little hazard, if any, to fresh water supplies and should be allowed to continue in order to prevent waste caused by the premature abandonment of wells.

(19) That additional rules and regulations should be established to require the timely metering, and reporting of produced water by the operators of the oil/gas wells in the vulnerable area and the special areas.

(20) That there is no evidence that any fresh water well in the vulnerable area has been contaminated by the disposal of produced water into unlined surface pits.

IT IS THEREFORE ORDERED:

(1) That Special Rules and Regulations are hereby promulgated to deal with produced water into unlined surface pits in certain vulnerable and special areas of the San Juan Basin as follows:

SPECIAL RULES AND REGULATIONS
GOVERNING PRODUCED WATER
FOR UNLINED SURFACE PITS
IN AREAS OF MCKINLEY, RIO ARRIBA,
SANDOVAL AND SAN JUAN COUNTIES
NEW MEXICO

Effective July 1, 1986, no person shall dispose of produced water, or fluids, produced in connection with the production of oil or natural gas, or both, into unlined surface pits within areas of the San Juan Basin designated as either a vulnerable area or a special area, as hereinafter defined, except in conformance with the following rules and regulations:

RULE 1: DEFINITIONS:

As used in these rules and regulations:

(1) Aquifer: means a saturated permeable geologic unit (a geological formation, group of formations, or part of a formation) that can transmit significant quantities of water under ordinary hydraulic gradients.

For purposes of this definition, the word significant means that the water from the aquifer is used for or may reasonably be presumed to be usable for municipal, industrial, domestic, agricultural, or stock watering purposes.

(2) Vulnerable Aquifer: means any of the following:

(a) unconfined aquifers that are less than 50 feet from the surface; or

(b) unconfined aquifers in floodplain areas; or

(c) aquifers in unconsolidated materials.

(3) Vulnerable Area: means an area which lies over or adjacent to a vulnerable aquifer and is defined as an area within the river valleys of the San Juan, Animas, and La Plata Rivers, which is bounded by the topographic line on either side of the river that is 100 vertical feet above the river channel measured perpendicularly to the river channel.

(4) Special Areas: Areas outside of the vulnerable area in which ground water is subsequently found to be within 50 feet of the ground surface. Special areas presently identified are listed below:

a) Sections:

T28N-R 8W, Section 17	T30N-R12W, Section 13
T28N-411W, Section 18	T30N-R12W, Section 15
T28N-R15W, Section 26	T30N-R12W, Section 27
T29N-R10W, Section 16	T30N-R12W, Section 33
T29N-R12W, Section 24	T30N-R13W, Section 1
T29N-R18W, Section 17	T30N-R15W, Section 6
T29N-R19W, Section 23	T30N-R15W, Section 16
T29N-419W, Section 30	T30N-R15W, Section 21
T30N-R10W, Section 5	T30N-R16W, Section 29
T30N-R11W, Section 3	T30N-R19W, Section 34
T30N-R11W, Section 7	T31N-R10W, Section 13
T30N-R11W, Section 8	T31N-R11W, Section 35
T30N-R11W, Section 10	T32N-R10W, Section 10
T30N-R11W, Section 19	T32N-R11W, Section 23
	T32N-R23W, Section 25

b) Areas that lie between the rivers and the ditches mentioned below are also special areas:

Highland Park Ditch
Hillside Thomas Ditch
Cunningham Ditch
Farmers Ditch
Halford Independent Ditch
Citizens Ditch
Hammond Ditch

(5) Produced Water Pit: That pit which receives water produced from primary separation in conjunction with the production of crude oil and/or natural gas whether or not such pit is located at the site of production.

(6) Ancillary Pit: Those pits not receiving fluids from primary separation, including but not limited to, dehydrator pits, tank drain pits, pipeline drip collector pits, blowdown pits, and compressor scrubber pits. Examples are listed below:

(a) Dehydrator Pit: Those pits which normally receive produced water only from the dehydration unit.

(b) Blowdown Pit: Those pits which receive liquid only when a well is blown down.

(c) Tank Drain Pit: Those pits which receive water that is drained from a production storage tank.

(d) Pipeline Drip Collector Pit: Those pits which receive liquids which accumulate in gas pipelines.

(e) Compressor Scrubber Pit: Those pits which receive liquids at the compressor suction in event of primary separator failure.

RULE 2: PRODUCED WATER PITS:

Within a vulnerable or special area, no produced water pit shall receive more than 5 barrels of produced water a day without special permit.

RULE 3: ANCILLARY PITS:

Within a vulnerable or special area, no ancillary pit shall receive more than 1 barrel of water or fluids a day without a special permit.

RULE 4: EXEMPTIONS:

The following are exempted from this order:

(1) Pits lying outside vulnerable or special areas are exempt from this order.

(2) Any pits, ponds, lagoons, or impoundments resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act.

(3) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or NPDES regulations authorized under the Resource Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act.

(4) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan, approved, and permit issued, by the New Mexico Coal Surface Mining Commission under the authority of the Surface Mined Lands Reclamation Act.

RULE 5: SPECIAL PERMITS:

The purpose of this rule is to allow for the disposal of produced water into unlined pits, based on the depth to ground water beneath such pits and provided that such pits meet the quality and soil characteristics criteria as set forth below.

Upon application to and approval by the NMOCD, unlined produced water pits which receive greater than 5 barrels a day and those ancillary pits which receive greater than 1 barrel per day, that are within the vulnerable area, may be permitted under this order based on the following criteria and after satisfying either a. or b. below.

(a) Quality Permit: If the operator can demonstrate that the quality of either existing uncontaminated ground water, or produced water, is such that the introduction of produced water will not cause degradation of the ground water, the unlined pit may be permitted upon application to the NMOCD. The demonstration must include analysis for organic and inorganic parameters as required by the Division.

(b) Soil and Geologic Characteristics Permit: If the operator can demonstrate through the use of standard soil analysis parameters (e.g., percolation tests, infiltration rates, particle size/distribution, etc.) that the existing soil and/or underlying geologic stratum exhibit low permeabilities such that the produced water will not cause degradation of the ground water, the unlined pit may be permitted upon application to the NMOCD. This can be accomplished on an areal or site specific basis.

RULE 6: WELL EQUIPMENT AND REPORTING PROCEDURES:

(a) Upon the effective date of this order and thereafter the operator of any oil or gas well in the vulnerable or special area shall accurately measure the volume of produced water or fluids leaving the separator and being discharged into the produced water pit.

(b) That such measurements shall be taken by the operators not less than semi-annually and shall be reported semi-annually on a daily rate basis to the District Office of the Oil Conservation Division on Division form _____.

RULE 7: EXPANSION OF VULNERABLE OR SPECIAL AREA

(1) That any person seeking to amend or expand the Vulnerable Area or to establish new Special Areas shall file a written application to the Divisiion and shall send a copy of said application to any oil/gas operator within the Vulnerable Area or within 2 miles of any Special Area, by certified mail return receipt, not less than 21 days before any Division Hearing.

(2) That the amendment or expansion of the Vulnerable Area or any Special Area or the creation of a new Special Area shall be done only after notice and hearing.

RULE 8: AMENDMENT OF RULES:

These Special Rules and Regulations shall be amended only after notice and upon hearing by the Division or Commission, as the case may be. Such hearing shall be held only after notice to any and all oil/gas operators, by certified mail-return receipt, who operate any well in the Vulnerable area or within 2 miles of any Special Area.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

RICHARD L. STAMETS
Director

STATE OF NEW MEXICO
DEPARTMENT OF ENERGY AND MINERALS
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

APPLICATION OF THE OIL CONSERVATION
COMMISSION UPON ITS OWN MOTION
TO DEFINE THE VERTICAL AND AREAL EXTENT
OF AQUIFERS POTENTIALLY VULNERABLE
TO CONTAMINATION BY THE SURFACE
DISPOSAL OF PRODUCER WATER, MCKINLEY,
RIO ARRIBA, SANDOVAL, AND SAN JUAN
COUNTIES, NEW MEXICO. CASE: 8224

TENNECO OIL COMPANY'S MEMORANDUM OF LAW AND ARGUMENTS

On behalf of Tenneco Oil Company, this Memorandum states the legal principles upon which the Oil Conservation Commission ("OCC") must base the promulgation of rules and regulations controlling the disposal of produced water into unlined surface pits within an area defined as containing potentially vulnerable aquifers.

I. INTRODUCTION:

On June 7, 1984, the Oil Conservation Division ("Division") in case 8224 called a public hearing to consider the prohibition of disposal of produced water on the surface of the ground in the San Juan Basin of New Mexico.

On July 18, 1984, the Division again called Case 8224 and at that time established a water study committee.

On February 20, 1985, the Commission held a public hearing to consider the report of the Water Study Committee and to hear a report by the Division hydrologist.

On April 3, 1985, the Commission again heard Case 8224 to hear testimony from various oil & gas industry representatives and experts.

II. FACTUAL BACKGROUND:

The disposal of produced water into unlined surface pits in the San Juan Basin has taken place for a period in excess of 40 years with no known documented case of contamination of ground or surface waters having occurred in Northwest New Mexico.

It is claimed that there are areas in San Juan, Rio Arriba, McKinley and Sandoval Counties, New Mexico where ground or surface water may be vulnerable to possible contamination by oil & gas production. These vulnerable areas were defined by the Water Study Committee from using available water well data, 100 year flood hazard maps, topographic maps and include areas where the depth to ground water is less than fifty feet, the aquifer containing the ground water is presently used for or has a reasonable future use for municipal, domestic, industrial, agricultural, or stock watering purposes as defined by the

State Engineer. These areas were defined as that which lies over or is adjacent to a vulnerable aquifer, including those portions of the San Juan, Animas, and La Plata River valleys which are bounded by the topographic line on either side of the river that is 100 vertical feet above the river channel measured perpendicularly to the river channel.

Special Areas were also identified which fell outside of the "vulnerable area" but which had water well records indicating water production from less than 50' and oil and gas production within the same section.

The Water Study Committee has developed proposed definitions for a vulnerable area and for special areas which are fair and reasonable and should be adopted by the Commission into special rules and regulations.

Within the vulnerable area, there are some 1,200 producing oil and gas wells and some 300 known water wells.

There is no evidence that any fresh water well in the vulnerable area has been contaminated by the disposal of produced water into unlined surface pits.

Currently available data shows that the hydrologic and geologic parameters that are used to define potential ground water contamination within the vulnerable area do not vary greatly and need not be developed on a well by well basis.

Using well accepted methods of hydrologic study, it has been demonstrated that the continued disposal of

produced water into unlined pits in the vulnerable area at rates of 5 barrels a day or less for a produced water pit, and of 1 barrel a day or less for an ancillary pit, does not present a potential risk of contamination to ground water.

III. TENNECO'S POSITION:

1. The Division's proposal to ban unlined surface pits in the vulnerable area, except on a pit by pit exemption process, is both unreasonable and unwarranted.

2. That using accepted methods of hydrologic study, the pits in the vulnerable area have been demonstrated not to constitute a risk to ground water if those pits do not receive more than 5 barrels of produced water a day.

3. That there is no currently available method for the economic disposal of the produced water, except with the continued use of the unlined pit method.

4. Small volume disposal rates are so insignificant as to present no hazard to fresh water supplies and should be allowed to continue for an interim period to prevent waste caused by the premature abandonment of wells.

5. That through the New Mexico Oil and Gas Act, the Water Quality Control Commission has delegated the responsibility of administering the Water Control Regulations, with respect to produced water disposal into unlined pits, to the New Mexico Oil Conservation Division which is bound to establish rules and regulations that are not more stringent than those of the Water Quality Control Commission.

6. That the rules and regulations adopted by the New Mexico Oil Conservation Division, concerning the disposal of produced water, must be in compliance with the New Mexico Water Quality Standards.

7. Additional rules and regulations should be established to require the timely metering, and reporting of produced water by the operators of the oil/gas wells in the vulnerable area and the special areas.

ARGUMENT

I. THE OCD MUST BASE RULE-MAKING ON SUBSTANTIAL EVIDENCE CONTAINED IN THE RECORD AS A WHOLE AND MUST COMPLY WITH THE LEGAL RESIDUUM RULE:

A. The Substantial Evidence Rule applies to the OCC.

The standard to apply in determining the legal sufficiency of decisions of the Oil Conservation Commission was most recently stated in Fasken v. Oil Conservation Commission, 87 N.M. 292, 532 P.2d 588 (1975). The court said:

> In cases where the sufficiency of the Commission's findings is an issue or their substantial support is questioned, after the dust of the Commission hearing has settled, the following must appear:
>
> [2] A. Findings of ultimate facts which are material to the issues. Such findings were characterized as "foundationary matters", "basic conclusions of fact" and "basic findings" in Continental Oil Co. v. Oil Conservation Com'n, 70 N.M. 310, 373 P.2d 809 (1962). These findings have to do with such ultimate factors as whether a common source of supply exists, the prevention of waste, the protection of correlative rights and matters relative to net drainage.
>
> B. Sufficient findings to disclose the reasoning of the Commission in reaching its ultimate findings. In Continental, it was said that although elaborate findings are not necessary, nevertheless:
> " ... Administrative findings by an expert administrative commission should be sufficiently extensive to show ... the basis of the Commission's order." (Citations omitted).
>
> C. The findings must have substantial support in the record.

The pertinent statute delineating the requirements for rule-making by the OCC is silent on the issue of a required statement from the OCC giving the reasons for promulgation of rules. It is necessary, therefore, to look to the New Mexico Administrative Procedure Act for guidance as to whether rule-making and adjudication are subject to the same evidentiary requirements.

Under the N.M.A.P.A., an agency "decision" encompasses decisions made as a result of rule-making,

i.e., the promulgation of a rule by an agency is in the form of a decision. See, NMSA S 12-8-5:

> ["Rule-Making Prerequisites: A(3) .... All persons heard or represented at any hearing, or who submit any writing to be considered in connection with the proposed rule, shall promptly be given a copy of the decision, by mail or otherwise (emphasis added)."]

Additionally, the N.M.A.P.A. applies the substantial evidence test to agency decisions. The scope of judicial review of agency decisions is set out in NMSA Section 12-8-22, which reads in pertinent part:

> A. In any proceeding for review of an agency decision or order, the court may set aside the order or decision or reverse or remand it to the agency for further proceedings or may compel agency action unlawfully withheld or unreasonably delayed, if it determines that the substantial rights of a party to review proceedings have been prejudiced because the agency findings, inferences, conclusions or decisions are:
>
> (5) unsupported by substantial evidence; or
>
> (6) arbitrary or capricious or characterized by abuse of discretion or clearly unwarranted exercise of discretion or upon a showing of substantial bias or prejudice.

Thus, the N.M.A.P.A. applies the substantial evidence test to rule-making as well as adjudications, and this practice must serve as a guide to the OCC in properly supporting its rule-making on judicial review.

B. The Substantial Evidence Test Applies to Review Agency Rule-Making.

In Bokum Resources Corporation v. New Mexico Water Quality Control Board, 93 NM 546. 603 P.2d 285 (1979), the New Mexico Supreme Court applied the substantial evidence test to rule-making: The issue in the case was whether standards set by the Water Quality Control Commission for discharge of certain toxic compounds were appealable as "rules", and, if so, were supported by substantial evidence. The court held that they were rules, and found that they were supported by substantial evidence. In applying the substantial evidence test, the court reviewed "conflicting expert testimony of a highy technical nature" and, while refusing to reweigh conflicting evidence, resolved conflicts in favor of the successful party below (the Commission).

C. The substantial Evidence Test Applies to the Record as a Whole.

The court's application of the substantial evidence rule in Bokum comports with its more recent decision in Duke City Lumber Co. v. New Mexico Environmental Improvement Board and New Mexico Environmental Improvement Division 23 NM St. B. Bull. 447, 681 P.2d 717 (April 4, 1984). In Duke City Lumber, the court held that application of the substantial evidence rule requires that the reviewing court examine the administrative record as a whole, and not ignore segments of the record.

The New Mexico Supreme Court held that the old standard of review, the substantial evidence in support of the agency decision, is.....

> "not only outdated but contrary to the rule followed in other jurisdictions and by the federal courts"...
>
> However, for administrative appeals we now expressly modify the substantial evidence rule as heretofore adopted by this Court and supplement it with the whole record standard for judicial review of findings of fact made by administrative agencies. A review of the whole record is clearly indicated in those cases where the administrative agency serves not only as the factfinder but also as the complainant and prosecutor. See 73A C.J.S., Public Administrative Law and Producure Section 213 (1983).

Administrative agencies can no longer ignore conflicting evidence in either rule-making or adjudicatory proceedings:

> While this rule is applicable to decisions of administrative boards and tribunals, as well as to decisions of courts, it does not permit accepting part of the evidence and totally disregarding other convincing evidence in the record considered as a whole. Duke City Lumber.

The evidence which has been presented to the Commission shows a lack of risk to the vulnerable areas which the Commission may not ignore in propounding its rules.

D. The Legal Residuum Rule Requires that the Agency State Reasons for its Regulation.

In Duke City Lumber, supra, the court was careful to state that adoption of the "record as a whole" standard did not in any way negate the requirement of the application of the "legal residuum" rule to judicial review of agency action. The court said:

> "[t]he standard for admissibility in an administrative hearing under [the New Mexico Administrative Procedure] Act is therefore one of whether the evidence has any probative value. However, New Mexico courts require that an administrative action be supported by some evidence that would be admissible in a jury trial. This has been referred to as the legal residuum rule. Young v. Board of Pharmacy, 81 NM 5, 462 P.2d 139 (1969)."

In Bokum, supra, the court addressed whether the reasons given by the Commission for adoption of its regulations were legally sufficient. The Bokum court found legal sufficiency in that eight reasons were given which were thoroughly analyzed during the hearing and for which additional information was provided after the hearing. The Bokum court contrasted the Commission's actions in that case with its action in a previous case, City of Roswell v. New Mexico Water Quality Control Commission, 84 NM 561, 505 P.2d 1237 (Ct. App. 1972), cert.denied, 84 NM 560, 505 P.2d 1236 (1972), in which the Commission gave no reasons at all for its decision. In City of Roswell, the Commission "did not give any general statement of its reasoning, and it gave no indication as to what testimony or exhibits were relied upon in formulating the regulations in question.... We agree with the Court of Appeals that ... reasons should

be given upon which the Commission bases its adoption of regulation." Bokum, at 553.

It is clear from this description of what would be adequate reasons that New Mexico courts require that agency rule-making be based on some type of evidence which would be admissible in a jury trial. This standard could not possibly be met by the OCD in promulgating the rule prohibiting disposal of produced water in unlined pits absent some type of scientific evidence which is legally sufficient to support the rule.

II. FAIRNESS AND ACCOUNTABILITY REQUIRE THE AGENCY TO PROVIDE REASONS UNDERLYING RULE-MAKING:

A. Fairness and Accountability of Agency Action can only be Insured by Providing the Public with a Complete and Accurate Statement of the Information Relied on in Rule-making.

The necessity for a complete factual record for judicial review of agency rule-making is examined in Informal Agency Rulemaking and the Courts: A Theory for Procedural Review, Cooley R. Howarth, Jr., Washington, U.L.Q. 61:890-978 (Winter 1984). The author makes a compelling argument for the requirement of such a record in order to be fair to all parties concerned:

> The right to petition for agency reconsideration, or judicial review, of final rules can be exercised most effectively only when the public is fully and accurately apprised of the scope,

> basis, and purpose of the rulemaker's decision. Recordmaking and explanation procedures also provide mechanisms to police the procedural fairness of the rulemaking process. A mandatory requirement that agencies fully explain and document their decisions may well reveal that the agency has failed to consider relevant public comment or has relied upon information or materials which were not subjected to public notice and comment. In addition, a published explanation and documentation of the agency's decision enhances at least the appearance of fairness by opening up the decision making process to public scrutiny. Id. at 966.

Additionally, agency accountability require an organized, detailed record:

> Even if a rulemaking record and a fully explanation are not considered essential for the fairness and effectiveness of rulemaking, it seems clear that agency accountability is unacceptably compromised in the absence of both. While Congress has a number of methods for holding agencies accountable for their actions, and continues to explore new techniques to enhance this accountability, it has placed its primary reliance on judicial review of agency action. Without a complete and organized rulemaking record and a detailed explanation of the basis and purpose of agency rules, courts cannot properly perform the role they have been assigned in the administrative process.
>
> When courts review rules, the agency's factual perceptions, together with its judgment about the legal significance of those perceptions, are to be closely examined. While the court is not to substitute its own judgment for that of the agency, neither is it to assume that the agency's judgment is rational. Instead, agencies are to be held accountable by the review of a court which must satisfy itself that the agency's rule is the rational product of a rational decisionmaking process. Id. at 966-67

The issue of accountability is particularly important in the present case because the OCD has, at present, absolutely no scientific evidence on which to preclude a blanket small volume exemption. Thus, there is no basis on which to decide if the OCD's determination whether the disposition of produced water into unlined pits presents an environmental hazard is rational.

In addition, discusses Howarth whether an agency is acting responsibly when it promulgates a rule without creating a complete record of a factual basis for the rule:

> If reviewing courts are to provide any reasonable barrier to arbitrary decisionmaking, they cannot be expected to guess at or entirely reconstruct the decisionmaking process. They must be provided with a complete and organized rulemaking record and a detailed explanation of the basis and purpose of an agency's rule. Courts simply do not have the expertise, let alone the time and resources, to wander through a huge and unwieldy rulemaking record guided only by vague and simplistic indications of what the agency through it had accomplished.
>
> The Supreme Court also has recognized the need for administrative assistance in responsbile judicial review. In a number of cases, the Court has demanded that agencies supply reviewing courts with records that detail the agency's findings and conclusions and demonstrate a process of reasoned decisionmaking. Even in Vermont Yankee, the Court left undisturbed the judicially imposed requirement that the agency prepare an organized rulemaking record and full explanation of its entire decisionmaking process. Interestingly, it has never seemed to bother the Court that neither the APA nor any organic statute explicitly required these agencies to assemble a record or to prepare findings of fact or conclusions of law supporting their

> decisions. Contemporaneous documentation and a complete explanation of the agency's decisionmaking process was deemed necessary if judicial review of informal decisionmaking was to be at all effective. Id. at 969-70.

Thus, without some documentation of scientific evidence on which the OCD would base the proposed rule, it would be impossible for a reviewing court to be effective in reviewing the decision-making for arbitrariness.

B. Other Jurisdictions Require a Complete Factual Record on Which Rule-Making is Based:

The requirement of a clear factual record is articulated in numerous cases. In St. James Hospital v. Heckler, 579 F. Supp. 757 (N.D. Ill. 1984), the court said:

> It is well-settled that a reviewing court is required to "review the whole record" in determining the validity of a regulation, 5 U.S.C. Section 706, and that the "whole record" consists solely of the administrative rulemaking record.
>
> It is important for "[a]n agency to identify and make available technical studies and data that it has employed in reaching the decision to propose particular rules." Id. at 762, 764.

The court in St. James quotes the U. S. Supreme Court in Baltimore Gas & Electric Co. v. NRDC, U.S. 103 S. Ct. 2246 (1983) for the definition of arbitrary and capricious:

> An agency's rule is arbitrary and capricious if (1) the agency relied on factors which Congress had not intended it to consider; (2) the agency entirely failed to consider an important aspect of the problem; (3) if it offered an explanation for its decision that runs counter to the evidence before the agency or is so

> implausible that it could not be attributed to a difference in view or the product of agency expertise. (Emphasis added).

In the present case, for the OCD to promulgate a rule prohibiting disposition of any produced water into unlined pits in the vulnerable areas would not satisfy either (2) or (3) above. The OCD would fail to consider an important aspect of the case - the fact that no scientific data exists to show contamination by toxic substances - or, alternatively, its decision would run counter to the evidence before it, which is that there is no evidence supporting the rule. Obviously, in this case, the OCD's explanation for promulgating the proposed rule would be "so implausible that it could not be attributed to a difference in view", Baltimore Gas, supra, since there is not yet any scientific information on which to base a view. The OCD's action would be arbitrary and capricious here.

In Wiggins Bros., Inc. v. DOE, 548 F. Supp. 547 (N.D. Texas 1982), the court reviewed the promulgation by the DOE of the marginal property rule, which excluded injection wells from the definition of "wells that produced crude oil." The court reviewed the agency action under the arbitrary and capricious standard, as stated:

> Under the "arbitrary and capricious" standard the scope of review is a narrow one. A reviewing court "must consider whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment....Although this inquiry into the facts is to be searching and careful, the ultimate standard of review is a narrow

> one. The court is not empowered to substitute its judgment for that of the agency." The agency must articulate a "rational connection between the facts found and the choice made." While we may not supply a reasoned basis for the agency's action that the agency itself has not given, we will uphold a decision of less than ideal clarity if the agency's path may reasonably be discerned. Id. at 551.

Without any scientific evidence on which to base the conclusions that produced water in unlined pits in the vulnerable areas causes contamination of the ground water, the OCD cannot articulate a "rational connection between the facts found and the choice made", Wiggins, supra, because there are not yet any facts found.

In United States v. Frontier Airlines, 563 F. 2d 1008 (10th Cir. 1977) the court construed the meaning of the Basis and Purpose Statement of the Administrative Procedure Act, a counterpart of which is found in the NMAPA at Section 12-5-8 (A) 3 and which should be followed by the OCC:

> This provision thus requires the agency to include in the rule a "concise" statement of why the rule was adopted and what it is intended to accomplish. The statement is a summary of what, in the legislative process, would be gleaned from the hearings and the statements of position which make up the legislative history. The Basis and Purpose Statement is a very significant portion of a regulation when an issue arises as to its application and scope. Id. at 1013.

In National Wildlife Federation v. Benn, 491 F. Supp. 1234 (S.D. N.Y. 1980), the Administrator of the EPA

defended a claim that its interpretation of a regulation it promulgated was arbitrary and capricious. The court stated that:

> Another important element to consider in evaluating an administrative regulation is "the thoroughness evident in its consideration, the validity of its reasoning, its consistency with earlier and later pronouncements, and all those factors which give it power to persuade, if lacking power to control." Id. at 1245.

Because the EPA could produce scientific evidence substantiating its position in interpreting the regulation, it prevailed. The court said:

> "The plaintiffs' contentions that this procedure is scientifically unsound is refuted by the government's experts . . . While the issue appears unresolved, this Court is constrained to accept the agency's reasonable interpretation of the regulatory requirements." Id. at 1246.

Clearly, if an agency can show a reasonable scientific basis for its rules or its interpretation of its rules, it is afforded great deference. But, when it cannot, as here, establish an adequate factual basis for its regulations, it is impossible for a reviewing court to determine if the agency has acted in an arbitrary and capricious manner, or has based the regulation on evidence which does not meet the substantial evidence test.

III. THE PROMULGATION OF THE PROPOSED RULE WILL HAVE A CONFISCATORY EFFECT, AND AS SUCH WILL ADVERSLY AFFECT TENNECO'S CORRELATIVE RIGHTS AND WILL CONSTITUTE AN UNCONSTITUTIONAL TAKING OF PROPERTY.

The New Mexico Constitution provides that no person shall be deprived of property without due process of Law. N.M. Const. Art II Section 18. All property rights are subject to the reasonable exercise of the police powers of the state. Kaiser v. Thomson, 55 N.M. 270, 232 P2d 142 (1951). Those powers must not be exercised in an arbitrary manner, however. An exercise of police powers which operates to deprive a person of property rights in an arbitrary way amounts to an unconstitutional confiscation of property. Kaiser, supra.

Tenneco has a vested property right in producing its fair share of hydrocarbons from its wells. Until the present rule was proposed, Tenneco and other producers with wells in the vulnerable areas operated their wells in those areas without having to line pits or be concerned that an alleged contamination problem would arise. Tenneco operated its wells under other regulations already promulgated by the OCD pertaining to well permitting, location, etc. None of these other regulations promulgated by the OCD made reference to the possibility that operation of the unlined pits would be subject to any alteration due to the possibility of contamination of ground water by produced water in the pits. Tenneco and others have operated their well in the areas in question for over thirty years without any indication from the OCD that its means of operation would be subject to a requirement which would impose on Tenneco an obligation to safeguard against

undocumented hazards. The practical effect of the proposed rule is to reverse over thirty years of an established policy of the OCD's of placement and operation of wells in the areas in question. As such, the proposed regulation operates as a taking of a vested property right.

Tenneco has developed a practice of using unlined pits for thirty years, and the imposition of the requirement to line them, and to stop using them until they are lined, constitutes a tremendous expense to Tenneco not justified by any evidence that such a change in practice is warranted in the interest of protecting the environment.

The question of how to dispose of produced water has been present as long as wells have been operated in the areas under consideration. It is not a new problem, and the OCD has impliedly, if not explicitly, approved of the methods of disposal heretofore employed. A definitive standard of conduct has therefore been established, and conformity to that standard will now be punished, if the proposed rule is promulgated. The extent of reliance by Tenneco and others has been great, since the use of unlined pits is the only means of disposing of the produced water in the area. Thus, the degree of the burden imposed on Tenneco would concomitantly be great, given that it would involve great expense to line the pits or otherwise dispose of the produced wateror be deprived of its property interest.

The statutory interest in applying the rule is questionable, at best, given that there is no evidence to show that a change in practice will improve environmental quality of the area.

IV. THE USE OF A FIVE-BARREL-A-DAY LIMIT WOULD BE THE LEAST BURDENSOME APPROACH, WOULD SERVE THE INTERIM PURPOSES OF THE OCD, AND WOULD COMPORT WITH SOUND POLICY-MAKING.

Tenneco's position is to accept a reduction in the allowable amount of produced water to be deposited in the unlined pits pending the development of a data base from which to determine the proper course of action in the long term. However, in the interim, Tenneco would urge the OCD to adopt an exception for small volume deposits of produced water until reliable data can be developed.

Such an approach to the imposition of an automobile exhaust emission regulation under the Clear Air Act was taken by the Administrators of the EPA, as discussed in Amoco Oil Company v. EPA, 501 F. 2d 722 (D.C. Cir. 1974). The Administrator of EPA, after promulgating a rule establishing emission standards for certain hydrocarbons, suspended the imposition of those standards for a year and in the meantime imposed less stringent "interim" standards. During the time the interim standards were in effect, oil producers challenged the validity of the original emission standard as not being supported by adequate scientific and economic evidence, including a cost benefit analysis, as

required by certain provisions of the Clean Air Act. The court in Amoco explained that the oil companies objected to the regulations because of the financial hardships they caused by being unnecessarily and unlawfully far-reaching and abrupt. Thus, the interim standards were effective to "soften the blow" of the great financial impact on oil companies by the new regulations.

In Amoco, the validity of the regulation was determined in light of the requirements of the Clean Air Act, which are more stringent than the Administrative Procedure Act. However, the court in Amoco discussed at length how an agency is required at times to make policy judgments, in the absence of sufficient factual information, concerning the relative risks of underprotection as compared to overprotection. In conjunction with this analysis, the court articulated the factual requirements of the "basis and purpose under the APA", a counterpart of which, as previously mentioned, is found in the New Mexico Statutes. The court said:

> "[i]n particular, the basis and purpose statement must advert to administrative determinations of a factual sort to the extent required for a reviewing court to satisfy itself that none of the regulatory provisions were framed in an 'arbitrary' or 'capricious' manner. Id. at 739. Further, the court said:
>
> Where EPA's regulations turn crucially on factual issues, we will demand sufficient attention to these in the statement to allow the fundamental rationality of the regulations to be ascertained. Where, by contrast, the regulations turn on choices

> of policy, on an assessment of risks, or on predictions dealing with matters on the frontiers of scientific knowledge, we will demand adequate reasons and explanations, but not "findings" of the sort familiar from the world of adjudication.
> Id. at 740-41.

Tenneco is not unaware or unconcerned about the OCD's interest in regulating on the side of "overprotection". Rather, it urges a course of regulatory action which would serve the interests of the OCD in environmental protection without being arbitrarily or capriciously unfair to the oil producers in the region who have detrimentally relied on a long-standing practice of disposal of produced water. The use of an interim standard for disposal would comport with rational policy-making, when an adequate assessment of the risk cannot yet be made. The interim standard of five barrels a day is low enough to serve the protective interests of the OCD while preventing Tenneco and other producers from suffering an immediate and burdensome expense as a result of having to find an immediate alternative to using the unlined pits.

In light of the fact that the pits have been operated for over thirty years with no restrictions imposed as to quantity of produced water deposited in them, it is unreasonable to conclude that the interim disposal of produced water resulting from no more than five barrels of oil per day would cosntitute a significant addition to whatever environmental hazard exists, if it exists at all.

Thus, the only reasonable approach to managing the problem of identifying the potential environmental hazard to the vulnerable area without being arbitrarily unfair to all of the producers in the area is to adopt an interim standard for disposal of producecd water until reliable data illuminating the risk, if any, can be obtained.

V. IN THE EVENT THE OCC DECLINES TO ADOPT THE INTERIM STANDARD, CERTAIN FINDINGS OF FACT ARE NECESSARY TO SUPPORT THE ORIGINAL PROPOSED RULE.

Should the Commission desire to adopt a rule for the vulnerable area that precludes a blanket small volume exemption, the following are the essential elements necessary to support such a rule:

1. Shallow water monitoring near unlined pits;

2. Location of Alluvial and shallow ground water occurrences;

3. Statistically reliable number of water analyses from pits and evaluation of plume movement;

4. Analyses of tank battery effluents, glycol dehydrator fluids, and transmission line wastewaters;

5. All chemical analyses must include a complete set of analyses, including those for hydrocarbons;

6. Agreed-upon (acceptable) sampling method for all analyses;

7. Agreed-upon method for assessing the volume of produced water in surface pits and the volume of hydrocarbons in produced water;

8. Mass balance analyses to determine water loss from pits;

No scientific evidence now exists upon which the Commission could base findings of fact which would support the interim standard. Even if the interim standard is eventually adopted, substantial testing and analysis is required.

CONCLUSION

Although there has been speculating and postulating about the possibility of contamination of ground water in the vulnerable area, the fact remains that in the vulnerable area where some 1200 gas wells and 300 water wells co-exist and have co-existed over the last four decades, we have yet to experience the first confirmed case of contamination of ground water by the use of unlined surface production pits.

The Oil Conservation Division has been unable to present substantial evidence of the reasonable probability of contamination. It speculates that contamination might occur and wants to place the burden of proof on the industry to show that contamination is <u>not</u> occurring. Tenneco Oil Company has undertaken that responsibility and has established, with its experts, that contamination will not occur by the continued use of unlined surface pits where the volumes are 5 barrels a day or less. To

terminate the use of the unlined pits would be unreasonable and arbitrary.

Tenneco Oil Company has attached to this Memorandum its proposed order, Exhibit A, which represents a logical and reasonable decision to be entered in this case.

Kellahin & Kellahin

Original signed by
By W. THOMAS KELLAHIN

W. Thomas Kellahin
P. O. Box 2265
Santa Fe, New Mexico 87501

STATE OF NEW MEXICO
DEPARTMENT OF ENERGY AND MINERALS
OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE: 8224
ORDER R-

APPLICATION OF THE OIL CONSERVATION COMMISSION UPON ITS OWN MOTION, TO DEFINE THE VERTICAL AND AREAL EXTENT OF AQUIFERS POTENTIALLY VULNERABLE TO CONTAMINATION BY THE SURFACE DISPOSAL OF PRODUCED WATER, MCKINLEY, RIO ARRIBA, SANDOVAL AND SAN JUAN COUNTIES, NEW MEXICO.

TENNECO OIL COMPANY'S REQUESTED ORDER FOR THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing on February 20, 1985, and April 3-4, 1985, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission".

NOW, on this _____ day of _____, 1985, the Commission, a quorum being present, having considered the evidence and being fully advised in the premises;

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That on June 7, 1984, the Oil Conservation Division, hereinafter called "the Division", in OCD Case 8224 called a public hearing to consider the prohibition of disposal of produced water on the surface of the ground in the San Juan Basin of New Mexico.

(3) That Division Case 8224 was again called for public hearing on July 18, 1984, at which time the Division established a water study committee composed of various members of the industry, of the Environmental Improvement Division, of the Oil Conservation Division staff and environmental groups and concerned citizens.

(4) That the Division appointed Water Study Committee held meetings on July 18, August 2, October 17, November 29, 1984, and January 9, 1985.

(5) That at the Commission hearing on February 20, 1985, the Water Study Committee submitted to the Commission its Report which was introduced as Commission Exhibit (1).

(6) That the disposal of produced water into unlined surface pits in the San Juan Basin has not contaminated ground or surface waters in Northwest New Mexico.

(7) That there are areas in San Juan, Rio Arriba, McKinley and Sandoval Counties, New Mexico, where ground or surface water may be vulnerable to possible contamination by oil & gas production.

(8) That the vulnerable area was defined by the Water Study Committee from using available water well data, 100 yr. flood hazard maps, topographic maps.

(9) That those vulnerable areas include areas where the depth to ground water is less than fifty feet, the aquifer containing the ground water consists of unconsolidated alluvial fill and the water is presently used for or has a reasonable future use for municipal, domestic, industrial, agricultural, or stock watering purposes as defined by the State Engineer.

(10) That the vulnerable area was defined as that area which lies over or adjacent to a vulnerable aquifer and includes those portions of the San Juan, Animas, and La Plata River valleys which are bounded by the topographic line on either side of the river that is 100 vertical feet above the river channel measured perpendicularly to the river channel.

(11) That Special Areas were also identified which fell outside of the "vulnerable area" but which had water well records indicating water production from less than 50' and oil and gas production within the same section.

(12) That the Water Study Committee has developed proposed definitions for a vulnerable area and for special areas which are fair and reasonable and should be adopted by the Commission into special rules and regulations.

(13) That within the vulnerable area, there are some 1,200 producing oil and gas wells and some 300 known water wells.

(14) That within the vulnerable area there is limited data available concerning the risk, if any, that the disposal of produced water into unlined surface pits has upon ground or surface water.

(15) That any contamination of ground water in the vulnerable area from the disposal of produced water into unlined surface pits, if it occurs, will most likely be from the disposal of large volumes of produced water in excess of 5 barrels a day or from the use of unlined surface pits within 15 feet of the bottom elevation of the major river beds in the vulnerable area.

(16) That until and unless quantification of such risk becomes possible, the disposal in the vulnerable area or in any special area of produced water into unlined surface pits at rates that exceed 5 barrels a day for a produced water pit and exceed 1 barrel a day for an ancillary pit may constitute a hazard to fresh water supplies and such disposal rates should be prohibited.

(17) That currently available data fails to provide substantial evidence that there is contamination or risk of contamination from the continued disposal of produced water into unlined surface pits in the vulnerable area at rates of 5 barrels a day or less for a produced water pit and of 1 barrel a day or less for any ancillary pit, provided said pits are not within 15 vertical feet of the elevation of the major river bottoms in the vulnerable area immediately adjacent to said pit.

(18) That the small volume disposal rates defined in Finding Paragraph (16) above are so insignificant as to present little hazard, if any, to fresh water supplies and should be allowed to continue in order to prevent waste caused by the premature abandonment of wells.

(19) That additional rules and regulations should be established to require the timely metering, and reporting of produced water by the operators of the oil/gas wells in the vulnerable area and the special areas.

(20) That there is no evidence that any fresh water well in the vulnerable area has been contaminated by the disposal of produced water into unlined surface pits.

IT IS THEREFORE ORDERED:

(1) That Special Rules and Regulations are hereby promulgated to deal with produced water into unlined surface pits in certain vulnerable and special areas of the San Juan Basin as follows:

SPECIAL RULES AND REGULATIONS
GOVERNING PRODUCED WATER
FOR UNLINED SURFACE PITS
IN AREAS OF MCKINLEY, RIO ARRIBA,
SANDOVAL AND SAN JUAN COUNTIES
NEW MEXICO

Effective July 1, 1986, no person shall dispose of produced water, or fluids, produced in connection with the production of oil or natural gas, or both, into unlined surface pits within areas of the San Juan Basin designated as either a vulnerable area or a special area, as hereinafter defined, except in conformance with the following rules and regulations:

RULE 1: DEFINITIONS:

As used in these rules and regulations:

(1) Aquifer: means a saturated permeable geologic unit (a geological formation, group of formations, or part of a formation) that can transmit significant quantities of water under ordinary hydraulic gradients.

For purposes of this definition, the word significant means that the water from the aquifer is used for or may reasonably be presumed to be usable for municipal, industrial, domestic, agricultural, or stock watering purposes.

(2) Vulnerable Aquifer: means any of the following:

(a) unconfined aquifers that are less than 50 feet from the surface; or

(b) unconfined aquifers in floodplain areas; or

(c) aquifers in unconsolidated materials.

(3) Vulnerable Area: means an area which lies over or adjacent to a vulnerable aquifer and is defined as an area within the river valleys of the San Juan, Animas, and La Plata Rivers, which is bounded by the topographic line on either side of the river that is 100 vertical feet above the river channel measured perpendicularly to the river channel.

(4) Special Areas: Areas outside of the vulnerable area in which ground water is subsequently found to be within 50 feet of the ground surface. Special areas presently identified are listed below:

a) Sections:

T28N-R 8W, Section 17
T28N-411W, Section 18
T28N-R15W, Section 26
T29N-R10W, Section 16
T29N-R12W, Section 24
T29N-R18W, Section 17
T29N-R19W, Section 23
T29N-419W, Section 30
T30N-R10W, Section 5
T30N-R11W, Section 3
T30N-R11W, Section 7
T30N-R11W, Section 8
T30N-R11W, Section 10
T30N-R11W, Section 19
T30N-R12W, Section 13
T30N-R12W, Section 15
T30N-R12W, Section 27
T30N-R12W, Section 33
T30N-R13W, Section 1
T30N-R15W, Section 6
T30N-R15W, Section 16
T30N-R15W, Section 21
T30N-R16W, Section 29
T30N-R19W, Section 34
T31N-R10W, Section 13
T31N-R11W, Section 35
T32N-R10W, Section 10
T32N-R11W, Section 23
T32N-R23W, Section 25

b) Areas that lie between the rivers and the ditches mentioned below are also special areas:

Highland Park Ditch
Hillside Thomas Ditch
Cunningham Ditch
Farmers Ditch
Halford Independent Ditch
Citizens Ditch
Hammond Ditch

(5) Produced Water Pit: That pit which receives water produced from primary separation in conjunction with the production of crude oil and/or natural gas whether or not such pit is located at the site of production.

(6) Ancillary Pit: Those pits not receiving fluids from primary separation, including but not limited to, dehydrator pits, tank drain pits, pipeline drip collector pits, blowdown pits, and compressor scrubber pits. Examples are listed below:

(a) Dehydrator Pit: Those pits which normally receive produced water only from the dehydration unit.

(b) Blowdown Pit: Those pits which receive liquid only when a well is blown down.

(c) Tank Drain Pit: Those pits which receive water that is drained from a production storage tank.

(d) Pipeline Drip Collector Pit: Those pits which receive liquids which accumulate in gas pipelines.

(e) Compressor Scrubber Pit: Those pits which receive liquids at the compressor suction in event of primary separator failure.

RULE 2: PRODUCED WATER PITS:

Within a vulnerable or special area, no produced water pit shall receive more than 5 barrels of produced water a day without special permit; and

RULE 3: ANCILLARY PITS:

Within a vulnerable or special area, no ancillary pit shall receive more than 1 barrel of water or fluids a day without a special permit; and

RULE 4: EXEMPTIONS:

The following are exempted from this order:

(1) Pits lying outside vulnerable or special areas are exempt from this order.

(2) Any pits, ponds, lagoons, or impoundments resulting from activities regulated by a discharge plan approved and permit issued by NMOCD or NMEID under Water Quality Control Commission Regulations authorized under the New Mexico Water Quality Act.

(3) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a RCRA or NPDES permit issued by NMEID or EPA under RCRA or NPDES regulations authorized under the Resource Conservation and Recovery Act, New Mexico Hazardous Waste Act, Clean Water Act or Safe Drinking Water Act.

(4) Any pits, ponds, lagoons or impoundments resulting from activities regulated by a mining plan, approved, and permit issued, by the New Mexico Coal Surface Mining Commission under the authority of the Surface Mined Lands Reclamation Act.

RULE 5: SPECIAL PERMITS:

The purpose of this rule is to allow for the disposal of produced water into unlined pits, based on the depth to ground water beneath such pits and provided that such pits meet the quality and soil characteristics criteria as set forth below.

Upon application to and approval by the NMOCD, unlined produced water pits which receive greater than 5 barrels a day and those ancillary pits which receive greater than 1 barrel per day, that are within the vulnerable area, may be permitted under this order based on the following criteria and after satisfying either a. or b. below.

(a) Quality Permit: If the operator can demonstrate that the quality of either existing uncontaminated ground water, or produced water, is such that the introduction of produced water will not cause degradation of the ground water, the unlined pit may be permitted upon application to the NMOCD. The demonstration must include analysis for organic and inorganic parameters as required by the Division.

(b) Soil and Geologic Characteristics Permit: If the operator can demonstrate through the use of standard soil analysis parameters (e.g., percolation tests, infiltration rates, particle size/distribution, etc.) that the existing soil and/or underlying geologic stratum exhibit low permeabilities such that the produced water will not cause degradation of the ground water, the unlined pit may be permitted upon application to the NMOCD. This can be accomplished on an areal or site specific basis.

RULE 6: WELL EQUIPMENT AND REPORTING PROCEDURES:

(a) Upon the effective date of this order and thereafter the operator of any oil or gas well in the vulnerable or special area shall accurately

measure the volume of produced water or fluids leaving the separator and being discharged into the produced water pit.

(b) That such measurements shall be taken by the operators not less than semi-annually and shall be reported semi-annually on a daily rate basis to the District Office of the Oil Conservation Division on Division form _____.

RULE 7: EXPANSION OF VULNERABLE OR SPECIAL AREA

(1) That any person seeking to amend or expand the Vulnerable Area or to establish new Special Areas shall file a written application to the Divisiion and shall send a copy of said application to any oil/gas operator within the Vulnerable Area or within 2 miles of any Special Area, by certified mail return receipt, not less than 21 days before any Division Hearing.

(2) That the amendment or expansion of the Vulnerable Area or any Special Area or the creation of a new Special Area shall be done only after notice and hearing.

RULE 8: AMENDMENT OF RULES:

These Special Rules and Regulations shall be amended only after notice and upon hearing by the Division or Commission, as the case may be. Such hearing shall be held only after notice to any and all oil/gas operators, by certified mail-return receipt, who operate any well in the Vulnerable area or within 2 miles of any Special Area.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

RICHARD L. STAMETS
Director

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

POST OFFICE BOX 2088
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May 3, 1985

Mr. W. Thomas Kellahin
Kellahin & Kellahin
Attorneys at Law
Post Office Box 2265
Santa Fe, New Mexico 87504-2265

Re: Case 8224

Dear Mr. Kellahin:

By your letter of May 2, 1985, you requested an extension of time from May 7, 1985, to May 20, 1985, to file requested post hearing documents.

This extension is hereby granted.

Sincerely,

R. L. STAMETS
Director

RLS/fd

cc: Ed Kelley
Jeff Taylor
Jennifer Pruitt
William F. Carr
Perry Pearce
Millard F. Carr
Marty Buys

Jason Kellahin
W. Thomas Kellahin
Karen Aubrey

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Telephone 982-4285
Area Code 505

May 2, 1985

Mr. Richard L. Stamets
Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87504

Re: NMOCC Case 8224

Dear Mr. Stamets:

On Friday, April 26, 1985, I received from EID and the OCD staff their respective lists for post hearing documents from our experts. Both lists require far more information and documents than I had anticipated when I indicated to the Commission that I thought we could have the post hearing documents submitted by May 7, 1985. For example, if the OCD staff really wants Mr. Gutierrez's printout data, as they have requested, it involves thousands of pages of computer data. In addition, Dr. Wall's report on the statistical data needs to be put into a form that is meaningful to anyone other than a statistician.

Accordingly, on behalf of Tenneco Oil Company, I respectfully request that the post hearing document production be moved from May 7, 1985, to May 20, 1985.

Very truly yours,

W. Thomas Kellahin

WTK:ca

cc: Jeff Taylor, Esq.
Oil Conservation Commission
P. O. Box 2088
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May 2, 1985

Jeff Taylor, Esq.
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504

"Hand Delivered"

RECEIVED
MAY 2 1985
OIL CONSERVATION DIVISION

Re: NMOCC Case 8224

Dear Mr. Taylor:

On behalf of Tenneco Oil Company, I am requesting that the OCD Staff provide to us the following post hearing documents concerning its ground water study of the Flora Vista site:

1. All field notes and data;

2. Schematic of site, with all monitoring wells or pit locations, including the direction of gradient and survey points;

3. All chemical analysis reports from all laboratories and for any and all samples taken;

4. Copies of all correspondence, documents, notes, and data concerning the Flora Vista site, including but not limited to, the Manana Mary Wheeler No. 1 well from the date of first reported contamination, and of any Flora Vista well.

Very truly yours,

Original signed by
W. THOMAS KELLAHIN
W. Thomas Kellahin

WTK:ca

cc: Mr. Richard L. Stamets
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Santa Fe, New Mexico 87504

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TELEPHONE: (505) 988-4421
TELECOPIER: (505) 983-6043

April 29, 1985

Mr. R. L. Stamets, Director
Oil Conservation Division
New Mexico Department of
Energy and Minerals
Post Office Box 2088
Santa Fe, New Mexico 87501

Re: Case 8224: Application of the Oil Conservation Commission Upon Its Own Motion to Define the Vertical and Aerial Extent of Aquifers Potentially Vulnerable to Contamination by the Surface Disposal of Produced Water, McKinley, Rio Arriba, Sandoval and San Juan Counties, New Mexico.

Dear Mr. Stamets:

Enclosed is a Statement for the Record of Union Texas Petroleum Corporation in the above-referenced case. We request that this be included in the record of Case 8224 as an unsworn written statement.

Your attention to this request is appreciated.

Very truly yours,

William F. Carr

WFC/cv
enclosure

cc: Charles W. Sponberg

STATE OF NEW MEXICO
DEPARTMENT OF ENERGY AND MINERALS
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

APPLICATION OF THE OIL CONSERVATION
COMMISSION UPON ITS OWN MOTION
TO DEFINE THE VERTICAL AND AREAL EXTENT
OF AQUIFERS POTENTIALLY VULNERABLE
TO CONTAMINATION BY THE SURFACE
DISPOSAL OF PRODUCER WATER, MCKINLEY,
RIO ARRIBA, SANDOVAL, AND SAN JUAN
COUNTIES, NEW MEXICO. Case: 8224

UNION TEXAS PETROLEUM's STATEMENT FOR THE RECORD

April 23, 1985

On behalf of Union Texas Petroleum Corportion I would like to commend the members of the Water Study Committee on all the work which led to the committee's final recommendations. The time, effort, and long distance travel (often in poor weather), is greatly appreciated.

Union Texas Petroleum, as operator of more than 800 San Juan Basin wells, conducts its operations with an emphasis on maintaining environmental quality. The protection of ground water is of foremost concern. This concern is evidenced by Union Texas Petroleum's casing and cementing operations in new wells, fresh water zones are always protected during these operations.

Union Texas participated in the short term water study committee meetings and supports the committee's final recommendations. Union Texas also supports a small volume exemption for wells making less than five barrels of water per day (BWPD), for the following reasons:

1) wells in the vulnerable areas producing more than five barrels of water per day would not be exempted and would have to comply with the OCD order by lining pits or setting tanks;

2) operators would operate under a consistent policy for State and Federal lands;

3) low volume wells, near their economic limit, could continue to produce without the economic burden of lining pits, setting tanks, and water disposal costs. These costs would cause wells near economic limit to be plugged, with a resulting loss of revenue to royalty owners and to the State;

I thank the New Mexico Oil Conservation Division for their consideration of Union Texas Petroleum Corporation's position.

Charles W. Sponberg

Charles W. Sponberg
Registered Professional Engineer
New Mexico Certificate #9258

CWS:rn

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

April 26, 1985

Mr. Thomas Kellahin
P. O. Box 2265
Santa Fe, NM 87501

RE: Documents requested in Case 8224

Dear Tom:

The Staff of the OCD has reviewed the transcripts and testimony of the produced water hearings and would like to request that the following information be provided by the May 7, 1985 deadline set by the Commission. Except for the documents requested relating to the testimony of Mr. Al Gutierrez, the requests for OCD and EID are the same:

Witness Gary Miller:

Creosote site data supporting testimony in reference to Tabak article, in which rapid biodegradation of benzene and toluene was observed, or another reference documenting one hundred per cent (100%) biodegradation of benzene in ground water in seven days.

Witness Randall Hicks:

Field data forms for all fifty to sixty wells studied and inspected in the vulnerable area, including any and all accompanying hydrogeologic studies, heavy metals data and field notes.

All chemical analyses reports from both Assagai and Rocky Mountain Laboratories for any and all samples done of soil, ground water or produced water samples in the vulnerable area.

Specific conductance measurements on ground-water samples from the three study sites, with information on who performed such measurements and when.

All volume records from Tenneco and Amoco on which you based your volume calculations of produced water at the fifty to sixty sites you studied.

Any and all data you considered in order to reach your conclusion that the effects of rain and snow during the period of your study were insignificant.

report or written material from any consultant regarding the statistical evaluation supporting your method of selecting sites, and regarding the statistical significance of your sampling results.

Witness Al Gutierrez:

Computer program and copy of printout of output and input data for Random Walk groundwater simulation.

Sincerely,

Jeff Taylor
General Counsel

JT/bok

71 Road 2335
Aztec, N. M. 87410
April 2, 1985

New Mexico Oil and Gas Commission
State Land Building
Santa Fe, N.M.

Attn. Mr. Richard Stamet, Chairman

Subject: Brine Water Evaporative Tanks at Cedar Hill, N.M.

Amoco Production Co. installed two (2) large evaporative water tanks north of Cedar Hill just west of Highway U. S. 550, for the purpose of disposing of brine water by evaporation.

These tanks were installed without apparent regard for or notice to the community as to their size or purpose.

The southern most tank was installed with the east side positioned on a natural arroyo that drains off the mesa into the north east section of the community and eventually south east to the Animas River. Both tanks have experience leakage ever since constructionwith the north tank (largest one)now having a torn liner with a formidable amount of leakage. It is my understanding that these tanks were installed according to state specifications, which called for a double liner with a leak protection system to moniter for leakage of the top liner. However, no provision was made to moniter leakage from the bottom liner.

On the east side of the tank at the north wet well, Amoco dug a leach pit to contain the leakage flowing out of the pipe on the wet well at ground level which would place it approximately at the half way point in the depth of the tank. The water flowing into this catch basin was disposed of by the leaching process. During the past two weeks, an open top fiberglass tank has been installed to catch the leaking brine water. A piece of plastic pipe was placed from the plastic tank to with in several feet of the leakage from the metal pipe of the wet well. The leaking water has enough pressure to cause it to boil out of the ground next to the metal pipe. There continues to be contamination from this leakage. This does not appear to be a satisfactory solution to the problem.

There have been additional wells drilled in the area besides the ones surrounding the evaporative tanks that will be producing brine water as a by-product. It is my understanding that "plastic" pipelines are to be laid from the wells to the tanks over the easiest route. Information garnered from Amoco employees indicate very little,if any studies have been made on the enviromental impact these lines would have or that any provision has been made for the safety of the peoples land over which these lines would transverse.

In closing, I would like to suggest two possible solutions to the problem. One, the use of injection wells to dispose of these by-products of production. It is by far a safer method of disposal. Two, if evaporation tanks are considered for disposal, selection of locations should meet a very strict set of regulations in order to protect the land, potable waters, and the people adjacent to them. Thank you,

Very truly yours,

Paul L. Rouse

Paul L. Rouse

ARCO Oil and Gas Company
Rocky Mountain District
717-17th Street
Mailing address: P.O. Box 5540
Denver, Colorado 80217
Telephone 303 575 7000

April 1, 1985

Oil Conservation Division
for the State of New Mexico
P.O. Box 2088
Santa Fe, NM 87501

Gentlemen:

This is a statement for the record on the hearing called by the New Mexico Oil Conservation Commission, (OCD) to define the disposition of produced waters in the San Juan Basin of New Mexico specifically the counties of McKinley, Rio Arriba, Sandoval and San Juan counties.

My name is John Calder. I am District Environmental Coordinator, ARCO Oil and Gas Company, a Division of the Atlantic Richfield Company, with offices in Farmington, New Mexico and Denver, Colorado. I have a Bachelor of Science in Chemical Engineering from the University of Tennessee and have held my position in ARCO's Denver offices for eight and one-half years. I have been active and have chaired many industry/government committees and task forces including those of the American Petroleum Institute, Rocky Mountain Oil and Gas Association, U.S. Bureau of Land Management, and including your own short term water study committee to determine the disposition of produced waters in the San Juan Basin.

The data presented by Drs. Shultz and Miller indicate that an exemption for quantities under 5 barrels of water per day is justified even in the areas of possibly vulnerable ground water. ARCO strongly urges the Commission to establish this exemption. There is no conclusive evidence that the oil and gas industry has contributed in any way to ground water pollution in the San Juan Basin. Lacking such evidence, ARCO believes that an exemption is justified particularly in light of the substantial financial resources that would otherwise be expended. This position is based on the knowledge gained by our participation not only in the short term study committee of the OCD but also the study previously presented and supported by ourselves, El Paso Natural Gas Company, Meridian Oil and Northwest Pipeline Company.

ARCO realizes that the world's natural resources of air, water, and land are vital to mankind's global existence, progress, and continued development. We consider environmental protection to be a paramount concern in our total activities. In over 25 years of operating in the San Juan Basin, we have made it our policy to be a good environmental citizen.

Thank you very much for your attention.

Sincerely,

J. L. Calder, III
District Environmental Coordinator

JLC:rd

LAND PROTECTION ASSOCIATION INC.

1106 U.S. HWY. 550 DURANGO, CO. 81301

February 18, 1985

We, the undersigned, object to the method in which gas and oil producers have installed evaporative, earthen, ponds above the Cedar Hill Community with no apparent regard to the communitys' welfare or wishes.

These evaporative, earthen, ponds are a potential time bomb with the ability to contaminate our wells, irrigation ditches, rivers and other water sources in the area that would adversely effect the entire valley.

NAME	ADDRESS
Richard E Barnes	1106 Hwy 550 So. Dur., Co
Jane L. Barnes	1106 Hwy. 550 So. Dgo, Co.
Patricia A Hanson	2593 C.R. 213 Dgo. Co.
Roy L Coglesen	1394 Hwy 550 So. Durango,
Kedell Coglesen	1394 Hwy 550 S. Durango, Co. 81301
Sr Anna Brands	3237 Hwy 550 S. Durango
Carl R Weston	3905 Hiway 550 Durango Co 81301
Cheryl Orris	2340 C.R. 213 Durango, CO 81301
Jack W. Scott	P.O. Box O, Aztec, NM 87410
James R Miller	P.O. Box 791 AZTEC N M 87410
Joe Leahy Jr.	3433 Hwy 550 S DURANGO 81301
ROB CRAIG	2494 CR 213 Dgo 81301
Terry Brown	2340 CR213 Dgo 81301
[illegible]	2494 CR 213 Dgo 81301

NAME	ADDRESS
Anna Anderson	1630 CR 214 Dgo Co
Harold G Hardcastle	148 CR 2105 Hesp.
Jean Lesley	3433 Hwy 550 Dgo Co
Blanton F. Coghurn	1636 Hwy 550, Durango Colo
Lucille E. Colbeere	1636 Hwy 550 Durango Co.
Junior Bodde	8237 Hwy 550 80 Durango Colo

PETITION

We, the undersigned, object to the method in which gas and oil producers have installed evaporative tanks above the Cedar Hill community with no apparent regard to the Communitys' welfare or wishes.
These evaporative tanks are a potential time bomb with the ability to contaminate our wells, irrigation ditches, rivers and other water sources in the area that would adversely effect the entire valley.
Also, in all fairness to the people of New Mexico and other surrounding states, oil and gas producers should not be permitted to transport by-products from one state to another or allowed to dispose ofthese by-products in such a manner as to cause them to flow from one state to another in the streams and rivers.

	NAME	ADDRESS Cedar Hill
1.	Helen M. Moss	5173 & 8 Hwy. 550
2.	Joe Timbes	Box 304 Aztec, N. Mex
3.	Ruth Timbes	Box 304 Aztec N. Mex
4.	[illegible] Day	4436 510 Cedar [illegible]
5.	[illegible] Day	4436 510 Cedar [illegible]
6.	Naomi Wilkey	[illegible]
7.	David Wilkey	[illegible]
8.	Carol J Harkness	108 Rd 2755 Aztec N.M.
9.	Lavina Harkness	108 Rd 2755 Aztec, N.M.
10.	Maryane Brown	5136 Hwy 550, Aztec N.M.
11.	Ray N Howe	5151 US HWY 550, Aztec N M
12.	Debbie K Howe	5151 US Hwy 550, Aztec, NM.
13.	Jerry H Knowlton	1019 Rd 2900 [illegible]
14.	[illegible]	1019 Rd 2900 [illegible]
15.	Theodore D. Carruthers	517 Rd 2700 [illegible]
16.	[redacted]	[redacted]
17.	Tom L Mossette	5530-3 Hwy 550 [illegible]
18.	Paul T Kennedy	
19.	Ronald D Osborn	5150 US HWY 550 AZTEC
20.	Doc Owen	5128 Hwy 550 Aztec N[illegible]
21.	Bill Moss	5173 Hwy 550 Aztec NM
22.	Carol S Masters	34 Road 2358 Aztec, NM
23.	Gary J Cheadle	34 Rd. 2358 Aztec, NM

	NAME	ADDRESS
24.	Martha L Rouse	71 Road 2335 Aztec NM
25.	Louis E Wiebe	#31 Road 2358 Aztec N.M.
26.	Kathleen Wiebe	#31 Rd 2358 Aztec
27.	Don Caston	#25 Rd 2358 Aztec
28.	Phyllis M. Caston	#25 Rd 2358 Aztec
29.	Larry L Harden	#26 Rd 2358 Aztec N.M.
30.	Donald W. Metz	#21 RD 2358 AZTEC N.M.
31.	Charlotte C Metz	#21 Road 2358 Aztec N.M.
32.	Velma McEwen	5138 U.S. 550 Aztec (Cedar Hill)
33.	Wright & McEwen	" " " " "
34.	William W. Brewer	13 Rd 2350, Aztec N.M.
35.	Wayne M. Hesch	76 Road 2335 Aztec N.M.
36.	Herbert R Hesch	" " " "
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PETITION

We, the undersigned, object to the method in which gas and oil producers have installed evaporative tanks above the Cedar Hill community with no apparent regard to the Communitys' welfare or wishes.
These evaporative tanks are a potential time bomb with the ability to contaminate our wells, irrigation ditches, rivers and other water sources in the area that would adversely effect the entire valley.
Also, in all fairness to the people of New Mexico and other surrounding states, oil and gas producers should not be permitted to transport by-products from one state to another or allowed to dispose ofthese by-products in such a manner as to cause them to flow from one state to another in the streams and rivers.

	NAME	ADDRESS
1.	Emma Jean Hallett	91 Road 3004, Aztec, N.M. 87410
2.	Kathryn A. Hallett	5040 Hwy 550, Aztec, N.M.
3.	Betty McGinty	416 Beuhler Aztec, N.M.
4.	J.D. Downes	4409 Hwy 550 Aztec N.M.
5.	Lori Houston	1234 Aztec Blvd Aztec N.M.
6.	Jeffrey L. Houston	1234 Aztec Blvd Aztec N.M.
7.	Sharon Vigil	407 Aztec Blvd Aztec N.M.
8.	Tony Simmons	Box 153 Flora Vista NM 87415
9.	Teresa Simmons	Box 153 Flora Vista, 87415
10.	Lynda Davidson	66 Road 2105 Aztec, N.Mex 87410
11.	Lisa Vigil	2305 E. 13th Farmington, N.M.
12.	Linda Quinn	901 Cimarron Aztec, N.M.
13.	Sue E. Jackson	15 Road 2350 Az. N.M.
14.	Olen Divine	901 Cimarron, Aztec, N.M.
15.	Jeffrey A Jackson	15 Rd 2350 Aztec N.M.
16.	Monica Martinez	Box 5 Aztec, N.M.
17.	Mrs Doris Garvin	601 Nava #401
18.	Lisa Vigil	2305 E. 13th Farmington
19.	Mr & Mrs Hayden Cason	#81 Rd 2335 Aztec, NM 87410
20.	Mr & Mrs Walter Griffin	5091 - Hwy 550 Aztec, N.Mex.
21.	Wanda Amon	12th Road 2335 Aztec, N.Mex
22.	Annabelle Simon	5102 U.S. Hwy 550, Aztec
23.	Gary D. Amon	12 Road 2335 Aztec, N.M.

	NAME	ADDRESS
24.	Ruth Simpson	#14- RD 2345 Aztec NM
25.	Mrs J D Boyd	Rt 1 Box 55 Aztec N Mex
26.	M L. Gauthier	#14 Rd 2345 Aztec N.M.
27.	A. Simpson	#14 RD 2345 Aztec N.M.
28.	Connie A. Gauthier	#14 Rd 2345 Aztec N.M.
29.	Benson C Leeper	R.D. 2900 Aztec
30.	Ruby Leeper	1083 RD 2900 Aztec
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	NAME	ADDRESS
1.	Cindy Miller	77 Rd 2400 Aztec
2.	Jerry Miller	77 Rd. 2400 Aztec
3.	Joan M Mason	80 Rd 2400 Aztec
4.	Joseph B. Mason	80 Rd 2400 Aztec
5.	Karen A Hise	69 rd 2400 Aztec
6.	Glenn R. Hise	69 Rd 2400 Aztec
7.	Karen Mawley	52 Rd 2400 Aztec
8.	John C Cox	51 Rd 2400 Aztec
9.	Naoma L. Cox	#51 2400 Rd Aztec
10.	Dona L Mead	#43 Road 2400
11.	Marshall R Mead	#43 Road 2400
12.	Joseph T. Morris Jr.	3 RD. 2400
13.	Joan Morris	3 Rd. 2400
14.	Charles Spencer	#46 Rd #2395 Aztec
15.	Sandi Spencer	#46 Rd #2395 Aztec
16.	Sue Ann Magers	44 Rd 2395 Aztec
17.	Kent B. Price	#30 Rd 2395
18.	Sue Price	#30 Rd 2395
19.	Patricia Young	#27 Rd 2395
20.	Tonia Van Diest	#33 Rd. 2400
21.		#33 Rd 2400
22.	Paul H Rhoda Mayor	#42 Rd 2400
23.	Robert J. Dennaman	56 Rd 2400

	NAME	ADDRESS
24.	Gail E. Farris	131 Rd 2400 Aztec
25.	O.C. Williams	133 Road 2400 Aztec.
26.	Mildred Williams	133 Rd 2400 Aztec N. Mex
27.	Gina Brown	143 rd 2400 Aztec NM.
28.	[illegible]	150 Rd. 2400 Aztec, NM
29.	[illegible]	150 Rd 2400 Aztec NM
30.	[illegible]	149 Rd 2400 Aztec NM
31.	Lindy Isbell	186, Road 2400, Aztec, N.M.
32.	Opal Martin	196 Rd. 2400, Aztec, N.M.
33.	[illegible]	154 - Rd 2400 Aztec, NM.
34.	Cheryl Sanders	108 Rd 2400, Aztec N.M.
35.	[illegible]	#18, Rd 2395 Aztec NM.
36.	[illegible]	4 Rd 2397 Aztec N.M.
37.	[illegible]	87 Road 2390 Aztec N.M.
38.	[illegible]	90 Rd. 2390 Aztec N.M.
39.	Robert R. Bird	155 Rd. 2400, Aztec, N.M.
40.	[illegible]	Lot 39 D Dutchmans Hills
41.	[illegible]	Rt 1 - #8 - Rd 2403
42.	[illegible]	#27 Rd. 2396 AZTEC.
43.	Lynnette Herring	#27 Rd. 2396 Aztec
44.	[illegible]	11 Rd 2403 Aztec
45.	Jerry Kuhn	#70 Road 2400 Aztec N.M.
46.	[illegible]	#70 Road 2400 Aztec N.M.
47.	Mark Brown	#11 Road 2403 Aztec, N.M.
48.	Sherri Farris	Box 34 Aztec
49.		
50.		

71 Road 2335
Aztec, N. M. 87410
February 14, 1985

Mr. Richard L. Stamets, Director
Oil Conservation Division
P. O. Box 2088
Santa Fe, N. M. 87501

Subject: Case 8224 Hearing to be held at 9:00 a.m. February 20, 1985, Morgan Hall, Santa Fe Land Office Building, Santa Fe, N. M.

Dear Sir:

We, the citizens of Cedar Hill N. M.,will be sending two representatives to the above mentioned hearing to establish our concern in this matter.

The installation of the evaporative tanks on the mesa above the Cedar Hill Community with out regard to the welfare or wishes of the residents makes it imparitive that we have representation at the forth coming hearing.

Messrs. Benson Leeper and Paul Rouse will be present as the appointed representatives of the Community. However, if work schedules permit, Messrs. James Welles and Ray Kysar, as concerned citizens will also be in attendance.

Mr. Frank Chavez of your Aztec office advised us to notify you of our intent to be present. Looking forward to meeting you on February 20th, I remain

Very truly yours,

Paul L. Rouse

mlr: PLR