BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
July 17, 1968

REGULAR HEARING

IN THE MATTER OF:

The hearing called by the Oil Conservation Commission on its own motion to consider the amendment of Order No. R-3221, the Commission's Salt Water Disposal Order, to provide an administrative procedure whereby lined evaporation pits may be utilized for salt water disposal, provided that they are designed, constructed, and maintained in accordance with certain minimum standards which shall be established by the Commission.

Case No. 3807

BEFORE: Honorable David Cargo
Mr. A. L. Porter
Mr. Guyton B. Hays

TRANSCRIPT OF HEARING

MR. PORTER: The hearing will come to order, please. The next case on the docket is Case 3807.

MR. HATCH: In the matter of the hearing called by the Oil Conservation Commission on its own motion to consider the amendment of Order No. R-3221, the Commission's Salt Water Disposal Order, to provide an administrative procedure whereby lined evaporation pits may be utilized for salt water disposal, provided that they are designed, constructed, and maintained in accordance with certain minimum standards which shall be established by the Commission.

If the Commission please, George Hatch appearing on behalf of the Commission and staff. I will have one witness, Mr. Nutter.

(Witness sworn.)

MR. PORTER: The Commission witness will testify first in this case. However, we would like to emphasize at this point that we would like all the information that we can get on this subject, including any discussion that you would like to give us or any information you would like to give us concerning various types of materials that are on the market or have been developed that might be suitable for the lining of pits.

We would like for you, when you give your testimony,

to stay clear of trade names, occasionally one may slip out. However, in any specifications that we might write later, of course, we would not use any trade name and just feel that the qualities of the material and so forth.

After the Commission witness has testified we will call on anyone else here who would like to come to the stand and testify as to his product or as to his experience in the installation and use of various lining materials. I won't call for appearances at this time but there will be an opportunity for anyone here who would like to testify to come forward and do so.

DANIEL NUTTER

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. HATCH:

Q Will you state your name and position for the record?

A Dan Nutter, Chief Engineer for the Oil Conservation Commission.

Q Are you familiar with Case 3807 and what it proposes?

A Yes, sir, I am.

Q As Chief Engineer of the New Mexico Oil Conservation Commission you have a duty to study orders of the Commission

and make recommendations concerning them?

A Yes, I do.

Q Are you prepared to make recommendations to the Commission concerning certain amendments to Order R-3221?

A Yes.

Q Would you refer to the docket, please, and to Case 3807 on that? It's been divided into three paragraphs, and I believe that it would be better to complete the last two paragraphs first and then the lined pit part will be taken up following that.

A Yes, sir. I won't go into the history of Order R-3221, Mr. Stametz, in the previous case, gave the background of how that order was entered and why. He didn't mention, however, that prior to the issuance of Order 3221 the Commission had entered several orders regarding salt water disposal, the first one entered was R-1224-A, which was the original salt water order of the Commission entered into ten or eleven years ago.

This order provided that exceptions to the no-pit rule for the 22 pools in ten different areas covered by that order would be limited to one-half barrel of salt water per well per day. There was no limitations as to the total number of barrels that could be disposed of into a particular pit

provided that the maximum would not exceed the one-half barrel per well.

Order R-2526 was issued a few years after that covering the Inbe-Lane-Bagley areas and it provided no exceptions whatsoever as far as a half barrel or any fractional barrel to be permitted to go into a pit.

Order R-3164 was issued a little over a year ago and it made no exception for any fractional barrels to be permitted to go into pits. Order R-2788 was issued several years ago covering an area right next to the Pecos River in Chaves County and it made no provision for fractional barrels to be permitted to go into the pits.

When we entered Order Number R-3221, which is the general salt water disposal order covering the four counties of Southeast New Mexico, we provided that a maximum of one barrel per well per day would be permitted to go into a pit. However, there is a limitation of 16 barrels on this. It's my recommendation this morning that these previous Orders R-1224-A, R-2526 and R-3164 covering the original 22 pools in the first order, the Inbe-Lane-Bagley area and the Vacuum area be amended so that this one barrel per day and sixteen barrels per day maximum would be effective in those areas.

I don't recommend that the order which prohibits pits next to the Pecos River in Chaves County be amended because this is in vital communication with the Pecos River and we wouldn't want any salt at all to go into the Pecos River, at that point it's not salty. So that second paragraph of this case covers that and that would be my recommendation.

Q Do you have anything further to recommend concerning that particular paragraph?

A That particular paragraph, no, sir.

Q Would you refer to the third paragraph of the docket there?

A All right, the third paragraph concerns Order Number (8) of Order R-3221. Order Number (8) reads as follows: "That the District Supervisor of the appropriate District Office of the Commission is hereby empowered to authorize temporary disposal in surface pits for a period not to exceed thirty days for such contingencies as injection system failures and evaluation of wildcat wells. Authority for said disposal shall only be granted on an individual case basis and only after the volume and quality of the water produced in the proximity of fresh water supplies have been taken into consideration."

I would recommend that this paragraph be revised

by the insertion of the word "storage or disposal" following the word "temporary", so that it would read "That the District Supervisor of the appropriate District Office of the Commission is hereby empowered to authorize temporary storage or disposal in surface pits". The reason for this is that there has been some misunderstanding as to what disposal meant in the case of injection system failures. We feel that storage and disposal are not synonymous and that in the case of an injection system failure where water is being produced and has to be placed some place before the injection pumps can go back on that this water could be placed in a pit but that the, it is incumbent upon the operator of this system to then withdraw the water from this pit and inject it in the normal manner after his injection system is back in operation.

I want to clarify that this is storage or disposal and that the storage would refer to the injection system failure. Now, disposal would be where water is being placed in pits for evaluation of wells. And prior to the time that a well in a pool might be connected to a salt water disposal system, in many cases this water is just placed in the mud pits and it's too rank to pick up and put into any injection system and for a short period of time whatever water is placed in those pits is not going to unduly threaten any fresh water

supplies.

I would also recommend that the statement that permits this evaluation of wildcat wells be revised so that it would read "newly completed wells". This would take care of the situation where you have a development well in a pool which may be connected to a salt water disposal system very shortly, or may have just a very nominal amount of water being produced while it's being evaluated and the restriction to wildcat wells only would be removed.

I believe that's all I have regarding this paragraph.

Q Would you refer, then, to paragraph one and explain to the Commission why there is a need for lined pits?

A There are situations where lined pits are probably going to be desirable and acceptable. Among these would be the case where you have isolated wells making small to medium amounts of salt water that cannot be economically connected to salt water disposal systems. You have other situations where there are leases in pools where small volumes of water are produced and production of salt water is expected to decrease or is not expected to increase in the foreseeable future.

Third, you have a situation where water production

is expected to decrease but for the time being the evaporation pits might be used without the current expense of connection to a salt water disposal system that may be required later.

I want to make it clear, however, at this point, that we're not recommending installation of a pit now and deferment off the investment to tie into a salt water disposal system late in the life of the well, because then we'll hear the story that the marginal production won't sustain the cost of tying into the salt water disposal system and won't justify the investment and, therefore, if the order were enforced, that it would result in premature abandonment. But I believe that there will be many situations where it's known that it is going to have to be tied to a salt water disposal system, but while the water produced can be handled in a reasonable sized evaporation pit that this pit should be permitted.

MR. PORTER: But actually you would emphasize that the volume of water should be static or decreasing?

THE WITNESS: It should be static or decreasing in most cases.

Q (By Mr. Hatch) What geographical area will be affected?

A I would recommend that the geographical area be the same area that is covered by Order R-3221, that is all the

oil-producing areas of Lea, Chaves, Eddy and Roosevelt Counties.

Q Do you have any specific recommendations as to the materials that must be used in the lined pits?

A No, I'm not going to make any recommendation concerning specific materials. There are numerous materials available for the purpose, some are better than others. I think among the materials which have been either previously used in other places or which have been proposed for use here are concrete, asphalt, gunnite, Fiberglass, butyl, neoprene, polythylene, polyvinyl chloride, synthetic rubber and nylon, just to name a few. I think that the grade of the material in many instances is more important than the type of material, and I would recommend that any standards that the Commission would adopt would require that first grade materials, whatever they be, would be required.

One thing is certain, the material that's used to line an evaporation pit should be of sufficient tensile strength and toughness to withstand punctures from any rocks remaining under the liner or from rocks or any other objects that are thrown into the pit after it is constructed.

The material should be sun-resistant or special provisions made to protect it from the sun. It should be heat

and cold resistant well beyond the normal ranges that are expected. The material should be fungus resistant and rot resistant. It should be inert to the attack by salt, by acids and by hydrocarbons, and if it is of rigid or semi-rigid construction it should have a reasonable coefficient of expansion to prevent cracking or parting due to temperature changes. Those are just general things regarding the materials.

Q If the Commission were to allow these lined pits, should any method of detecting leaks be required?

A I'm not sure just how many satisfactory methods of leak detection can be utilized in an installation such as a lined evaporation pit. One means that could be used requires a gravel-filled sump connected by a pipe to another concrete-lined sump outside of the pit. The reliability of this method would be greatly improved by the installation of four gravel-filled trenches radiating out from the sump to the corners of the pit; the bottom of the trenches should be sloped toward the center slump.

There are several variations of this basic method of detecting leakage, any of which would be satisfactory providing that the arrangement of the trenches and the sumps was properly designed. But the sump method on any drainage from under the pit to the outside where leakage could be

detected is one means. Another means of detecting leakage might be the use of electric censors which could signal the presence of accumulated salt water under the pit liner.

I heard of another device installed somewhere in Texas that had a sump in the center of the pit with a pipe extending vertically from the sump; the liner was sealed all around the pipe, then a broom handle on a float was placed in the pipe and cut to just the right length and whenever they saw the broom handle peeking out of the pipe they knew they had a leak.

I don't know what provision could be made to prevent somebody from wading out there and cutting off the broom handle, however. Where the pit is installed in sections, that is with parallel modular units, then there are at least three of these units, two of the pits could be stabilized, the water level in two of the pits could be stabilized by siphons and then the siphon broken and the evaporation rate in those two pits compared while the water production is going into the third pit. Of course, the pit that evaporated the fastest probably has the leak in it.

While we are on the subject of safeguards, I might add that one other safeguard that must be undertaken in the use of line pits will be the ultimate disposition of the liners on

any accumulated salt that is in those liners. This accumulation could be placed in natural salt lakes where there is already natural contamination or there's no danger of further contamination, or it could be placed in those big tailings ponds that Dick was talking about in the previous case.

Another acceptable method, I think, would be the digging of a shallow trench and burial of this material in a shallow trench after which the dirt would be compacted and mounded to prevent seepage from going in there and dissolving it too fast. I think if it were compacted, mounded and buried like this it would be dissolved over a period of hundreds, maybe even thousands of years, and there wouldn't be any immediate contamination at any point along the way.

I believe that's all I have to say on the subject of leakage and safeguards.

Q Do you have any recommendation to make concerning the capacity of the lined pits?

A This is the most difficult part of the whole thing. Anyone proposing to use an evaporation pit for the disposal of salt water is going to have to carefully analyze his water production against the evaporation rates and make sure that he doesn't find himself in a bind with his production shut in because his pits are full.

Evaporation rates vary widely within a single year as the seasons change and even vary greatly from year to year as the weather cycles change.

I have an analysis of a three-year period for the Hobbs area and find that pan evaporation of fresh water averaged 93.6 inches a year but ranged from a low in this period of 82 inches to a high of 101 inches. The variation month by month ranged from a low month of an inch and a half to a high month of over sixteen inches. Conversion of the fresh water pan evaporation rates to saline water in pits greatly reduces the total evaporation. The three-year average is 53.5 inches compared with our previous average of 93.6 inches.

The low year for pit evaporation of saline water is approximately 61 inches or 49 inches, and the high year is 61 inches. Adding the precipitation that fell further reduces the evaporation so that you have an average annual evaporation rate for the three-year period of 36.2 inches, with a range from 17 inches to 45 inches.

Now, this is one of the wettest years in the history of the Hobbs area that is included here. That's what brings the average down. They had 32 inches of rainfall that year, which is extremely high. This is something that operators are going to have to take into consideration. You can't design

your pit on the basis of a dry year. You have to keep in mind that you do occasionally have wet years.

Q You would expect the applicant to submit figures along with his application to show that the pit was adequately sized?

A Yes, sir. Now, what we plan to do is to make a more comprehensive study of the evaporation rates and compute evaporation tables for each of the District Offices. Operators then would be able to come in and knowing they had a given rate of water production to handle be able to determine from our tables the number of square feet of evaporation surface that will be required to handle that amount of water, either to evaporate it or to store it during the winter months when the evaporation rates were at their minimum.

I would also recommend at least a 25 percent excess capacity be required in order to allow for unexpected rains or snowfall or periods when evaporation rates just are not up to par because of high humidity or cloudiness and so forth.

Another thing you have to consider in here is the elevation. We've got comparative studies showing Portales with a 4,000-foot elevation evaporated 67 inches while Hobbs during the same weather at 3600 feet evaporated 72.6 inches. Now, this is fresh water in a pan. So you have an almost six-inch difference between Hobbs and Portales because of a 400-foot

elevation change.

Last but not least, there should be a header pit installed in each of these installations to permit the brine to go into a pit and any hydrocarbons that are in it to be allowed to surface and skimmed off or otherwise removed prior to placing the water in the evaporation pit, because any accumulation of oil on the surface of the water is going to greatly reduce the evaporation.

Q Do you have anything further to say concerning the amendment of R-3221?

A No, except to say I don't have any particular pride in what I'm presenting here this morning. There are many gentlemen here in the hearing that have far more experience than I do have in this field and I want them to express themselves on anything that I have said. They can add to the suggestions or they can blast them if they wish, because we on the staff know very little about actual evaporation rates in lined pits. We are willing to learn, however. We only hope that we can come up with some general standards and safeguards that will not only protect the fresh water but will also permit the operators to protect themselves from excess expenses and still be able to properly dispose of the produced brines.

Q You had no exhibits?

A No, sir.

MR. HATCH: That's all I have.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Nutter, as a matter of administrative procedure, in the event that the Commission should see fit to authorize some type of lined pits, should this authority be given to the District Supervisors in each District or should the Secretary-Director grant these?

A I think this should be at the District level because you have the engineers in the field that work for the companies and some of them are going to be at a loss as to what they are going to need to dispose of forty or one hundred barrels of water a day as far as surface area is concerned, and our District engineers and supervisors, as time goes on, will become quite well acquainted with the requirements, these engineers from the company can come in and consult with them, help them to design the pits to get the adequate capacity that would be required.

I think it should be at the District level and the operators in the Hobbs area come into our Hobbs Office and the operators in the Artesia area come into the Artesia Office and discuss it with the engineers and supervisors there.

Q Also, Mr. Nutter, as far as any minimum specifications that the Commission would prescribe, do you think that these should be somewhat flexible, in other words, would you recommend that these specifications be written into the order or would you recommend that the Commission, as a matter of policy, establish these specifications for the guidance of the District Supervisor? The reason I ask this question, there are rapid developments now in this area as far as the manufacture and design of mining materials are concerned, it might be necessary for us to update this quite frequently to take into account new developments and technology.

A That's right. I would hesitate to mention any specific materials in the order or any specific requirements as far as -- let's talk about flexible linings for a minute, as far as stretchability, elongation before breakage, puncture resistance, things like this. You can draw standards for things like this but they might be extremely restrictive and preclude the use of some other material that may be developed tomorrow.

I hate to recommend any kind of standards other than this pit shall be composed of first grade quality materials which are known to be adequate for the service that they're going to be used for, and the list would be continuously changing. Some things that we may have confidence in today

may not prove to be reliable. It's going to be up to the operators to be sure they have good materials because we are going to want, and I firmly recommend that we have safeguards to detect leakage, and if the operator installs a poor pit and it develops that it leaks, it's going to have to be discontinued.

Q Then if an adequate system of leakage detection is established, then prudence would dictate that the operator --

A Select good materials.

Q -- select the very best material that he can find?

A That is correct. I think it's going to be unwise to try to save money in selecting your material because some of them just won't last.

MR. PORTER: Does anyone else have a question of Mr. Nutter? Would you identify yourself?

MR. HUDRY: Hudry with Atlantic.

CROSS EXAMINATION

BY MR. HUDRY:

Q These small amounts of water which you are talking about, are you still referring back to the one barrel of water per day for a sixteen total in these lined pits?

A No, sir. The provision in that, as far as that one barrel was concerned, is --

MR. PORTER: That's for unlined pits?

A That's for unlined pits, and paragraph 4 of this order would have to be revised to include these other areas that were covered by the previous orders, but this paragraph reads as follows: "Surface pits may be utilized for the disposal of a maximum of one barrel of produced water per day for each developed 40-acre tract served by such pits." This is talking about an unlined surface pit.

Q (By Mr. Hudry) When we go to lined pits, then, the amount of water that goes into that pit, if you are talking about small amounts, is there going to be any --

A I am not talking about any specific amount. I don't think anyone is going to try to evaporate the water that is produced by one of these Pennsylvanian wells that makes 700 or a thousand barrels a day. It seems that evaporation rates are not as great as a lot of people have thought they were, because I think a lot of these pits at the present time are evaporating from top and bottom both, but a prudent operator is going to find that thirty to one hundred barrels is probably the maximum he is ever going to want to install a pit for.

MR. PORTER: I would imagine a hundred barrels a day would take a pretty big pit.

THE WITNESS: It's going to take a good sized, a hundred barrels is going to take a heck of a big pond, and by the time you install that and maintain it, it might be cheaper

to look for a disposal system, underground disposal system.

MR. PORTER: Mr. Knauf, you had a question?

CROSS EXAMINATION

BY MR. KNAUF:

Q On this three-year evaporation study in Hobbs on the brine, was that pan evaporation or pond evaporation?

A No, this is calculated for ponds.

Q For ponds?

A Yes.

Q And the fresh water was in pans?

A The fresh water was in pans and then you take a factor. Actually the factor you take is .6 to convert from fresh water pan to salt water in a pit. This was taken from the U.S.G.S. study when they were trying to determine if they could evaporate the water up there in the Malaga Bend, the salt water was coming out of those springs that Dick Stamets was talking about.

MR. PORTER: Does anyone else have a question? Mr. Motter.

MR. MOTTER: Dean Motter of Cities Service.

CROSS EXAMINATION

BY MR. MOTTER:

Q Referring to paragraph (a) of Order R-3221, I may still be a little bit vauge on this, but is it your intent that someone operating an injection system, whether it be a waterflood or salt water disposal system, would have to apply for a permit

every thirty days for use of that pit? Some of these wells might have been in service for ten years and twelve years and so on, could we not get this administrative approval at one time, or whatever approval is necessary? Perhaps outline what the operator is installing and handle it in this manner, or do you intend to request this every thirty days?

A Well, I don't think the thing is going to be -- are you talking about getting approval to use the thing and have the approval renewed every thirty days?

Q Well, that is my question. Is that the intent of the wording here, that you would be required to do this every thirty days?

A Well, I think that the thirty days is applicable more to the disposal of water and not to the storage of water in these injection wells. I think that the District Supervisor of this District should be notified at the time an injection system breaks down and I don't think that any injection system, you are not going to leave your waterflood shut down for any thirty-day period, you are going to be fixing those pumps and have that thing back on in a couple of days, and I think each particular case, whether it is a breakdown today and another breakdown possibly next week, would be a separate instance and you would notify the Hobbs District Office of a breakdown if it

were in that district or the Artesia District Office. Then if you were evaluating a well, it would probably limit you to thirty days, and if the evaluation period were to be extended past that thirty days, he would have to renew that.

Q Then is it the intent of Paragraph 8 you also advise the District Supervisor when repairs are being made and the pit evacuated?

A Yes, sir. I believe he would want to know that. He should be advised.

MR. PORTER: We have another question.

MR. HEMBREE: Low Hembree of Sinclair.

CROSS EXAMINATION

BY MR. HEMBREE:

Q Pursuing that same line where the permit is for pumping out of these facilities that are provided at injection plants or disposal plants and as a matter of routine operation where the backwash operations are conducted on the filters, this water picked up daily, you aren't referring to calling the local office each time the well is backwashed?

A No. As a matter of fact, I believe that these backwashed pits that are used that frequently should be lined. That's my own personal opinion. I know some installations backwash into tanks, and if a tank isn't adequate or can't be

justified, I think no larger than a backwash pit has to be, that it could be lined.

MR. HEMBREE: Thank you.

MR. PORTER: Are there any further questions from Mr. Nutter? Mr. Gray?

CROSS EXAMINATION

BY MR. RALPH GRAY:

Q Mr. Nutter, I'm not quite certain about what you mentioned or what your proposal is in regards to handling this temporary amount of water that's been put into the pit under emergency conditions. Is it your proposal that this water should be pumped back into the system and reinjected?

A Yes, sir.

Q We very much oppose that. We go to great lengths to keep out the air or oxygen out of our system where we're handling produced water. We have found that when you combine oxygen with produced water, you create a very corrosive water. You create a water that is subject to formation of various plugging agents, and from the standpoint of injection, we don't want to have any oxygen coming into the system where we're handling produced water. I could say we go to great lengths to keep the oxygen out of the system. Do you have any suggestion on how we're going to do that and still pump the water back

into the system?

A No, I sure don't. I recognize you've got a problem there, but you can visualize a water flood that's making five or 6,000 barrels of water a day with a five-day breakdown and putting 25,000 barrels in the pit. If it's not pumped out and reinjected, you're not going to have any place to put the water the next time you break down.

Q Usually, we don't have any five-day breakdown. I don't recall ever having any breakdown for that length of period. Usually, it's a matter of hours, but certainly, up to this time, we haven't pumped any of that water back into our system and we'd certainly object to having to do that.

Another point which I'm not quite sure on, is it your intention that we get prior approval to use these emergency pits?

A No. I think when the system breaks down, you're not going to dicker for approval for a breakdown. When the system breaks down, go ahead and use the pit, but notify the district office.

Q I believe that's the thing to do; no doubt to me, and sometimes they do happen. Sometimes we might even have water going into the pit, the emergency pit, before our personnel gets to the scene.

A Sure, well, I think that --

Q So if we had time to do that; but your intention is that --

A But you notify the District Office.

Q But we notify them.

A Right. Because if he comes out there and if it's our inspector that comes out there and finds that pit full of water and he hadn't been notified, he might think that you've been using that to dispose of the water.

Q Well, we would like to suggest to the Committee, the Commission, to reconsider not having to pump this water out and back into the system of produced water, because, in my experience, we can tell you for sure that you create a very highly corrosive situation when you combine oxygen with produced water. And furthermore, we can show you by experience that you do create these solids that clog up the wells and, in some cases, we have instances where people have tried to inject this produced water without letting the air out and we get some awful looking solids come out of that stuff.

A Well, another answer might be lining of your emergency holding pits. I know that there are some right now which are lined in this State for these waterfloods, and like you say, if you've got a breakdown of a few hours only, that the

capacity of the pit could tell, is designed to take whatever you expect to be your maximum breakdown time.

MR. PORTER: There's someone back there. Mr. Ramey?

CROSS EXAMINATION

BY MR. RAMEY:

Q Now, on your provision for a newly completed well to use pit disposals, you don't intend that to be a blanket order, do you? In other words, for every newly completed well, why, you'd have an automatic thirty days to put water into an open pit?

A No, I don't think it would be automatic. I think that this authority for this should be obtained from you.

Q You would suggest maybe a well makes ten or twenty days, you'd have the full thirty days; or maybe a well that makes 800 or 1000 barrels, why, you don't.

MR. PORTER: Mr. Ramey, I believe there was some discussion of that at the regional hearing, and among the things that the person authorizing the test take into consideration would be the volume of the water to the proximity of the fresh water. I can visualize a situation is where you probably wouldn't want to grant any disposal; some others, you could be more generous depending on those factors.

MR. RAMEY: Yes. Well, that would be my interpretation, but I'd like to, you know, clarify it so that the operators

wouldn't think they had an automatic thirty days.

MR. POPTER: Anyone else have a question? The gentleman in the back.

MR. GOODHARD: Roy Goodhart with Rice Engineering.

CROSS EXAMINATION

BY MR. GOODHART:

Q Considering this thirty day pit period for a newly completed well, I would like to make a recommendation. We were considering this. However, would you consider longer than a thirty day period in some instances?

A Well, I think this would be renewed at the end of the thirty day period. Again, the District Supervisor would take into consideration the volume and quality of the water produced and the proximity of the fresh water supply in the area.

Q The reason I raise the question is that sometimes it takes a little longer to get a petition from the owners of the system to get in a new well.

A I'm glad you're here because I'd like to ask you: If a lease is already connected and has three wells on it and they're all going into the disposal system, does the fourth well have to be recirculated to all the owners of the system?

Q No. This would be automatic.

A As long as the lease and the wells on that lease are

going in, a new well could go in, too?

Q I imagine.

A Well, that's good. I'm glad to hear that.

Q I was referring to a new lease, Mr. Nutter, a new well on a new lease which would become a party to the system. Probably take considerably longer than thirty days to petition the owners and get approval.

A Probably, if the volume of water produced is not great and the quality is not extremely bad and the proximity of the fresh water is relatively distant, he'd probably renew that; otherwise, he might want to give a thirty day period or a fifteen day period. But thirty days is automatic, for a period not to exceed thirty days, but he can renew that and he might not renew it if conditions weren't right and maybe the operator would have to truck for the remaining period of time.

MR. PORTER: Anyone else have a question of Mr. Nutter? If not, he may be excused. I don't believe you had any exhibits, did you?

MR. HATCH: No exhibits.

MR. PORTER: Now, I'd like to offer an opportunity for anyone who desires to put on any testimony in connection with any phase of the case to come forward and do so. If you'll raise your hand, and it will be first come, first served opportunity.

We have a gentleman in the back over here.

MR. HENDERSHOT: My name is Hendershot, John Hendershot.

MR. PORTER: Mr. Hendershot, would you come forward and take the chair, please, sir?

MR. HENDERSHOT: Yes, sir.

MR. PORTER: Mr. Hatch, would you swear him in?

MR. HATCH: Yes, sir.

(Witness sworn).

MR. PORTER: Would you take the stand, please, sir, and we'd like for you to just tell us what your experience has been in this area of pit lining and something concerning the nature of materials that you have used for lining pits and so forth.

JOHN HENDERSHOT

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PORTER:

Q Proceed.

A My name is John Hendershot. My liner company is Unit Liner Company of Wewoka, Oklahoma. My personal experience has been as an independent oil operator for some twenty years and, some time back, I became interested in this pollution setup and so forth and have established Unit Liner Company for the purpose

of helping to solve the oil industry, oil producers' problems as well as, of course, I have a monetary interest in it, also. We don't plan to do this for free.

In this connection, I have approached a number of the larger supply companies who manufacture both plastics and synthetic rubbers. We, incidentally, are staying with the flexible materials. In addition, I have engaged, through the Oklahoma Economic Development Commission in Norman, I have made arrangements for Doctor George Reid of the Civil Engineering Department of the University of Oklahoma, who is a very foremost pollution expert. He has done considerable investigation along with us to attempt to determine what are good materials, what is used today, what the conditions are in the field, what the materials must meet and what the capabilities of the various materials in use are. And he has already done considerable work and has just recently set up a continuing testing program to fully establish the capabilities of, not only the materials that we are handling, but any flexible materials that we have been able to come up with that are being used for pit liners. This is going to be about a fifty-two week program, and at the end, this will be published. It's non-biased. It's a complete individual study by Doctor Reid.

That sort of gives the background of myself and my

company.

MR. PORTER: Is that Doctor Reid, R-e-i-d?

THE WITNESS: Yes, sir. Doctor George W. Reid.

MR. PORTER: He's with the Oklahoma University?

THE WITNESS: Yes, sir. He's in charge of the Civil Engineering Department at the University of Oklahoma.

MR. PORTER: Thank you.

A My own personal opinion and my objective in selecting materials, I have insisted that each and every supplier that we consider take a field trip, see what is required, and each and every one of them have been surprised and a little chagrined or taken aback by what severe service is expected of their lining materials, and as an oil operator, why, I felt this is most important that these companies know exactly what they're facing, what service is expected of their materials, what service life, that they've got to have a decent service life in the materials and this type of thing.

We have developed, also, various methods of what we're calling oil field fluid containment. We have, as far as I know, the full route of these lined oil field tanks. Your bolted tanks that are completely damaged, we can put a liner in those that they will satisfactorily contain fluid for years to come. We also handle pit liners, actually, and we have developed a

special type, I might say. These little above-ground evaporative pits have been in use, I'm sure, for a number of years. We have designed one of those primarily for simplicity of erection, installation, and to compensate for some of the faults that some of them have had in the past. This has just been done. It's just now going on the market.

Now, as far as fluid containment is concerned, I'd like to compliment Mr. Nutter on his ideas. I think it's good that some system be devised to monitor these oil field pits or these brine pits to determine whether or not they are leaking. Now, this does lots of things, in my opinion. And everything I'm saying here is my own personal opinion from my experience, of course. This, in a sense, relieves the Commission of asking the operator to spend lots of money. It is more or less up to his devises to decide what he's going to put in the pit and he's assured that whatever it is, it's going to be looked at, that it must not leak. This can be done relatively inexpensively.

As far as my company is concerned and my personal experiences are concerned, we welcome this type of monitoring. This then puts us on notice, also, when we go to sell a man a pit that he expects a completely 100% impervious lined pit, and we have just recently taken a contract to line one involving four and a third acres of this type of arrangement, and I know

from personal experience that it makes you hump up just a little bit when you know that this operator is going to expect that thing to hold every bit of water he puts in it. So I do commend you on that type of -- I do think a monitoring system is a very good idea. I don't think any of the other states have adopted that, as yet, so far as I know.

In addition, it might be well to consider along those lines the requirement that the smaller amounts of fluids in the order of 1,000 to maybe 2,000 barrel storage be maintained above ground. I believe perhaps that the economics are as well for above-ground storage as they are in a pit liner, and from what I've seen in Oklahoma, Texas and so forth, the smaller pits create the most problem and that's just one of my own ideas and personal opinions.

As far as selection, as far as these materials are concerned, it is quite -- Now, I say "almost impossible" to determine from a visual standpoint of what the material is made out of. One of our suppliers tells us -- and this is in the order of plastics -- that they manufacture 300 different types of plastics, and I would only caution the oil operator to make certain, as certain as he can, that the plastic or synthetic rubber or whatever flexible material he might select or other type of material, that it has been specifically designed

for the oil field operation. This, I think, is imperative. You can't take a swimming pool lining and expect it to contain hydrocarbons. Most of those type liners are formed, as I understand it, with plasticizers derived from hydrocarbons and when hydrocarbons hit them, they cause extraction and the material gets stiff and brittle and will break up on you.

If I might be permitted in this connection with regard to the type of materials, I'd like to read a letter here I've received from one of our large suppliers and I'll delete the name of the supplier and any reference to his material, if that's permissible, and it just pretty much gives you an idea of the type of investigation that we have done and what these large suppliers will tell you. Now, again, we've gone to the technical people and the upper echelon people in these companies. The sales people will usually tell you pretty much what you want to hear, but the technical people do not. They will caution you against the use of various materials and caution you to be certain of the application and what is expected of the materials.

Now, this particular company came to our area in January of this year. I shipped them -- they helped me gather, oh, eight to ten gallons of various types of fluids for their own testing. Incidentally, it was interesting that these people had developed this type of compounded material for four

to five years and had never put it on the market, had never been requested to put it on the market, and so far as I know, I bought the first pound of it for use in the oil industry and I bought all that has been bought to this date.

I'd like to read from this letter. "Dear Mr. Hendershot", and I had asked them to give me any ideas of anything they had that I might present here to this Commission.

The following information is provided for your use in discussing oil field pit and tank lining materials with the New Mexico Oil Conservation Commission. Blank Company has developed a flexible vinyl sheeting, specifically formulated for use in the above application identified as, blank, and they have in parentheses -- I can give you this -- Unit Liner Company Code UCB030. This material will effectively contain pollutants generated by oil well operations and should provide a significant aid in fresh water conservation efforts.

He refers to the material: is based on polyvinyl chloride resins blended with other additives to provide essential properties and is used to process in our Blank plant into a stable and homogeneous continuous sheet. The nature of the material allows it to be welded into large pieces of pit liners -- and this is important, too, but we'll get into that later -- or into complex sheet for use as liners for tanks of any shape.

Both dialytic sealing and solvent sealing are applicable to produce seams which would have bond strength equal to the original, nativical value of the material. The sealing, in my opinion, is as important as the material itself. The blend of ingredients used and the manufacturing process employed to produce the sheet yields the following properties:

Blank material can be sealed and installed easily, even during adverse weather conditions, without danger of cracking. The low temperature impact value is minus 12 degrees Fahrenheit. This is under flexibility.

Toughness, considerable strain and abuse do not affect the product. Tensile strength exceeds 2,000 pounds per square inch. Tear strength is above 300 pounds per square inch. Elongation before breaking is over 300 percent. Weatherability: continuous exposure in both XW and XIA type weatherometers for 200 hours revealed no change other than in appearance valued in fading of colors. No ballooning, shrinkage, spotting or tackiness was observable. Extraction resistance: This is quite important, in my opinion, if you're talking about vinyls. Under accelerated laboratory conditions, there is no indication that Blank materials loses serviceability when exposed to crude oil, brine, pumping well fluid and bottom settlement. A constant monitoring of tensile strength, elongation and weight

change shows no significant degradation. Fungus resistance: Rated excellent. Tested by Methods ASTMD, 1924, recommended practice for determining resistance of plastic to fungi. Based on careful observation after vigorous exposure, it is our belief that Blank material will fulfill the need for an impervious lining material for fluid containment devices associated with oil pumping operations. This -- and this is one of the points I want to get across -- This contention is reinforced by an on-site inspection of actual environmental conditions by our technicians, a review of the objectives and regulations with the Western States Regulatory Commission and an inspection of our testing techniques and facilities by the staff of Western University, which is the Oklahoma University, concerned with the pollution control problem.

Our evaluation program is continuing both in the field and in the laboratory. We will be pleased to discuss any aspect of this product with the New Mexico Commission at their request and convenience.

Currently, we are utilizing this material as a vinyl material. We are utilizing a synthetic rubber material as flexible material. Also, it has undergone the same rigorous evaluation and the University, Doctor Reid from the University of Oklahoma, has visited both of these suppliers, as I mentioned,

to observe the work that these people have done, and I cannot stress too much the importance of selecting your materials, not necessarily based on grade, but on their ability to -- their formulation and their ability to withstand the hydrocarbons, acid and brine combination of material.

FURTHER DIRECT EXAMINATION

BY MR. PORTER:

Q Do you have any recommendations for a device for leak detection?

A Well, this can be done, I'm sure, in a number of ways, and one way, I think, is pretty well what Mr. Nutter outlined, is perhaps a trench at the bottom of the pits with a sump in the middle, draining that way and leave this drain outside, out the pit into another sump. Now, some companies, I'm sure, do it this way; others use slotted pipe and there are, I'm sure, other methods probably in use now that I don't know about.

Q Have you made installation where a sump was required or some means for detecting leaks?

A Yes, sir.

Q It can be satisfactorily done?

A Yes, sir, it can be done, in my opinion.

Q You mentioned at the outset of your testimony, you've done considerable amount of study of materials and so forth, and you also indicated that your preference would be a flexible material, I believe.

A Yes, sir.

Q Would you tell us why?

A Yes, sir. In my opinion and from what I have seen, a rigid or semi-rigid material -- Well, maybe I'd better go at it another way. An earthen pit is subject to earth shifting and this is almost over a period of a number of years. It will shift on you. And this, again, can cause cracking in rigid or semi-rigid materials. Also, it has been our findings in conjunction with these large major suppliers that the weather has a tremendous effect on any material used in a pit and this is whether it is rigid or semi-rigid or what have you. That weather is a constant factor to -- It is probably as important to consider as the hydrocarbon resistance.

Q I had some information from a neighboring state that one of their unofficial requirements was that this, any lining material, be at least a thickness of 30 mill. Now, what do you think of this requirement as a minimum?

A I believe it's good. So far as it goes, I think that a man should put in 30 mill material in about anything he does. The cost, the actual cost of the material is relatively insignificant when you go to the lighter weights, when you consider what that pit has cost you, what it costs you to seal that material and the profit that my company or the selling company has to

take out of the texture and the sealing, the sealing is a big factor in these things, and when you take those into consideration, the mill thickness is relatively -- the cost, the difference in cost of a lighter weight material is relatively insignificant and it's not worth the risk, in my opinion, just because you have a 30 mill material, it does not mean that that is going to withstand hydrocarbons. It's just like when you've got three-sixteenths inch steel or three-quarter inch steel, it's just going to corrode or deteriorate slower.

Q I see.

MR. HAYS: What's the range of costs of these materials so that you can get it or how do you price it?

THE WITNESS: Well, our sale or price of our material is -- We have one, the vinyl material is 40 cents per square foot; the synthetic rubber material is 45 cents per square foot. Some of them, I'm sure, are less and perhaps some of them are more. This seems to be, I would say, pretty much, oh, in between range.

MR. HAYS: I was just curious. I'd never heard of the price factor.

THE WITNESS: One of the big factors is in completion now. We have our materials electronically or dialytically sealed into sections -- I'm talking of pit liners now -- up to 20,000 square foot. This means that a dialytic seal is a positive seal.

It's a fusion of the two materials together by an electronic method. Therefore, you've got just one solid, single sheet in your liners and this is an expensive procedure, although it isn't, in my opinion, more expensive than going out on the ground in a pit, attempting to seal three, four foot wide sections together in a pit. This costs money, too. Yet, a lot of people are inclined to discount the installation cost. We prefer to put our cost in the fusion of the material by an experienced factory indicator.

MR. PORTER: Anyone else have a question? Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Now, Mr. Hendershot, you mentioned polyvinyl chloride and you also mentioned that the material, whatever it is, that's used should not contain hydrocarbon based plasticizers. Now, do any of the polyvinyl chlorides have petroleum based plasticizers?

A It's my understanding that they did, many of them do.

Q I see. So, in other words, all polyvinyls wouldn't be acceptable?

A This is my opinion. Right, yes, sir.

Q How about synthetic rubbers?

A I would say probably the same thing would apply. I don't know what their plasticizers are, but you certainly have

the same conditions, and you have different grades of synthetic rubber.

Q How about polyethylene? Do you know anything about it?

A Very little, except that it is a pretty light material and the information I have is it is not designed to withstand hydrocarbons and should be used only as a temporary liner in most temporary applications; not as a permanent application. Incidentally, we have told our suppliers that for the oil industry and to justify the type of price we're talking about and what these people are going to be put to, we felt that the oil operator should, would expect a minimum of a ten-year service life. Now, that is a very minimum. I know we would like to have twenty-five years if we can get it. So far, most of these materials are so new that the only time you know how long they're going to last is when they finally do fail.

Q Now, some of them withstood our accelerated weathering tests --

A Yes.

Q -- but we don't know whether this is severe enough to be converted into actually--

A Right, but the lab test indicates that there will be, they will have this type of service life, but we'll only know

in the field after ten years. To my knowledge, these flexible materials, some of them have stood up very well at least three years in very severe service.

Q Now, I mentioned butyls and neoprenes, do they fall in the category of synthetic rubbers?

A They're synthetic rubbers, yes, sir. Neoprene, of course, a good grade of neoprene is oil resistant. However, in my opinion, there's a severe problem in sealing this in the field. It also has a high cold factor index and it has a real high tear factor. And the butyl, of course, is not hydrocarbon resistant. Hydrocarbons will get to it.

MR. PORTER: Mr. Nutter, we will interrupt the questioning at this point and recess the hearing until 1:30 at which time Mr. Hendershot will be available for further cross examination and anyone else that wants to present testimony can do so. We'll recess until 1:30.

(Whereupon, noon recess was had, and at 1:30 o'clock P.M., the following proceedings were had:)

MR. PORTER: The hearing will come to order, please. Mr. Hendershot, would you take the stand and answer any questions that anyone has? Mr. Nutter, have you finished your questioning of this man? Did you have some more?

MR. NUTTER: I think I have, for the time being,

Mr. Porter.

MR. PORTER: Does anyone else have a question of Mr. Hendershot? Mr. Stamets?

CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Hendershot, I believe that you said that the smaller pits create more problems than the bigger pits. Could you give us a specific or two on that point?

A Well, this again is just a personal opinion of mine and from what I've seen of oil operations over the years. Again, I know the operator is going to be reluctant to not being granted to drain his tank into any -- just out on the ground or into the pit below the level of his tanks, but it seems that about every tank battery in the country -- at least in our part of the country -- have one of these little pits there and they're always very messy and this type of thing and it's a problem of getting them fenced and so forth and they usually create a considerable amount of trouble. That's just been some of my experiences in the oil operations.

Q And it apparently is more due to the lack of attention by the operator than by the specific size.

A Right. Right.

MR. PORTER: Any further questions? Mr. Nutter?

RECROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Hendershot, undoubtedly, in the course of the operation with your company, Unit Liner, you've investigated numerous materials and you have finally settled on the synthetic rubber and the polyvinyl chloride --

A Yes, sir.

Q -- which you use at the present time. Now, in your investigation of other materials, have you come across any specific types of materials that you don't think are satisfactory, without getting into any tradenames, but generalities?

A Yeah.

Q Now, take first of all a sheet of pure rubber. We know that's not right.

A That's no good. Also, many of your vinyls, polyvinyl chloride, most of them are general, what they refer -- at least the trade refer to them or tell me, are general purpose vinyls such as the type you use in swimming pools and this type of thing.

Q And these would be the ones that have the petroleum base?

A That is what I understand, yes, sir. Now, the ones that we are using, they refer to them more or less as an exotic vinyl and there are very relatively few of those available, as

I understand it. As a matter of fact, I only know of two of them that are available, that are especially compounded for this type of application. I may not know of them all, I'm sure, but I've made a pretty good round to study it.

Q Now, have you studied any semi-rigid types of materials?

A Not a great deal. I have viewed some. Well, as a matter of fact, we are replacing one that I would, might say was a semi-rigid material that is some type of a -- to me, it is a wall bore type of material with an asphalt impregnated and then sprayed-on asphalt to seal it.

Q Now, this wouldn't be resistant to hydrocarbons, would it?

A Not in my opinion and most of it -- In this particular application, it's an LPG Plant. They will tell you that they don't have hydrocarbons in many cases, but I believe that most of them are beginning to realize now that they do have some hydrocarbons and a very minute amount of hydrocarbons. They might well --

Q What function does this serve in this LPG Plant?

A These are storage ponds or ponds where they retain their fluid and where they have these salt cabins.

Q Oh, where they have their storage cabins and they keep salt water in there?

A Yes. Undoubtedly, when they displace their LPG or when they displace their salt water with the LPG, they said salt water comes back on top and some limited amount of hydrocarbons in there. I've seen some, of course. There are some fiberglass materials being used. I don't know too much about them. I have seen a limited number of them. Seen some of them new and some of them after about two years that begin to chip and flake and crack.

Q Now, the next thing I want to ask you about is, was the resistance of these materials to the sun. We have a pretty hot sun here in the Southwest and it will get to many materials after some time.

A Yes. I think weathering is an extremely -- as I mentioned before, is an extremely big factor in any material. And again, I have to go back to the materials that we are handling. We have been assured that both of them are, as I read in this letter, weatherproof and the technical people of the companies involved recommend them for weather exposure. Again, going back to vinyls, and my knowledge may not be the greatest, but what I know now from what experience we have had, this one vinyl is the only one that I know of that is recommended for outside exposure in conjunction with hydrocarbons. And I made very, very certain that this was recommended because I know,

as I mentioned earlier, I know of another exotic vinyl and it does a mighty fine job in a tank liner as long as it's undercover, and we didn't want to get into the position of putting something in the field that would create a problem with weather.

Q Now, in the event some oil is carried over in separate tanks or the Header Pond, which I think probably should be required in one of these installations to keep oil at a minimum so as to not to retard the evaporation rates, but have you had any experience in the removal of these oils from the ponds or the pits?

A Not --

Q Of course, when we got a lined pit, you can't burn the oil.

A Right, you can't burn the oil. Not particularly, no. We haven't used those to any great extent back in our part of the country.

Q I see. And you don't know of any type of treatments or detergents or anything else that might --

A No, I don't. I know there's ways of treating reclaiming oil, but it will have to be, might be rather expensive. You'd hope that the oil would pay for the reclaiming job.

MR. NUTTER: I believe that's all. Thank you.

MR. PORTER: Does anyone else have a question of

Mr. Hendershot? Mr. Knauf?

MR. KNAUF: Jim Knauf.

CROSS EXAMINATION

BY MR. KNAUF:

Q Are you acquainted with removing salt out of some of these pits?

A I'm aware that that is a problem. I don't have an answer.

Q I just wondered what it might do to your sealed ponds later on after some conditions were removed.

A This, as I say, I know is a problem. I know one company we quoted on a liner or two that they anticipated putting some heavy machinery in on top of the liner and removing salt in that manner. They had planned to keep a cover over their liner of maybe six to eight inches of salt material, hoping that that would not damage the liner. I don't know whether that's workable or not.

Q You mentioned something about, if it's a storage of 1,000 or 2,000 barrels, it might be possible to put that above-ground.

A Yes, sir.

Q You mean in the tanks or some special evaporation?

A Well, most operators have old storage tanks that can be lined, bolted or welded tanks, and, also, we're not the only

ones, I'm sure, I know, that sell a small tank that is very versatile and with capacity of, say, from maybe eighty barrels to several thousand barrels. And these have been used, I know, in many, many instances for evaporation tanks. The ones that have been used are generally four feet tall and with a sizeable -- depending on what you want there, the diameter, and we make one that we are just coming out with on that type of situation where we can go from sixteen feet diameter up to 120 feet diameter and from four feet tall to eight feet tall and that can contain a heck of a lot of fluid.

Q Now, that would be entirely above-ground?

A Yes, sir. This is actually, I say, a tank that is merely a steel ring with a liner in it.

MR. NUTTER: This is similar to the portable swimming pool you have described.

THE WITNESS: Yes, that's right.

Q Now, your evaporation rate would be about 50% greater if you got it above-ground than you've got it sunk in the ground?

A That, I wouldn't know. I'm sure, you all know much more about it than I do.

MR. PORTER: You know how deep it was, I guess.

MR. KNAUF: Yes.

MR. PORTER: Mr. Elwell?

MR. ELWELL: Bob Elwell.

CROSS EXAMINATION

BY MR. ELWELL:

Q What type guarantee does your company or manufacturer put on these liners?

A We do not put any, for this reason: We've discussed this, needless to say, numerous times. We are dealing with the major supply companies in the United States that are nationally known firms and I don't feel that my company can add anything to their reputation and their ability to replace the material at this time.

Q They will replace it if --

A I've seen it done a number of times even where I didn't feel like it was justified.

Q As far as a written guarantee of the company that wants it, what do you do?

A We have in certain instances, maybe tank liners, things like that, that may be given a year on material and workmanship or something like that. This large liner -- of course, that came up numerous times -- we did not give any warranty whatsoever on it. These people were satisfied with the reputation and so forth of our suppliers, and I feel like probably their reputation is a heck of a lot better than mine. At least, they have a lot

more basis to go at than mine.

MR. PORTER: Anyone else have a question? Mr. Hembree?

MR. HEMBREE: Loy Hembree of Sinclair.

CROSS EXAMINATION

BY MR. HEMBREE:

Q With regards to your lined pits, do you have any specific means or recommendations as to the removal of solids from lined pits, such as in backwash systems? This is in line with Mr. Knauf's system, the question on the salt.

A I've got about the same answer.

Q Without damaging the pit liner.

A I've got about the same answer because I have not had enough experience on that. I don't really know how to remove the solids.

Q This is a considerable problem because this usually involves -- If you're using a pump, you have to move the tank around to get your suction and, if so, why, you can definitely enter the pit itself, and when you do, why, of course, you run the risk of damaging your liner.

A Sure. We are putting in some cone-shaped bottoms in some of these pits, the tank-type pits, and that's about -- in an effort to compensate to keep the water circulating, but that's about all that I know.

Q All right.

MR. PORTER: Does anyone else have a question of Mr. Hendershot? You may be excused.

MR. HENDERSHOT: Thank you.

MR. PORTER: Thank you for your testimony. Mr. Staff, you want to go on next and testify?

(Witness sworn).

CHARLES STAFF

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PORTER:

Q Mr. Staff, would you state your name for the record?

A Charles Staff, Staff Industries. Upper Montclair, New Jersey.

Q Would you give your address or location of your company?

A I did. Upper Montclair, New Jersey.

Q Now, would you go ahead and explain, give the Commission the benefit of your experience in this type of work?

A Thank you very much for the opportunity of talking to you.

Q Mr. Staff, at the outset, may I ask you to speak loud enough so that the people out in the audience can hear you

because they may have some questions concerning your testimony.

A I appreciate the opportunity of talking with you briefly today. I didn't have much warning of this, and I'm not an oil man, so I'll talk to you at a little different angle.

My background in this thing, I'm a chemical engineer with a Doctor of Chemistry. I used to be with Union Carbide Corporation as Systems Director of Research in the Plastics Division, and then I took over some experimental work in agricultural uses of plastics in 1952 and carried that on for ten years before I left them and formed my own company.

A part of this phase of the work in agricultural uses of plastics was the prevention of seepage from reservoirs and canals. For instance, for irrigation structures, and started this work with a Grant to the Agricultural Research Department from the Department of Agriculture to investigate the use of plastics which were rather new at that time for this application.

Previous to that, liners have been used for swimming pools, principally vinyls, and Carbide was heavily interested in polyethylene and so we concentrated on these two materials. We wanted to determine which materials were suitable, thicknesses, et cetera. The Bureau of Reclamation soon became interested in this and we began working with them through the Denver laboratory, made field installation, beginning probably '54, '55, of canals

in Tucumcari, New Mexico, which were my first ones. We used light weight materials on these, generally eight mills, eight-thousandths of an inch, because we were interested in the cost factor as well as the performance. And with irrigation water, it doesn't hurt it. You do have a little bit of leakage, so we continued this work, but Carbide decided not to continue this project as a marketing operation so I took over the marketing myself and I own the company.

In the work done with the Bureau of Reclamation, Agricultural Research Service, they were principally in polyethylenes and vinyls but, of course, in other words, as to the difference in formulation. We have some materials that are fungus resistant, micro-biologically resistant, tough, "alterant" durability, low extractibilities, vapor pressure and all this. Polyethylene has some advantages over vinyl. It doesn't have any vapor pressure and it doesn't have any extractibles as far as water is concerned, but they found it has low puncture resistance. So we dropped that in most of our investigation work. It is low priced and so it is being used quite a lot in irrigation application. Vinyl formulations that Mr. Hendershot mentioned, and I compliment him on his remarks, are made in a lot of different formulations and it is necessary to select the formulations that will apply to this application. Some of the

vinyl swimming pools have been in use for over fifteen years, and a portion that was continually emersed under water is still in good condition. Formulations have since been improved so that longer life can be anticipated. The portion above the water line does embrittle due principally to the heat of the sun, not so much the decomposition of the resin as it was in the real old resins. I started in vinyls in 1935. But the heat of the sun causing evaporation of the plasticizers which causes embrittlement, I would like to -- Mr. Hendershot doesn't claim to be a chemist, but all plasticizers are petroleum based except for those that are organic oil derivatives and these are not recommended for vinyl composition because they are subject to microbiological attack. And plasticizers is the weak point of a vinyl system in that they do have different extractibilities, different vapor pressures. They compare the flexibility to a normally rigid resin so we had to select a plasticizer for the application. So in our experimental work, we found plasticizers which have very low volatility, very low extractibility so that we could anticipate the number of years life. The Bureau of Reclamation in their accelerated tests, after six months, they said our material was fungus resistant for twenty-five years, but they continued this for ten years and still no change. But they do like to use these, generally speaking, in irrigation structures as a buried membrane, and, of course, I like all

membranesburied, to protect them from not only the heat of the sun, but mechanical damage from animals, hail, and vandals. There have been a number of cases where exposed linings have been stolen. They make good covers for haystacks and other things and so on. These have to be taken care of.

The linings, covered, of course, operate at a lower temperature and so we get into less problems with vapor pressure of plasticizers, so I don't know how long we are anticipating a life, but it is over twenty-five years for even some of our lighter membranes. But, of course, for irrigation structures, as I mentioned, we're not quite so critical on seepage prevention. I would say that at Oklahoma State University, we put some liners in there, I think, in about '57. There are two of them on evaporization suppression studies and Professor Coe told me last summer that he can't detect any leakage in these. They have water meters that feed the ponds. One is used for evaporization study, and the other is for control and there's no difference in the -- You can't detect any seepages. We have a number of other instances where we have not been able to detect seepage. It does take a little care in installation, but this is quite easy to do.

Since we started our own business, we have found that the consulting engineers are more interested in linings, so we're

getting into more applications of the industrial type. One of the other installations was a hydro-electric reservoir in Costa Rica. Professor Pekoe of the University of Illinois specified a twenty-mill lining. He said if the linings leak, the whole reservoir will slide downhill because it's on an artificial bottom, and this one I mention, because this does have some underdrains to pick up any leakage and so they'll know about this. This is a daily-filled reservoir from a small stream **for** peaking capacity. Initially, there was a little bit of dirty water that came out of the drains, but they found some of their trucks had been driving over the linings, right on top of some crushed rock which was put in the drain, and they repaired those and since that time, they have not had any trouble with seepage.

We have a number of facilities for holding brine. We have some that are used for salt production; quite a number in California. We probably have twenty, twenty-five ponds in California for production of salt. There's another large Lithium -- Well, fairly large. It's only about five acres, but for Lithium production that will go into a larger unit soon, we anticipate. These are brine holding. I think all the others, we probably have twenty-five or more, twenty-five to fifty brine holding ponds. Now, the holding of petroleum, as

Mr. Hendershot mentioned, is different and for plasticizers, suitable for holding oil, is quite limited, and you do sacrifice some things. In other respects, since one other thing has been low temperature properties -- but that's not such an important property in most of New Mexico. It would be at a higher elevation, but this can be had. There are a number of plasticizers that are suitable for oil and we have sold some of these.

We have a couple ponds down in Texas where we are holding oil. Shell Oil Company has a few, two or three installations now where a pond has been divided into two or three ponds. The first one was lined with an oil resistant material from which the water is decanted into acetylene basins. El Paso Natural Products Company, outside of Monohans, Texas, has about a five-acre pond for their little corner, about a hundred -- No, about a sixty-foot square with an oil decanting section which is lined with an oil resistant material. The other portion is lined with a regular water holding pond which is less expensive and is suitable for the application, we believe. A little bit of oil on top of the lining, a little bit of oil would not cause extraction of the plasticizers. It would be absorbed into the vinyl. It would be some exchange, but it would be more absorbed into the vinyl, but it wouldn't suppress the evaporation, so it could be removed by decantation beforehand.

Our little company buys materials from Union Carbide and a couple of other principal suppliers of vinyl sheeting. Then we specialize in fabrication of large pieces. We solvent-seal everything together because vinyl is soluble. Outer vinyls are used for a very durable chemical resistant coatings. We solvent-seal everything together to get the highest strength. We don't get any rupture in the tensile case at the bind and we use solvent-sealed pieces of material. We prefabricate sections up to a weight of about 4,000 pounds, sixty-two foot wide and gauges up to thirty-five, forty mills and then we supply the sealer for joining these sections in the field. We have a number of installations. Well, I suppose there are a couple hundred of installations around the country and a number of foreign installations that we have. We put in a twenty-two acre pond for Weirhauser up in Oregon and they had a specification on seepage, seepage control on that and they checked it against evaporation pans and they found their evaporation pans lost more in their ponds so we presume that there isn't very much seepage. This is uncovered. We do recommend that the linings be covered to prevent them from heat. Only the top portion, the portion above about two feet below the water line in this lagoon, is covered. The one outside of Monohans is completely covered with blowsands and the side slopes are covered with caliche, in addition.

Next week, we'll start putting a pond in Odessa of

ninety acres. This will not be a brine pond. This will be a pollution-control pond and this will be covered only on the side slopes. Again, this will be for evaporation of a plant effluent.

MR. PORTER: This ninety acres?

THE WITNESS: Yes. This will be divided into two ponds. We have, as I mentioned, evaluated -- Well, I started working on polyethylene and PBC we used only PBC. We sell some polyethylene when people want it, but they tell them not to use it, so we don't know how to make it. There are some adhesives for polyvinyl -- polyethylene, but I have not been satisfied with them. They also have a high shrinkage factor which causes stresses in the seams and there's some trouble. It is necessary, I am told, by some people that put it in to allow for ten or fifteen percent shrinkage in polyethylene. We also had to put in some little bit of pipe around linings. We also worked with nylon-reinforced vinyls, very little, but I think it has some application. But as a whole, I prefer un-reinforced materials because they are put in places where they encounter ground settlement and it's necessary to have an elastic material which will yield with the ground. I think a very good example of that is the dam that was built in Canada a number of years ago and stored 120 feet of water, and this particular dam was built over an area where there was a clay shelf in the area, and the engineers knowing about this, designed the dam accordingly but

they put a thirty-mill vinyl blanket under a four-foot clay blanket on the face of the dam and in due time, due to hydraulic pressure on this clay, there was settlement in the dam creating a number of sink holes which were ten to fifteen feet in diameter and four feet deep. A part of the material would have had to rupture, but the thirty-mill vinyl that was used on this elongated 200%, the engineers told me, and was no ruptures. After a few years, well, they let the water down and went **back** and repaired all the sink holes and put it back in operation.

And a canal in Washington D. C., the one that George Washington laid out, the Chesapeake and Potomac, they had a number of sink holes on that due to some ground settlement again, and the engineers asked about putting in reinforced materials, and I told them the story and they put in unreinforced materials because they'd had sink holes develop in that that were eight feet long and three feet wide and a couple feet deep and they wanted to be able to take this sort of ground settlement if it should occur again.

We only work, as you gather, I mean, **with** background plastic and we don't work in rigid materials; but at a meeting of the agricultural engineers which I was involved in and still am, a little bit, about two years ago in Chicago, Professor Hansen of New Mexico State University, Head of Agricultural Engineering Department, later had a symposium on flexible linings

for canals and his introductory remarks indicated that he hadn't had too much experience with plastic linings or flexible linings, but in a lot of New Mexico, they use concrete for laterals and small canals and he said, "Frankly, that doesn't prevent seepage. That's good for hydraulic characteristics and leak control." But the cracks in concrete open up, open and it's got large infiltration area under the concrete. Concrete is a good structural material, but it needs the impermeability of water-proof material underneath it, and there are a number of structures that are built with a membrane under concrete. You need concrete for a hard surface.

One of the questions from the audience before was on removal of solids and salts from liners, and this can be done in a number of ways. The Bureau of Reclamation on canal linings in Tucumcari have skillful operators on their draglines so they can operate a dragline controlling the depth within six inches of the bottom so they'd remove their sediment for the draglines.

Vinyl has high puncture resistance, as I mentioned, and incident to experimental work at Purdue University on highways, for the use of films on highway construction, we drove a five-inch tooth, a sheepsfoot roller, on top of about six inches of sand on top of an eight-mill vinyl film and Purdue reported

no puncture. We do occasionally drive equipment on top, but we try to keep the equipment off as far as possible because there's always a possibility that there may be some rocks in there that are sharp or something like that. Incidentally, the Bureau of Reclamation data on puncture resistance carries their films, carries the vinyl film, even a ten-mill vinyl film on a three-quarters, one and a half inch crushed rock, increasing the pressure two and a half psi every eight hours up to 115 foot head. It did get ruptured at 115 foot head, but that took about a week, but this was a very sharp rock which, when I squeezed a sample in my hand, it hurt my hand.

For a long life -- and I quote: For a long life, we like to see membranes covered with earth and/or errosion resistant materials, particularly on the portion which is going to be above the water line. It does take a three to one side slope in order to retain fine texture soils on the side, but in any area, these are subject to wave action and it is necessary to put some gravel on the water lined area to protect it from errosion.

Some tests that I saw in England, which I brought with me, indicate that with a gravelled cover alone, you can probably go to a two to one slope. These tests were in connection with the rapid drawdown of the large canal we'd lined in

the rock where we have about 250 acres of material, but they can turn up the -- They have had to test out the water rapidly and with a two inch an hour drawdown, they have some slippage of fine material on a two to one side slope but with the gravel, it was satisfactory because it was free drainage.

Well, I think that's about the few remarks and I don't want to take up too much of your time, and if there's some questions, I'll be glad to answer them, Mr. Porter, or I'll try to answer them.

FURTHER DIRECT EXAMINATION

BY MR. PORTER:

Q You recommend that this material be covered. Are you talking about exposed part of the material above the water line or the whole pit, the portion that's underwater also?

A Principally, it will be the portion which will be exposed to the sun. Our experimental work with agricultural research service indicated that if we had a foot of water on top of a membrane, our resistance to falling objects, the puncture obtainable -- We would not obtain puncture with falling object at probably five times the height we would if we did not have a foot of water in it, and this is one of the things that we always have to watch for and that's vandals throwing something in. On golf course ponds, we tell them to cover, because

people throw golf clubs in them when they're capable, so we want them covered.

Q Who'd want to throw a golf club in one?

A We've dropped a lot of stuff in, but one lagoon we had out West a little while ago had a little leakage in that and we found that the welders had been dropping their hot welding rods in, point down, you know, and that, we don't want to come in.

Q Another question. For an application of this kind for salt water pits, do you have any recommendations for minimum thickness of this material?

A Well, I would prefer to say not less than twenty mill. I think that the Texas or the brine ponds, as you know, require a thirty mill. The Water Pollution Control Board in Texas is accepting twenty and fifteen mill, but this is for pollution prevention, not for brines, organic waste.

MR. PORTER: Does anyone else have a question? Mr. Nutter?

MR. NUTTER: Yes.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Staff, if all of these vinyls do contain some petroleum based plasticizer, you state that one that's going to contain hydrocarbons should have a plasticizer with a very low volatility and a low extractibility, is this correct?

A Now, what about hydrocarbons, the one that's going to be used for containing hydrocarbons?

Q That's going to be used for hydrocarbons or water which may have the hydrocarbons in it.

A Yes.

Q Now, how is the Commission to determine that a PBC is, or does contain a plasticizer which is of low volatility and low extractibility?

A Well, we specify in the material we buy, the volatilities. This is also in the Bureau of Reclamation specifications. The Bureau of Reclamation in Denver, their laboratory there, has quite a bit of information which you might care to obtain.

Q Well, now, they're not interested in materials that are going to be holding hydrocarbons, are they?

A No, they're not.

Q They're part is of holding your hydrogen water.

A That's right. But then for hydrocarbons resistance, they have discussed that if I had the material be hydrocarbon resistant and this has to be more specific to the type of hydrocarbon, too, because oils vary, as you know, chemically, and they have different extractibilities.

Q Now, are all these PBCs acid resistant?

A Yes.

Q They're all salt resistant?

A Yes.

Q They're all fungus and rock repellant --

A Not all fungus resistant.

Q They're not?

A No. Those based, principally, upon vegetable oil derivatives are very poor on fungus resistance. Some of these synthetic materials are also not suitable on fungus resistance.

Q Now, any of these vegetable oil films, are they hydrocarbon resistant?

A I would say they could be. They could be. You get hydrocarbon resistance by using high molecular weight plasticizers and -- but you decrease the product only by a molecular weight and also by the chemical composition.

Q Are we likely to encounter vegetable oil film?

A If you specify fungus resistance, then you'll take care of that problem; inherent fungus resistance, not by added fungicide.

Q An inherent fungus resistant --

A Of any additives like the fungicide is gradually lost.

Q Is going to be lost, yes. Well, now, you mentioned the elasticity of the PBC and its resistance to breaking under these sink holes.

A Yes.

Q Would you compare the elasticity of the PBC with a couple or three other materials, say, polyethylene and butyl and so forth?

A Yes. Polyethylene has a very high extensibility. It varies with the processing methods. Can be as high as 600%. However, it's yield point, which is what is more important here, is only about 6%, in the normal polyethylene. Now, that's a modifi -- You're right, Mr. Porter, in saying that you shouldn't write exact specifications on material because there's so many new materials coming, and some of these, we don't know enough about yet under a long-term application. There are some modifications of polyethylene which do have a greater yield point. Polyethylene, after it's stressed beyond its yield point, becomes crystalline and the overall --

MR. PORTER: Get's pretty thin, too, doesn't it?

THE WITNESS: It gets very thin, but it thins down in spots. When you stretch a piece of polyethylene 100%, part of it is stretched only 6% and the other portions are stretched up to about 500%.

MR. PORTER: So you don't have a uniform?

THE WITNESS: It is not uniform. This portion that is stretched very highly is oriented, it's crystallized and it's very easy to separate the -- separate in another direction. That's the reason for the poor puncture resistance.

Q (By Mr. Nutter) Now, does PBC have a uniform --

A No. PBC is elastic up to its rupture point.

Q It stretches uniformly rather than in spots like polyethylene?

A Yes. Butyl is also elastic but its puncture resistance is considerably lower according to the Bureau of Reclamation tests.

Q Now, in the event that a covering were specified, and we're talking about, say, a covering of rock-free dirt on the bottom of the well --

A Yes.

Q -- or the pit and say you had a maximum of three feet of water there and a minimum of a foot or six inches, how much dirt is going to be necessary to protect that film from the sunlight and the heat of the sun?

A I'd say about four inches is enough.

Q And how about if you have a two to one or three to one slope, how much gravel or rip-rap will be necessary to protect it from the heat of the sun? Now, this is going to be dry most of the time.

A I think on the side slopes, you'd probably need six, about eight inches.

Q Of gravel?

A Yes, sir.

MR. NUTTER: I believe that's all. Thank you.

MR. PORTER: Does anyone else have a question of Doctor Staff? Thank you very much, sir. You may be excused.

Are there other representatives or suppliers here who want to testify? Mr. Elwell?

MR. ELWELL: I might say a few words on this.

MR. PORTER: All right, sir. Would you come forward and take the stand, please, sir?

(Witness sworn).

BOB ELWELL

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PORTER:

Q Proceed.

A My name is Bob Elwell. I'm with the R & R Service Company of Hobbs, New Mexico. Mine won't be too technical and I deal in semi-rigids, which is fiberglass material. I think one thing we're kind of missing the point on here, I believe most of our pits are going to be from fifty to 100 foot square and also trying to keep the cost down where it won't be too prohibitive. In a lot of instances, they could set a tank and line it rather than go to a pit, but I think we will find most of them

from, oh, say fifty foot to 100 foot diameter and possibly four to five foot in depth. So, actually, rather than looking at these larger pits, I think the fiberglass, the one-piece fiberglass pit lining is really one of the best on the market.

It is easily sealed and will withstand considerable pressure. It's approximately two ounces per square foot and, oh, which would run possibly seventy, seventy-five mills thickness and your polyesters are highly developed, resistant to sun.

Now, there are different types. The type that we use in tank work isn't weather resistant, but the type we use in our pits is; also resistant to hydrochlorides. I believe there's sixty-two different types of polyester resins that can be used in conjunction with fiberglass and if you're not acquainted with all of them, it's pretty easy to get them confused.

The type used in the boat-building industry naturally wouldn't work for pit liners, and by the same token, the ones we use in the tanks isn't satisfactory in the sunlight. But we have experimented considerably with fiberglass. I worked with it for nine years and found that it has worked very satisfactorily in tank linings and, now, in the pits.

Q Mr. Elwell, I gather from your testimony here that you think perhaps you could vary the specifications of lining materials with the size of the pits?

A Yes, sir, if it needed to be heavier, it could be

very easily installed at the same time. We spray with a filament chopper gun from a continuous strand fiber and we can build it to any thickness, any desired thickness at the time we spray in the pit, in one application

Q Have you made any installations in Southeast New Mexico?

A Yes, sir, we have two for Gulf.

Q Are they for water storage?

A No, sir, for evaporation pits.

Q Evaporation pits.

A Yes. One is in operation; the other one, they haven't had any considerable rain in there. About nine inches, I think, this month, something like that. But, this one, we're watching it pretty close and we're well satisfied with it.

Q What about the weatherability of this type of material? Should it be covered?

A No, sir. We cover the edges, like everyone else, to keep from getting blowing out, but as far as -- It possibly would prolong the life, but keeping it covered down in that part of the state would be kind of a problem, that part which wasn't under water.

Q Especially with blowsand.

A Yes, sir.

Q Well, now, in connection with your installation, do you make any kind of a guarantee as to how long it will last?

A Yes, sir. That's usually one of the first things the company wants to know and we do have a five-year guarantee on ours.

Q And that's against leakage?

A Yes. Actually, this is on workmanship because the products we use are national brands which no one can question. I think with nearly any one brand you use, --

Q In other words, if the material fails, the manufacturer or supplier would replace it, do you think?

A Not to us, no, sir, because if it's applied right, it will stay there. We feel like it's our responsibility to apply it in such a manner that it will be there.

Q If you make the proper installation, you think that --

A Yes, sir. The materials that we use are manufactured by Ornite Division, a California company.

Q How large are these pits that you have described?

A One of them is fifty-nine by fifty-nine. The other one is approximately sixty-five by seventy-five, just random pits; they were old pits that were in existence. We hauled some sand in to cover the oil and things over there and went ahead and sealed the pits over this.

MR. PORTER: Does anyone else have a question? Mr. Nutter.

MR. NUTTER: Go ahead and get it out of him.

MR. PORTER: Okay, Mr. Abbott.

CROSS EXAMINATION

BY MR. ABBOTT:

Q W. C. Abbott with Agua Corporation. Bob, you told me earlier that your cost of applying this lining runs about forty to forty-five cents a square foot.

A Yes.

Q And one of the other previous witnesses testified that his coating ran about the same.

A Yes.

Q Now, is that the total cost of an installation?

A No. This would be approximately 50% because you still got somewhere in the neighborhood of probably forty to fifty cents a square foot to get your pit ready for this application on any pit because of the dirt work. Now, this is simply if they had a pit ready.

MR. PORTER: You would line it for that much?

THE WITNESS: Yes, sir, this is simply the lining. Now, the dirt work and specifications, which we do have certain specs; in other words, they can't just go out there and bulldoze a hole in the ground and turn it over to us in that respect. It

has to be done to certain specifications. In other words, no large sticks, rocks or anything like that that couldn't be raked out readily, you know, and we roll the pit before we apply this, but we do like to have it raked and in fairly good shape for it. But preparation of the pit would vary depending on the type of ground whether it was caliche or sand, but I would say approximately forty to fifty cents a square foot cost there, too, and that's something else that we got on this inspection because when you get them too high, of course, no one will go with it. If they could, if there was some simple way for an inspection, and of course, I think maybe a sump with a single drainage pipe connected to another sump would possibly work as well as anything and they could monitor the pits on occasion.

MR. PORTER: I believe you had a question.

CROSS EXAMINATION

BY MR. HUDRY:

Q I had one question; Bill asked that one, but I have another one. Clyde Hudry of Atlantic. There have been cases where fiberglass pipe exposed to the sunlight where the fibers separate, and do the rods deteriorate?

A Yes, sir.

Q In your case, you said you didn't have to cover it. Do you use an epoxy of some sort where you don't have to worry

about that?

A It isn't an epoxy.It's an isopolyester resin and, like I say, right now there are sixty-two different types, some of them for -- In other words, the ingredients to protect them from the sunlight and some of them will deteriorate just rapidly in the sun.

Q But yours won't?

A This particular resin we use does not.

REDIRECT EXAMINATION

BY MR. PORTER:

Q What thickness is the lining of this material in the Gulf pits to which you refer?

A On these particular ones we have in, it will vary from two ounces. Now, this two-ounce is the actual fiberglass in per square foot. It will vary from two to five ounces in the bottom and we have it five ounces there, and it tapers off up the sides down to two ounces.

Q I believe I have a couple of samples of the material to which you refer.

A Yes.

Q Now, is it similar to this that you use?

A Yes, it is, a little more flexible than that. This particular resin here is fairly rigid.

Q Have you made any installations in Texas?

A No, sir, I have not, other than --

Q These are the only installations so far?

A Yes, so far as the pits are concerned. Now, we have used this for nine years in tank linings.

Q I see.

A We spray this same --

Q And you have had some experience with it towards exposure to the weather?

A Yes, sir. In fiberglassing the deck of a tank, we had to do it from the top. It's impossible to get it to stay up above you, so we had to plastic coat the deck on the inside and we fiberglassed the deck from the top and we just built a new deck on top of the old one and we have had some of those on for as high as five years with no deterioration of the resin.

MR. PORTER: Anyone else have a question? Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Elwell?

A Yes, sir.

Q Mr. Elwell, you state that some of these fiberglass products are sun resistant and some are not.

A Yes, sir.

Q How is the Commission to know that a fiberglass that is being installed in a pit would be a sun resistant fiberglass?

A Well, that's going to be the integrity of the applicator and also you could check the number against the manufacturer's specs.

Q And do the manufacturers state that some are sun resistant and some are not?

A Yes, certainly.

Q And the glass matting that's put down, that's the same for all of them?

A Yes.

Q It's only the resins that you apply on them?

A The resin itself is all that would deteriorate. The fiberglass would not deteriorate.

Q Now, are all of these fiberglass products, whether they're sun resistant or not, resistant to salts or acids or hydrocarbons?

A No, sir. This particular one that we use, we're having to strike a happy medium in there, the best that will catch everything. In other words, your best resistance to salts and hydrochlorides isn't a sun resistant material. We lose a little of this to stop the deterioration from the sun.

Q Now, you said hydrochlorides. Did you mean hydrocarbons?

A Yes, sir. I'm sorry.

Q So if you get the better product, as far as sun resistance is concerned, you've lost --

A You will lose a little, now, in this particular one, yes, sir.

Q I suppose the best would be then one that's resistant to the salts, acids and hydrocarbons and then covered to keep the sunlight from it.

A I don't know. That's just going to have to be worked out in time I think. Now this, I know enough about this and I am making a five-year guarantee.

Q How about resistance to fungus on rocks?

A It will grow on there. Now, I don't think any more so than on a PBC line.

Q It will grow on it, but it won't eat it up?

A Oh, no, sir.

MR. NUTTER: I believe that's all.

MR. PORTER: Anyone else have a question of Mr. Elwell? Thank you, Mr. Elwell. You may be excused.

MR. NUTTER: I'd like to ask Mr. Hendershot one question since Mr. Elwell mentioned the price of installation and the cost of the pits.

MR. PORTER: Yes.

MR. NUTTER: Mr. Hendershot, when you were mentioning

your price of forty, forty-five cents a square foot, you meant for the material and the installation, you didn't mean the preparation of the pit?

MR. HENDERSHOT: That's just for the material.

MR. NUTTER: And the installation?

MR. HENDERSHOT: No, that's just the material.

MR. NUTTER: Just the material. Okay. Thank you.

MR. PORTER: Are there any other manufacturers or suppliers?

(Witness sworn).

L. L. YAEGER

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PORTER:

Q All right.

A I am L. L. Yaeger, Technical Director of the Griffolyn Company, Houston, Texas.

Q What's the name of the company?

A Griffolyn, G-r-i-f-f-o-l-y-n. We manufacture a fiber reinforced film laminate, both polyethylene and polyvinyl chloride. This product was developed about fifteen years ago by an independent research laboratory under an Air Force

contract. They wanted a substitute for nylon cloth, parachute cloth, that could be used for cargo parachutes that could be manufactured quickly and inexpensively in case of a national emergency, and after years and time on this, we evaluated many different configurations of plastic films and reinforcing yarns and came up with this configuration where you take two sheets of film, put an unwoven thread in there of high tenacity, continuous filament, synthetic yarns in a pattern forty-five degrees in each direction from the machine direction of the roll and this is held with a special adhesive which allows these fibers to slip slightly so that they will align themselves with the direction of stress that's applied to the laminate.

We've been manufacturing this for about twelve years and, like a lot of these military applications, the major market turns out not to be for the original intended use--parachutes, but for many other applications, hundreds of other applications such as pilot covers, building enclosures. And one of these applications is pit liners which it has been used for. We make this in a four-foot wide roll and we have a fabricating department where this can be cut off and heat sealed into larger sheets up to forty by a hundred feet. That's our maximum stock size.

On special order, we can go to a larger size, but they get unwieldy to handle when they're rolled up. The films

we use run around two to three mills and by the time you get the adhesive in there and the yarn, the overall thickness is in the neighborhood of eight to ten mills.

But if you want a heavier gauge film, we can take two rolls of this laminate and run it through the machine just as we would raw film, just single layer film, put another layer of fibers in there and come up with something around twenty mills. So we have four layers of film and three layers of reinforcing yarn in there. The polyvinyl chloride itself can be solvent bonded. There are a number of proprietary commercial adhesives that larger sheets can be assembled in the field from these forty by a hundreds, and the weatherability of the polyethylene, the black polyethylene, is superior to the polyvinyl chloride but we've been manufacturing the product, the polyethylene, for ten years and we've had actual experience in pit liners up to five years that weathered very well which was carbon black woven film.

Q (By Mr. Porter) Just for brines?

A Yes, sir. Polyethylene for brine. And for oil, we have oil skin, the upper liners would probably be the PBC laminate. Well, I can't think of anything unless I can answer some questions that might bring something to mind.

Q How do you think your product can compare in cost to

some of the other figures we have heard here?

A The black polyethylene is four and a half cents a square foot. The PBC is eight and a half cents per square foot, and if you go to the four-ply material, it slightly doubles the cost of that which is a forty by a hundred foot sized delivery.

MR. PORTER: Does anyone have any questions of Mr. Yaeger? Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Yaeger, now, you stated that the black polyethylene had more weatherability than the PBC type.

A Yes, the PBC --

Q But it's not resistant to the hydrocarbons, is this true?

A That's right.

Q So if you're going to use one in a pit where there may be some carryover of oil, we ought to have a PBC liner?

A The upper liner skimmer barrier should be PBC, but the bottom of the pit where you're going to have salt water, the polyethylene is suitable.

Q Then you bond the two of them together, the PBC with the polyethylene?

A They cannot be heat sealed. There are probably some adhesives where you can get a bond with them. Generally, there either has to be a mechanical attachment or they use a sealing tape or an --

Q Well, you claim that your header pond should be the PBC liner, and then over it, to the evaporation pond, itself, the polyethylene would be suitable, is that what you mean?

A That's right. If you want to bond the two together and can't make a mechanical attachment, you could use a tape, a sealing tape, bond one to the tape; either laminated or bonded to the tape, but not to each other.

Q Now, how resistant to weather are these two products, the PBC and the polyethylene?

A The black polyethylene is suitable up to five years, and we have some installations that are still enough good after that. The PBC, that's a dark green. We've never gone to a black on that because there hasn't been a requirement on it. It will have two to three years normal service life.

Q This is uncovered and completely exposed?

A Uncovered, horizontal, gets the full force of the sun. It's on a vertical installation or slightly embanked. If you had none of the exposure, you could probably get a little more out of it. But forty-five degrees to the south or horizontal, it

is limited to two, three years.

MR. PORTER: For lining of a pit, do you recommend covering this exposed area?

THE WITNESS: Yes. If you could bank dirt over it, you could get longer service.

Q (By Mr. Nutter) Now, we heard some testimony earlier that some of the PBCs were oil resistant and some were not. The one that you make does entail the use of an oil or hydrocarbon resistant --

A Yes, we specified our film suppliers that we want oil resistant material according to ASTMD, 1924, and we do not make our films or fibers. We buy these from five or six leading suppliers. We'd like to buy all our adhesives, laminating adhesives, too. We never found one that was suitable for the purpose, and we've had to develop our own and manufacture it to get the properties of slippage that we need along with good adhesion.

Q What about resistance to punctures?

A Well, like any plastic films, a sharp object will puncture it. However, we believe the fiber reinforcement there in the bottom of the pit, say you have a cave-in in a certain area there, your liner is going to sag a little bit. We believe the yarn reinforcement in there is going to limit the amount of

which this laminate can sag. The black polyethylene has a Mullen burst resistance of 80 psi and the PBC 100 psi and you get up to the four-ply material, you're up over 200 psi in a Mullen burst. And say there are rocks under the liner, too, and the film starts to drape around that and stretch, we believe the yarn reinforcement there is going to limit the amount to which it can stretch and thin out to become weak. On unreinforced film, why, it will stretch almost to an unlimited amount of one specified to.

Q Well, actually, the reinforced one then would cause it to break?

A Because of break?

Q It will cause it to break when it's trying to stretch over --

A Yes. Once you get up to the ultimate tensile of it, it will break, as long as you're going to break the yarns in there. They're the ones that give it the extreme tear resistance and burst resistance and tensile resistance.

MR. NUTTER: I believe that's all. Thank you.

MR. PORTER: Are these the type of materials to which you're referring?

THE WITNESS: Yes, sir. That is the product. I don't believe you have the black polyethylene there. I have a sample

in my bag if you'd like to see it.

MR. PORTER: What is this material that is reinforced?

THE WITNESS: That's the transparent PBC and that's the green PBC that's used for oil liners or pit liners. The transparent PBC is used for greenhouses, places where you want, need light transmission, building enclosures.

MR. PORTER: Does anyone else have a question? No further questions of this witness, he may be excused. Thank you very much. Are there any other suppliers or manufacturers or representatives here? Mr. Loveless, I believe you had been experimenting with evaporation pits. Do you have some information you could give us of your results?

(Witness sworn).

CHARLES LOVELESS

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PORTER:

A First, for Doctor Staff's sake, I'd like to testify that oilfield truck drivers are worse than any other kind of truckdrivers, as far as destruction.

Q Did you give your name for the record?

A My name is Charles Loveless from Roswell, New Mexico.

In February of this year, I installed a three-module evaporation pit in Lea County, New Mexico, in the proximity of one of our water supply points in our salt water disposal systems on the administrative authority of this Commission in an effort to determine if there were not a more economical way to dispose of salt water than by constructing the gathering systems and equipping deep wells particularly in the case of marginal wells which could not afford the luxury of these elaborate disposal systems.

I tried to arrive at a configuration that would lend themselves to economic construction, keeping in mind the need for the optimum design to effect the greatest evaporation and with the purpose to determine whether it would be economical and feasible for a small operator, say, of one well to construct a pit that would handle from thirty to fifty barrels per day of salt water. Also keeping in mind that the state would probably not want to get into an intensive policing action in order to enforce the integrity of the pits insofar as our water loss is concerned, and in trying to arrive at this configuration, I conceived of a three-module arrangement which would permit an inspector to flag a couple of the modules and mark the liner at the waterline with a yellow wax pencil in the morning and come back at some later hour in the day and determine whether the pit was indeed leaking with comparison with the adjacent pit which

he'd also marked and leaving one module available for the pumper to put his salt water in during test period.

In February, on February 15th, I put this pit into operation. The pit is lined with polyethylene film, the black color. Two of the liners are just standard six mill polyethylene and one of them is this reinforced nylon that the Griffolyn people afforded. The header pit is not lined with PBC. It is lined with ten mill polyethylene, but in our case where our water has been processed through several tank stages, we don't have much of an oil problem by the time the water gets to our pit although we have seen just small remnants of film in our header pits but our testing hasn't been over a sufficient period to indicate any deterioration of the polyethylene in the header pit.

Q (By Mr. Porter) But yours is not the usual type of oil field installation for a disposal; I mean, as far as separating your oil?

A No. I would imagine that the normal operation would be in conjunction with a gun barrel with a siphon and the operator would probably encounter varied -- He would, from time to time, spill some oil over or the pumper would let his oil get over into the header pit, and I think it would be essential in the usual oil field installation to use some kind of an oil-proof material

which, I assume, a PBC liner would suffice.

The pit is three forty by one hundred foot, side by side, parallel pits, with a sixty by twenty foot header pit with common walls; that is, we simply put a bulldozer in and with the idea that the cost of dirt movement is usually based on a yardage cost and that rather than to build an enormous one-cell pit, that it would be cheaper to have the bulldozer move the dirt from short distances and throw it up in common walls and in cross section, nominally, we removed a foot of earth below the -- surrounding ground elevation from about a twenty-four foot strip at the bottom and just shoved it up with tapered banks to a common wall between the pits, and the common wall between the header pit at one end. This cost in normal dirt, that is, unless you got into caliche or rock, by keeping it at a foot below the surface, usually, you can find some spot on a lease where you have enough top soil that you could arrange this pit.

The earthwork on this particular pit ran about two hundred dollars. We then took three or four roustabouts and raked out the large clods and stepped them, tramped them into the dirt and generally tried to prepare the bottom of the pits as smooth as possible and threw out any rocks. And then we buried the edges of the liners in the edge of the dikes which brought the forty

by a hundred foot membranes up to within about a foot of the top of the dikes, and we have found this to be very satisfactory.

We've had some eighty-mile winds out there since this installation and apparently have had no problems with anchoring the pit liner. We did have available, immediate supply of salt water which we loaded on the bottom of the pits after we lined them. The lining procedure on the three modules and the header took about two hours.

The pits are fenced with cattle-proof fencing and to avoid -- I think this is the greatest hazard to the puncturing of a liner, is the invasion, is the animal invasion because in most of your remote areas, there are chances of somebody throwing a spear or shooting an arrow or something that seems rather remote to me. We've operated the pit on the theory that we have approximately a 9,000 square foot exposure area in the three evaporative modules although the nominal size is 12,000 feet. And we have 12,000 feet of liner, of course, but when you drape it into the recess of the pit and up the wall and bury about a foot of it, the usable area within about six to eight inches of the top of the liner is about 9,000 square foot, so that's about the basis of your evaporation.

We designed this pit with the thought that we would have a unit that in normal years, based on the evaporation data

available to us from these many sources, that this pit would permit the -- the disposal system, the daily disposal system, year round of thirty barrels per day of salt water. In the winter months, according to these open-panned experiments conducted at the Bitter Lakes near Roswell by the Fish and Wildlife, and this is the figure we adopted as our standard and leaving a margin of safety for this unusual rainy weather we've had, we estimated that we would need about 2500 barrels storage capacity in the winter months to accumulate the water when the evaporation rates were below thirty barrels a day and, according to the nine year figures that we used, the low point per day would be about ten or eleven barrels of evaporation on the average for nine years and the high point would be sixty-five to seventy barrels per day, so that in the summertime, of course, you have no problem. In the wintertime, you need some accumulations capacity.

One of the things that we found was the need for a snow fence on the windward side of the pit. During one of the big snow storms we had on the Caprock, as in the usual case, a geometrical snow drift will build up to a certain point and then the snow goes on by, but in the case of a salt water disposal pit, that snow dives in that salt water and it doesn't leave. It stays right there. And during a one night snow storm,

we filled the pit with four inches of water, so I don't know how much snow it took to file in those pits. But in the northern regions of Lea County, I would think that as winter precaution, you'd probably want to put some snow drift fences up windward from the pit which could be removed and could be very simple with pailing or -- Mr. Yaeger tells me that his company builds one, for example, out of strips of polyethylene strung by ropes. I guess anything that will change the course of wind direction. This pit that we installed, recording humidity and temperature meters which we kept twenty-four hours a day, seven days a week, we metered the water into it and we found that we can very easily evaporate thirty barrels a day, at least, this year and I think we've had some rather abnormal weather conditions.

Now, as for life of liners, I cannot testify as to the longevity of these liners because these have only been in there nine months or roughly nine months, eight or nine months. So far, I cannot detect any appreciable depreciation. One thing that I observed, that your dust and sand immediately puts a shield over the polyethylene. You can see an accumulation of dust, tumble weeds, cement sacks, mud sacks, you name it, anything that blows around the oilfield will eventually get into the pits. The pits are small enough in configuration that a man can walk down the dikes and pick this stuff out from time to

time.

We're precipitating on paper, eight-thousandths of an inch of salt a day. We're using this Pennsylvanian water. It is Bough-C water with chloride content of about fifty-five thousand parts per million. Now, I assume that in some areas like Cato or Chaveroo where the chlorides run as high as 150 thousands that there would be a salt problem, and I would say that if I were designing a pit in that area, that I would provide for salt removal by the simple process of pulling the siphon out of one of the pits when -- to put it out of commission for a few days, let the salt get down to a mush or a semi-flowing consistency and simply put a portable pump on the dike and throw a whole rubber hose over it and pump the salt over into a trench which could be dug by a bulldozer and then pump the mush, the salt, the semi-fluid salt into it and cover it back over and I think if you put twelve inches of soil and ran the bulldozer over it, that salt would be there for a long, long time before it would have a tendency to dissolve into it. I think at 150 thousand parts per million water, about every two years, you'd probably want to pump those pits out into some kind of a ditch at the header. But I would not anticipate that this would be a very costly procedure.

Philosophizing about this thing for a moment, I think

the principal concern, and I take the principal concern of the Commission and the State who is one of the large beneficiaries from oil production, is the premature abandonment of some of the marginal wells. And on this basis, I think it would behoove the Commission, whatever Order it writes, to write one that a small operator with a six or eight barrel per day well, a six or eight barrel per day well, could construct within his means and stay alive economically.

Now, you can get into a long discussion of liner qualities. Yes, we could build liners and spend a dollar a foot on them, nine thousand -- 12,000 square foot. We have $12,000.00 invested. I would rather presume that the Commission or -- and let me say this, too: in these water detection devices, certainly, in the trade, there are many such devices ranging from those electronically based on resistivity between two wires or conductivity of the soil, I might say, or sump drainage into ditches around gravel packs. There are some areas in south-eastern New Mexico where you couldn't find gravel within a hundred miles to use a gravel pack or a sump device of satis-factory means, and I would say that considering the topography, the terrain and geography of the land, that the Commission might better give consideration to a configuration that would lend itself to ease up policing occasionally than attempting to rely

on some device based on a mechanical method that would be costly to the operator. And I would say, for example, if you permitted these module type pits, and I would envision that an inspector would decide today to inspect the pits in Chaveroo or Cato in which I also visualize that in some of the multi-well leases where you have sixteen wells going into a battery, that you might have -- And, incidentally, an average well per dike is six barrels of water per day -- you might want to have a number of modules of forty by a hundred or whatever you determine to be the optimum size, that the inspector would simply come out in the morning with an armload, with some kind of a red flag and a little staff and he'll stick one of those into a dike on a couple of these side by side pits that he decided he wanted to see if they're leaking and simply take a yellow wax pencil and make a line on the liner and throw the siphon out from the header pit and when the pumper came out and saw the red flag on the dike, it tells him that there is an inspector inspecting his pit. And if in the afternoon when the inspector comes back and sees that one of these pits has gone down two inches and one of them has gone down a quarter of an inch or half of an inch, he would simply leave the red flag on that pit which would say on it, "This flag indicates this pit is leaking." And he would pull his flag up on the one that he's determined was not leaking and the man could still stay in operation. It would simply entail,

in my opinion, on these small pits, it would remove the necessity to drain vast areas to isolate a leak and it would provide a means whereby the operator could simply take a couple of roustabouts out there and if he's so determined to do it and roll another liner out in it at an expense of $150.00 and then he's back in business. If you permit the construction of large pits, trying to isolate the leak, for one thing, would be a major task, and when you did isolate it, you're out of business because you've got a lake instead of a cell, a water cell, and I can visualize on some of these large well leases that are making small amounts of water, you might have twelve modules or whatever it takes.

We found that, just as a rule of the thumb in southeastern New Mexico, I would say that one module is equivalent to ten barrels a day of evaporative capacity.

Now, speaking of these evaporation figures, they vary all over the lot, granted. Down in the south end on the Texas line, I believe, there's some figures available that evaporation runs as high as 1600 inches a year, and I assume that there are some areas where it probably runs in the order of sixty or seventy inches a year and maybe even lower, but I do think that a lot of that depends on the environment or in the mechanics of the testing. I think we all agree that evaporation is a function of

humidity, of the removal of the saturated air on the surface of the tank, that is, by wind, and by keeping the pit shallow enough so that you get your convection current set up early in the morning when the sun first hits them and you do not have a large recess of cold water in the bottom that has to be brought up to pit temperature to start the normal vapor pressure or get the vapor pressure up to the point where you're removing enough water to amount to anything.

We found in our chartwork out there that most of your evaporation takes place from 7:00 in the morning until about 7:00 at night because as your temperatures go up -- and, incidentally, we have, aside from some areas in the Himalayas, I believe, we have some of the highest average temperature spread from night to day, than in anywhere in the world, in Lea County, New Mexico, so that it is very important that these pits be kept shallow enough to keep the ambient water temperature at a point where, in the morning, when you start your evaporation, you get the immediate effect of the sun evaporation because you don't do very much evaporation at night. Your humidity will climb up to forty, fifty, sixty percent as the temperatures drop in the Spring to thirty and forty degrees at night and then your humidity will drop to, usually, in a normal day, to eight or ten percent during the daytime when your temperatures run up

in the order of seventy or eighty or ninety degrees. So I do think, getting back to these evaporation figures, that a lot of your variations are occasioned by the type of reservoirs in which the observations are made.

And I do think that it is important to -- within the storage capacity of the pit, to keep those pits as shallow as possible to get the optimum evaporation.

In summary, I would say that these pits can be built and fenced in southeastern New Mexico for a price somewhere around $1500.00, and I dare say that this is considerably -- that is, for a thirty-barrel per day capacity -- is considerably cheaper than trying to erect steel storage and haul the water away. And I believe, further, that when you're talking about these marginal wells and you're talking about life of liners and so forth, most operators operating an eight-barrel well would be tickled to death to think that he had a five-year life ahead of him economically. So I think when you get into the discussion of liners for what the type of operation we're talking about, saving small wells or making it possible to economically produce wells, making small amounts of water, that cost is important and life is important, but not as important as cost.

And say that the liners, for example, that I'm using, the polyethylene liners only last five years. It's simply a

matter of drying up the pit and rolling another one out there with a couple or three roustabouts and you're back in business at a cost of $150.00. So I do think that life is not so important as impermeability or water barrier. Do you see what I mean?

In other words, I think we could build pits that wouldn't pass four-hundredths of a milligram in four days, if you want to spend the money for it. Polyethylene films containing liquid do not leak. They become osmotic at about ninety-five degrees Fahrenheit to gas, but as long as you've got water on them, we have no temperature problem as far as seepage out or loss of water through the membrane. So I would say to you, in writing specifications, it would be more important to say to the man, "Thou shalt not leak", than to try to prescribe something for him that would guarantee longevity rather than immediate effectiveness.

That's my observation.

MR. PORTER: Anyone have any questions of Mr. Loveless?

DOCTOR STAFF: I'd like to make one inquiry of Mr. Loveless.

MR. PORTER: Doctor Staff.

CROSS EXAMINATION

BY DOCTOR STAFF:

Q Do you know about commercial or the Civil Engineering processes in New Mexico State on attribution of dye colors where it's increasing evaporation rates?

A No, sir, I am not connected with them.

Q It's in connection with the Civil Engineering Department, where as in Israel, they've done a lot of work with black dyes. They're finding that their green dyes are made more effective, but the problem is that the green dyes do not have the stability. They fade.

A Is this because it converts the ultraviolet to infrared?

A No, I don't know. Why the colors fade, do you mean, or why you get --

A No, why --

Q Well, I think a good part of it may be because you're heating the upper inch of the material rather than the depth, like the water being transparent to heat the bottom of the reservoir rather than to drop the material with the dye stuff in it, in the water, and then you heat the top of the water. You'll heat the bottom of the reservoir, too. But that might be a good request to make to the Civil Engineering Department.

A Yes, with real interest and it probably can be done

very cheaply.

MR. PORTER: Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Loveless, you stated you put this experimental pit in operation in the middle of February. What evaporation were you able to obtain in February or March?

A We observed from eleven to sixteen barrels in February. We had some pretty good weather in February.

Q And what is the current rate of evaporation, except for the days it rains?

A Well, except for the rains, I don't really think it's significant, but I think we're doing about fifty barrels a day. The design rate should be about sixty-five, but we've had just a series of rains out there practically nightly and our rain gauge has been catching quite a bit of rains as you probably know.

Q Have you made any attempt to determine how much evaporation you're getting, less the rainfall? I know, of course, the rains --

A Well, as I say, we're probably getting around forty, at the rate of forty barrels a day as near as we can tell, including the rains.

Q Of course, these rains are contributing to the humidity --

A The high humidity, that's right.

Q -- and increasing the evaporation. But when it's not raining, --

A That's right. Fortunately, in southeastern New Mexico, your normal rainfalls occur during the summer, the Spring and the Summer, in late summer months, at a time when your evaporation rates are in excess of thirty barrels a day anyway, so this is helpful.

Q Have these been unnormally high rains this summer?

A Yes, sir, they sure have.

Q I mean, total precipitation as ahead of normal?

A Very much so. I'm told this is the third wettest year in the history of the Hobbs Weather Bureau.

Q I see. So it may be then that this pit won't sustain the full thirty barrels a day for the next several months until February the 15th?

A Well, no, I would say this: That even if you had three or four inches of rain a month during your summer months, your rates of evaporation during May, June and July over a nine-year period -- and that takes in many wet years and dry years, that was from '51 to '60 that the figures were kept by the Fish

and Wildlife -- that you should be able to, with this pit configuration during the summer months, evaporate up to sixty-five barrels a day so that even if you had two or three inches a month, which would be unusual, you'd still have plenty of capacity so that playing catch-up is only in the winter months.

Actually, right now, we would expect our pits in normal times to go dry, in other words, running thirty barrels a day until they should practically stay dry.

Q Well, would the pit be able to evaporate sixty barrels a day?

A Yes, that's right.

Q That's what I mean. If you're only evaporating approximately forty now, you probably won't average thirty for the entire year, I believe.

A Yes. I think that if we have a normal August, September, that the pit will dry up during those months.

Q And you'd have to go into the fall months with practically a dry pit.

A I would say along about October, you'd want to have a pretty low pit, right.

Q And you've got 2,500 barrels of storage --

A Yes.

Q -- that's designed for the system --

A That's right.

Q -- which would be storage for about ninety days, eighty to ninety days.

A And I would hasten to add, Mr. Nutter, that if you did have an unusual year, that it would not be -- It would seem to me it would -- Well, an operator facing a situation would simply go out there with a bulldozer and build another module on the side of the pod and throw another siphon hose over as a relief valve and he would probably be looking at a total expenditure of $300.00 to do that dirtwork and liner.

Q Now, your pit is probably 100 by 120, but you've got about 9,000 square feet --

A That's right.

Q -- for the effective evaporation of the surface.

A That's right.

Q So that's something less than a quarter of an acre.

A Yes. I would say we've figured about a fifth of an acre. The reason I asked you this morning, the testimony USGS gave on those potash mines is five gallons per minute per acre. That figures out, 171 barrels per acre per day, and on that basis, that's average, he said, year-round. On that basis, a fifth of an acre would run fifty-four barrels per day. Now, I don't know where they got that figure, but I would say there is quite a

safety factor on that basis.

Q Well, now, you might have remembered from my testimony this morning, I mentioned that there was considerable difference also due to elevation.

A Yes.

Q What is the elevation here where your pit is located?

A Well, it's about thirty -- No, it's 4,000 feet.

Q It is?

A Yes, 4,000 feet, as near as I remember.

MR. NUTTER: I believe that's all.

MR. PORTER: Mr. Loveless, your recommendation would be to not make specifications to enjoin, but rather to establish an adequate leak detecting system and leave it pretty much to the prudence of the operator as to what he lines his pits with?

MR. LOVELESS: Yes. It would seem to me, Mr. Porter, that an operator knowing that, first, let me say, building his pits to the given geometric configuration, first, I would insist upon that, which would lend itself to adequate inspection as occasioned whenever the Commission decided it was time to run an engineer out and just spotcheck pits. An operator, knowing this was going to take place from time to time, I should imagine, would-- a prudent operator would make every effort to build a pit that would be leakproof going in and keep it leakproof.

MR. PORTER: It would probably cost more to reline it than it would to put it in the first time.

MR. LOVELESS: Yes. Well, I'm sure that he would want to use an adequate liner the first time so he wouldn't be having to reline it every month or every six months, is what I'm getting at. I should think a prudent operator would want to build a pit of sufficient quality that it would pass your inspection because he knows he's going to be shut down if he isn't. I hope I'm not assuming too much for the operator.

MR. PORTER: Does anyone else have a question of Mr. Loveless? Mr. Ramey?

CROSS EXAMINATION

BY MR. RAMEY:

Q Back on testing the pits for leakage, Mr. Loveless, how long do you think we would have to, well, place two of them on test to find out whether they're leaking?

A Mr. Ramey, honestly, I don't know, but I have a feeling that in Lea County, Chavez, Roosevelt, in most places, if you breach that lining, the water is going to go out of it fairly rapidly. In other words, it's not going to pile up and be self-sealing because we all know how fast water leaves in most areas in the ground in Lea, Chavez and Eddy Counties. In other words, I think if you had any leak that amounted to anything, that the

water at the surface of that pit would go down at a noticeable rate, a detectable rate, say, within an eight-hour period. What I had in mind is, a man would go out in the morning and place flags on his pits and he might cover thirty or forty leases. It would be a very rapid operation because I would visualize all the guy would do would be to drive up with his red flags and stick them in several of these selected pits and take his yellow waxed pencil -- and polyethylene lends itself very nicely; you can make a beautiful yellow mark on it with a waxed pencil -- and then do this maybe to fifteen leases within an hour in the morning and then come back at 4:30 or 5:00 in the afternoon and just walk up and observe the relative depths of the water in the test pits, and I believe that he'd be able to catch most leaks. Maybe I'm being over-optomistic.

MR. NUTTER: You'd have to take all the yellow waxed pencils away from the pumpers, though, wouldn't you?

MR. LOVELESS: Most of them, it's been my experience, don't even carry pencils. It's pretty hard to remove that wax from polyethylene after it's been applied. I know that.

MR. PORTER: Does anyone else have a question? Thank you very much, Mr. Loveless. You may be excused. Does anyone have anything further to offer in the case, any testimony? Mr. Woodruff has a travel schedule that he has to meet and he

has asked permission to make a statement now.

MR. WOODRUFF: Thank you, Mr. Porter. Norman Woodruff of El Paso Natural Gas Company.

I appreciate the opportunity to make my statement out of the normal order. We consider that the testimony here supports the recommendation of Mr. Nutter, that administrative procedure be established under the provisions of Order Number R3221 to permit the Commission District Supervisors to grant exceptions for the use of properly lined salt water disposal pits and to meet the certain minimum standards as may be established by the Commission. And, further, to grant temporary disposal in surface pits for up to thirty days under emergency conditions.

It is further recommended that these provisions also apply to the areas in pools affected by Orders Number R1224A, R2526 and R3164. The promulgation of these amendments to Order Number R3221 to facilitate operations in the area of the salt water disposal is a problem. Procedures which could be handled administratively will benefit both the operators and the Commission. We believe the number of hearings would be minimized and most problem conditions can be expeditiously cared for.

We think the testimony certainly justifies Mr. Nutter's recommendation that the specifications not be placed in the rules

but be placed in to administrative policies so it can be changed as the conditions may necessitate, and we do wish to commend the Commission on the timely calling of this hearing. Thank you.

MR. PORTER: Does anyone else desire to make a statement? Mr. Kellahin?

MR. KELLAHIN: If the Commission please, Jason Kellahin representing the Standard Oil Company of Texas. Right at the moment, Standard Oil Company of Texas has no salt water problems but is in hearty agreement with the recommendations that have been made by Mr. Nutter for an administrative procedure for the use of lined surface pits, under a system under whereby the District Supervisor would grant the permits in accordance with specifications to be adopted, not in the Order itself, but by administrative procedure which could be subject to change from time to time.

And in that connection, we do agree that, at least to this extent which was a statement that was made by Mr. Loveless, as we see it, most of the exceptions that will be sought for the use of certain specs of this nature will be for wells of rather limited production, as a normal thing. And if the specifications are too rigid and the expenses too high, the adoption of the exception would defeat its own purpose. We hope that

the Commission will be as liberal as it can be, consistent with good operations. This is a difficult problem. And I think it's one that will be subject to change from time to time on the basis of experience.

In connection with the change of Order Number A to Order R-3221, as I understand it, it's a matter of policy, or at least it is the intent of the Commission that reinjection of produced water from waterflood projects, stored for emergency purpose, be a matter of policy and that such reinjections will be required. In line with a statement that was made by Ralph Gray, we will suggest that this not be a rigid requirement or a blanket requirement but, in each instance, the requirement for reinjection will be based on the facts in the particular case because in many cases, and particularly true I think in the Malaga Bend of Tenneco, that water is aerated and it will be very difficult to handle from there on in.

MR. PORTER: Thank you, Mr. Kellahin. Anybody else want to make a statement in this case or further comments? I want to take this opportunity of asking the Commission to adjourn the hearing and, before we proceed with the next case, to thank all of you gentlemen who have offered testimony here in response to our invitation to do so. Now, all our staff has to do is sit down and figure out how much weight to assign each statement.

So if there are no further statements in this case, we will take it under advisement and proceed to the Southeast Nomenclature Case, which is Number 3808.

I N D E X

I N D E X - (Continued)

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me on pages 2 through 22, inclusive, and I, CHARLOTTE MACIAS, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that pages 23 through 114, inclusive, were reported by me and that the same is a true and correct record of the said proceedings, to the best of knowledge, skill and ability.

Ada Dearnley
Notary Public

My Commission Expires:

June 19, 1971.

Notary Public

My Commission Expires:

February 10, 1971.