CASE 5252: App. of ROGER C. HANKS for Amendment of Order No. R-4158, Eddy County

R-4158-A

CASE No.

5252

Application,

Transcripts,

Small Exhibts

ETC.

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
June 5, 1974

EXAMINER HEARING

IN THE MATTER OF:

Application of Roger C. Hanks for the Amendment of Order No. R-4560, Lea County, New Mexico.

Case No. 5252

BEFORE: Daniel S. Nutter, Examiner.

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the New Mexico Oil Conservation Commission:	Thomas Derryberry, Esq. Legal Counsel for the Commission State Land Office Building Santa Fe, New Mexico
For the Applicant:	Sim Christy, Esq. JENNINGS, CHRISTY & COPPLE 1012 Security Nat'l Bank Bldg. Roswell, New Mexico

I N D E X

E X H I B I T S

MR. NUTTER: We will call the next Case, Number 5252.

MR. CHRISTY: Sim Christy of Jennings, Christy and Copple, Roswell, New Mexico and for the Applicant we have one witness, Mr. Examiner.

MR. DERRYBERRY: Why don't I call the Case.

MR. CHRISTY: I thought you had called it, I'm sorry.

MR. DERRYBERRY: Case 5252, Application of Roger C. Hanks for the amendment of Order No. R-4158, Eddy County, New Mexico.

(Whereupon, the Witness was sworn)

ROGER C. HANKS

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

DIRECT EXAMINATION

BY MR. CHRISTY:

Q Please state your name and address.

A Roger C. Hanks, 2100 Wilco Building, Midland.

Q Mr. Hanks, have you previously testified before this regulatory body and had your qualifications as a geologist accepted?

A I have.

Q I think you are the Applicant in this Case and I assume by that that you are familiar with what is sought by the Application. Would you please state to the Examiner what is sought by the Application?

A By the Application I desire to dispose in my Monsanto Foster, dispose of water in the Devonian formation through 2 and 7/8 tubing set in a packer as indicated by the Exhibit and dispose of this water in non-cement lined or plastic lined tubing, which I will go into detail on.

Q All right. Now, I believe this particular well was the subject of Case 4550, Order R-4158, entered June 21, 1971. Let me refer you to Exhibit 1, I believe that was an Exhibit in that Case, is that correct, showing the mechanics of completion?

A Yes.

MR. CHRISTY: The only purpose of Exhibit 1, Mr. Examiner, is for reference to Exhibit 2, so you can see the changes coming up.

MR. NUTTER: I presume that this was the Exhibit that was introduced at the original hearing, that showed the well before it was converted for salt water disposal, is that correct?

MR. CHRISTY: No, no.

MR. NUTTER: Well it doesn't show a packer.

MR. HANKS: May I explain?

MR. NUTTER: Yes, sir, please do.

MR. HANKS: In this application, Mr. Nutter, the tubing was set below the perforations with an oil blanket on the back side, which we were gravity feeding water into the well and we put an oil blanket on the back side, that is between the tubing and the casing and with a pressure gauge on it and if you sprung a leak or your well started to plug off on you then your pressure would be indicated on the gauge. The Commission before in the past has approved this type of disposal so long as the well was on a vacuum.

MR. NUTTER: The Order required a packer, though, didn't it?

MR. HANKS: No, it said and/or. Now if you will read the last line of the Order, it didn't require a packer.

MR. NUTTER: I believe it did.

MR. HANKS: It provided, however, that the tubing shall be plastic lined and that the casing to the annulus shall be filled with an inert fluid and that a pressure gauge be attached to the annulus at the service in order to determine leakage in the casing, tubing or packer.

MR. NUTTER: But in the paragraph above it says, "Injection to be accomplished through 2 and 2/8 inch tubing installed in a packer set at approximately 10,000 feet." This gauge down here is to detect leakage in the tubing, casing or packer.

MR. HANKS: I believe you are correct.

MR. NUTTER: Well, be that as it may, we are just referring to an exhibit from a previous hearing.

MR. HANKS: Well, it is important because I didn't intentionally do it that way, I mean, because it is not a question of that you have got to calculate this specific gravity of the oil to be sure that you get the right weight of oil in order to keep this blanket on the back side, because where you have tubing down here you have a bottom hole pressure that keeps a fluid level and then you calculate the correct weight of oil, and, I believe as I remember it was 32 gravity oil that we had to go find to put in the annulus of that, between the tubing and casing in order to keep the oil blanket down to the approximate depth where it would not come around, you see, and get into the tubing or get into the well.

MR. NUTTER: Well, I realize in some instances an applicant has requested and we have approved a balanced hydrostatic head of inert fluid behind the pipe there without the use of the packer.

MR. HANKS: Right.

MR. NUTTER: However, this particular Order was not that type, it did require the packer.

MR. HANKS: Well, I was in violation of that and it was an oversight on my part, but by the same token, we were still conforming under two other systems I had going at the time that were set up in that manner and this well was on a vacuum, but in order to get the volume down we had to start pumping it and then that totally eliminated the hydrostatic blanket, you've got to set a packer.

MR. NUTTER: Okay.

BY MR. CHRISTY:

Q Now, let's refer to Exhibit 1 and Exhibit 2, and would you please discuss the differences in the two completion indications on the exhibits to what you are now proposing to change from what you have got on Exhibit 1.

A I am proposing that, with the Commission's approval for on a thirty-day period, I have a packer set at 10,024 feet and disposing at the rate of about 2 and 1/2 barrels a minute at the present time, at a pressure of about 300 pounds. I have two large triplex pumps on it, one which will be here in two weeks, where we can put surface pumping passes on there to get 12 barrels minute. We have to have 10 barrels a minute in order to get rid of the water that we are producing at the present time, as a result I have had to shut wells in waiting on this pumping equipment. It is very difficult to get.

Q From how many wells are you disposing of water into this disposal system.

A Nine.

MR. NUTTER: Nine producing wells.

BY MR. CHRISTY:

Q I believe four of them are located north of the disposal well, five of them; I was thinking one was about parallel, and the other four are south, is that correct?

A Yes, sir.

Q All right.

A At the present time, Mr. Christy, there are only three wells that I have going to it.

Q I was about to ask you that. How many wells can you actually produce from and still put the amount of water that you can get down into this well at this time?

A The way it is structured at this time, three wells.

Q When you get these two new pumps then?

A I should be able to handle, probably seven.

Q Why do you have two pumps instead of one, won't one do it?

A You can get a large triplex which will probably handle the capacity, but in the event this pump goes down, then you are down, that's it because the well won't take enough to where you would have to go back and shut down. Say we had seven wells on it, you would automatically have to go shut four in because if one pump goes down you would only have to shut two down because you can still run one pump. They are 150-horse electric pumps and they are triplex pumps that will handle 12 barrels a minute at a thousand pounds. But it takes two of them to get there, so with the addition of this new large pump that I have coming in two weeks, I will only be half way there at that time and it will be another month before I get the system completely operative because I am waiting on the other pump.

Q You said that would allow you then to produce seven wells, that is still not the total of the nine; do you have any plans to have further disposal systems in order to produce all nine wells?

A At the present time I am seeking two additional dry holes in the area which I want to deepen to the Devonian and it appears to be the only formation that will take the amounts of fluid.

MR. NUTTER: You are looking at a couple of other wells?

MR. HANKS: Two others, yes.

BY MR. CHRISTY:

Q That are in the immediate area of these nine?

A One within a half-a-mile or three-quarters of a mile, and the other about a mile and a half.

Q Each of those two you will have to deepen to the Devonian?

A Right. They are dry holes in the Morrow and we will have to deepen them to the Devonian and condemn that will a drill stem test, just like we did this one.

Q So at best this is a standby measure that we are talking about in this case.

A This only takes care of, in this case, seven ninths of our problem. However, at the time, when we first started the system we only had the four wells at the south on, and I didn't realize the capacity of this well until we put them all on and then it wouldn't handle it, so I got Halliburton out there with the tubing out of the hole and ran a 24-hour continuous pump test on it, around the clock, and the results of our test was 12 barrels a minute at a thousand pounds, so we designed our pump in that capacity.

Q How much water in quantities are you presently disposing of in this well; is it the two barrels per minute times 24 hours a day?

A Yes, it would be 120 barrels an hour times 24.

Q On your Exhibit 2 and in your Application, as I understand it, you do not propose to plastic line the tubing?

A Right.

Q Do you have plans for an inert fluid between the casing and the tubing?

A Treated water.

Q Treated water, I see.

A Which is presently in that fashion, the back side is loaded with treated water.

Q I see, and you have a pressure gauge up at the top?

A Right.

Q At the packer section you mentioned?

A Yes.

Q Can you tell from that type of installation whether a leak occurs in the tubing?

A Very definitely.

Q How?

A We have a casing gauge, casing pressure gauge on the casing in the head and if a leak appears either in the casing or the tubing or the packer, we will have a pressure indication on this gauge. For instance, yesterday morning I was informed by my production superintendent that we had a 50-pound pressure indication on the casing. We had a unit down there working so they are presently pulling the packer to find the leak.

Q You shut it in?

A Oh, yes.

Q Let's speak a little bit about the water that we are putting in here; what is the quality of the water?

A The quality of the water is: It averages somewhere between 9 and 12 thousand parts per million which is considerably fresher than heretofore in the past we have considered to be a brackish water or salt water and the total dissolved solids in this water is really my big problem. The disposal into the Devonian formation is accomplished by differential weight. The weight of the heavier produced water in previous areas causes the formation to take it because of the differential weight. In this case, this water is not as heavy, it is much fresher, say, than San Andres water by as much as -- it is one twelfth of the salinity of the total solids of San Andres water so, consequently, the Devonian won't take it as readily. In my previous disposal wells, on the No Pepite and the John Gault ones, we could get as much as 17 barrels a minute on just disposal. Strictly without anything, just on a 27 point vacuum because the weight of the fluid of this water is so much lighter that it is restricting us almost in the same proportion. The well will take it, but you have got to induce it. To get 12 barrels a minute at 1000 pounds, you have got to go from 300 pounds to 1000 pounds, and, of course, this all has to be pumped, and this is the big cost of disposal.

Q You were speaking of the quality of the water, let me refer you to Exhibits 3 to 8 and very briefly would you tell us what they depict. Let's take 3 first. Was this taken on 6-30-73, is that right?

A Yes, sir. This sample was taken at the top in my holding tank at the well.

Q We are talking about the disposal well, aren't we?

A The disposal well, right, at the Montano Foster. This sample was taken at the top and Baroid did a simple

(Reporter's note: Page 14 inadvertently skipped in transcription; text of deposition is intact.)

water analysis. Over on the right side you see total dissolved solids of 12,061 parts per million.

Q Exhibit 4?

A It was taken at the same time, but it was through the means of a thief. We accurately took a middle sample in this same tank, getting somewhat smaller total dissolved solids of 11,469.

Q Exhibit 5?

A It is a sample taken at the bottom of the same holding tank on the same date, getting a total of dissolved solids of 11,465 parts.

Q And Exhibit 6 seems to be your own report?

A This was taken to the Texas A & M Extension service in Lubbock. It is a water sample that was taken on May 1st of this year of which they are showing 42,000 parts per million. In essence this is considerably softer than the other three samples, but by the same token, I am trying to establish more than anything that it is a very light water.

Q Exhibit 7 seems to be out of a different well.

A This is an individual well which we periodically went through the field and picked out, just two wells, just run samples on them to have some variety as far as what one particular well would give. I believe the total dissolved solids in this one are -- you would add up the sulfides, chlorides and magnesium -- would be 15,320, it would be the total dissolved solids in that well.

Q Exhibit 8, given on another well?

A This is from the Robin Federal No. 1, it is showing 51,020 total dissolved solids. These samples were taken at the heater dump valve where they are dumping into the lines.

What I was actually trying to do was to find out which of the wells was giving me the highest solids content.

Q Did you find out?

A Yes, it is from the Barber 2.

Q The Barber 2 which is one of the north wells.

A Right, and since we have plugged that lower zone and are producing in the one above it.

MR. NUTTER: Is that one of the new wells.

MR. HANKS: Yes, but the lower zone -- the water in that zone, Dan, was extremely corrosive and even though the richness of the gas was like 6 and 1/2 gallons per million, real rich gas, but the well was only making about 14 barrels and it was making about 300 water, so I set a plug and recompleted and now the salinity of that should be conformed up to about these, but we can't really run an accurate test on it for two or three weeks and I have only had it on since Saturday.

BY MR. CHRISTY:

Q I would like to discuss a little bit, realizing we have a light water that is not as corrosive as the San Andres type of water; why do you feel that you don't need plactic lined tubing in this well for disposal purposes?

A Well, my experience --

Q (Interrupting) By the way, let's start back with your experience, you have had past experience, have you not, with this salt water disposal in New Mexico and in Texas?

A Yes, well three other systems that I had in New Mexico and one in Texas, and we have disposed of several million barrels of water.

Q All right, now go ahead, please.

A Primarily in the Devonian formation I have found that it is more economical to find a structural low where the Devonian affords itself to, the reason I have already explained.

The reason I am asking the Commission to grant me permission to produce this water or put this water away through tubing is that any time that you suspend a string of tubing below, let's say 8,000 feet, and we are set at 10,024 here, the tension factor becomes such a factor in it that holidays or ring fractures occur within the joint, coupling, within the entire string and in effect it sounds good that we do have cement line PDC tubing in there, but it totally sloughs off, it plugs the well off and it restricts the diameter, and in effect, I am not affording the protection and I am fooling myself in saying that I am actually protecting that string. Now I have surface, intermediate, long string and tubing with an inert fluid on the back side between the tubing and the casing with a pressure gauge attached. I have a positive determination as to any problem that occurs in that well. The simple fact is that the plastic-lined tubing, or in this case the plastic-lined-squeezed-cement tubing that I used has sloughed off to the effect that it is plugging off my perforations and about every 5 or 6 days we are out there re-acidizing the well to try to get it to take anything. Evidence of this is in pulling the well, pulling the tubing, and as you break a joint off it has to be handled with kid gloves because when you set it down and raise a joint up there is a pile of cement and flakes of plastic. In that entire 10,000-foot string, if there is holiday then I am not doing what I have told the Commission I intend to do, and it is doing nothing but costing me money, and it is just not practical.

MR. NUTTER: This is an unique problem that you are having with this; I haven't heard of any other operators having this problem with plastic-lined. What you are saying, though is that on the long string, more than 8,000 feet, the iron stretches more than the plastic and causes these holidays.

MR. HANKS: Right. Here is a very interesting article about it, and it is put out by "Engineering Approach to Cement Lined Tubing" by A. E. Runyon of Permian Enterprises.

MR. CHRISTY: Let's mark this as Applicant's Exhibit 9.

MR. HANKS: In essence in this article Runyon is saying that tension is such that your stretch destroys the effectiveness of your PDC liner or cement lined, it makes no difference because temper differentials would be virtually impossible to calculate. When you are beyond 8,000 feet with tubing, I can't really see that it is giving me the protection as well as you the protection that we both want.

MR. NUTTER: We need rubber lines.

MR. HANKS: I think we could use rubber hose. What we need is a drainage lake and grow some frogs out there. I have been warned against that, so there will be none of that.

BY MR. CHRISTY:

Q Mr. Hanks, do you have anything else you would like to advise the Examiner with in connection with your application?

A Not to my knowledge.

MR. CHRISTY: That's all from the Applicant.

CROSS EXAMINATION

BY MR. NUTTER:

Q You mentioned in your Direct testimony, Mr. Hanks, that you had detected what appeared to be a leak in the packer or the tubing and that they are pulling that?

A Right.

Q Now this string of tubing was recently re-run in the well, was it not?

A It has only been in there about 10 days.

Q Was that new tubing or used tubing, or what, when it was run in?

A Part of it was new and part of it used. In fact, what I was doing, I was pulling another string out of my Preston well down to the south, and rather than test this tubing we just ran that string down there because I know it is good. Some of this tubing is ten round and we couldn't find any at the time, so I went ahead and told them to run it and quite honestly I am afraid there is a leak in it, rather than in the packer, because normally I'm not putting out but 350 pounds against that thing now and if it is going to fail, it means that we are going to have to test each joint of that tubing.

Q Have you notice any difference in the resistivity of the well to the water as time has gone on; you said you have had to increase your pressures, but you have also had to increase the volume of water; is the reservoir itself plugging up, because I notice you have got quite a few carbonates and sulphates included in your analysis here?

A Regardless of your structure, in order to dispose in this Devonian formation, Dan, you have got to periodically about every 45 days, you have got to put 1,000 gallons of -- I won't go any higher than 20% acid.

Q You have got to flush that reservoir?

A Well, yes, because of your precipitation of these chlorides and sulphides, you are going to grow seaweed in that wellbore if you don't keep it clean, because it will plug off just by precipitation. We try to keep the system closed, by that I mean I am on hydraulics, all my fluids come in there free-water-knock-out; free-water-knock-out immediately dumps into the line, and it is all buried, into a six-inch conduit line and it goes down and it goes into the back side of one tank, I have two 500-barrel tanks at my disposal well, and then there is an equalizing line which gives settling time. We are trying to get the impurities. There are two things you don't want in a disposal well: One of them is oil, and the second is any impurities, because by reason, obvious reasons, it plugs off. We are trying to keep this system closed in order to keep the oxidation of these sulphides and chlorides from precipitating. Iron is the worst thing. The iron sulphide seems to be relatively small, it is only the chlorides and sulphides that are very high.

Q It doesn't show any iron on the analysis does it?

A Really it is nil, the sulphides are very high.

MR. NUTTER: Are there any further questions of Mr. Hanks? The Witness may be excused.

MR. CHRISTY: We now offer into evidence Applicant's Exhibits 1 through 9 inclusive.

MR. NUTTER: Applicant's Exhibits 1 through 9 will be admitted into evidence. Do you have anything further, Mr. Christy?

MR. CHRISTY: No, sir, we do not.

MR. NUTTER: Does anyone have anything that we should offer in Case 5252?

We will take the case under advisement.

STATE OF NEW MEXICO)
) SS.
COUNTY OF SANTA FE)

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

RICHARD L. NYE, Court Reporter

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 5252 heard by me on 6/5, 1974.

........................, Examiner
New Mexico Oil Conservation Commission

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

I. R. TRUJILLO
CHAIRMAN

LAND COMMISSIONER
ALEX J. ARMIJO
MEMBER

STATE GEOLOGIST
A. L. PORTER, JR.
SECRETARY - DIRECTOR

July 30, 1974

Re: CASE NO. 5252
ORDER NO. R-4158-A
Applicant:
Roger C. Hanks

Mr. S. B. Christy
Jennings, Christy & Copple
Attorneys at Law
Post Office Box 1180
Roswell, New Mexico 88201

Dear Sir:

Enclosed herewith are two copies of the above-referenced Commission order recently entered in the subject case.

Very truly yours,

A. L. Porter, Jr.

A. L. PORTER, Jr.
Secretary-Director

ALP/ir

Copy of order also sent to:

Hobbs OCC x
Artesia OCC x
Aztec OCC ____
Other State Engineer Office

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE NO. 5252
Order No. R-4158-A

APPLICATION OF ROGER C. HANKS FOR
THE AMENDMENT OF ORDER NO. R-4158,
EDDY COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on June 5, 1974, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 30th day of July, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

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

(2) That Commission Order No. R-4158, entered June 21, 1971, authorized the applicant, Roger C. Hanks, to utilize his Monsanto Foster Well No. 1, located in Unit D of Section 5, Township 20 South, Range 25 East, Eddy County, New Mexico, as a salt water disposal well with injection to take place through 2 3/8-inch plastic-lined tubing set in a packer at 10,000 feet.

(3) That the applicant seeks amendment of Order No. R-4158 to allow injection to take place through unlined 2 7/8-inch tubing set in a packer at 10,000 feet.

(4) That applicant has alleged that the plastic lining in the tubing currently used in the subject well is flaking away from the tubing and is clogging the perforations in the well.

(5) That the water to be injected through the subject well is relatively non-corrosive.

(6) That the subject application should be approved so long as there are sufficient safeguards to ensure that the injected water enters only the proposed injection interval.

IT IS THEREFORE ORDERED:

(1) That Finding (4) on Page 1 of Order No. R-4158 is hereby amended to read as follows:

"(4) That the injection should be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 10,000 feet; that the casing-tubing annulus should be filled with inert fluid; that a pressure gauge should be attached to the annulus at the surface in order to determine leakage in the casing, tubing, or packer; that the injected water should be treated with a corrosion inhibitor; and that corrosion levels should be monitored by continuous coupon tests with the results of those tests to be reported annually to the Commission's Artesia District Office."

(2) That Order No. (1) on Page 2 of Order No. R-4158 is hereby amended to read as follows:

"(1) That the applicant, Roger C. Hanks, is hereby authorized to use his Monsanto Foster Well No. 1, located 660 feet from the North line and 660 feet from the West line of Section 5, Township 20 South, Range 25 East, NMPM, Eddy County, New Mexico, to dispose of produced salt water into the Devonian formation, injection to be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 10,000 feet, with injection into the perforated interval from approximately 10,220 feet to 10,504 feet.

"PROVIDED HOWEVER, that the casing-tubing annulus shall be filled with an inert fluid; that a pressure gauge shall be attached to the annulus in order to determine leakage in the casing, tubing, or packer; that the injected water shall be treated with a corrosion inhibitor; and that corrosion levels in the well shall be monitored by continuous coupon tests with results of those tests to be reported annually to the Commission's Artesia District Office."

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

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

A. L. PORTER, Jr., Member & Secretary

S E A L

dr/

(1)

Application of Roger C. Hanks for the amendment of Order No. R-4158, Eddy County, New Mexico.

Case No. 5252
Order No. R-4158-A

DSN - June 5, 1974
FINDS:

(1) Jurisdiction

(2) That Commission Order No. R-4158, entered June 21, 1971 authorized the applicant, Roger C. Hanks, to utilize his Foster Well No. 1, located in Unit D of Section 5, Township 20 South, Range 25 East, Eddy County, New Mexico, as a salt water disposal well with injection to take place through 2 3/8-inch plastic lined tubing set in a packer at 10,000 feet.

(3) That the applicant seeks amendment of Order No. R-4158 to allow injection to take place through unlined 2 7/8-inch tubing set in a packer at 10,000 feet.

(4) That applicant has alleged that the plastic lining in the tubing currently used in the subject well is flaking away from the tubing and is clogging the perforations in the well.

(5) That the water to be injected through the subject well is relatively non-corrosive.

(6) That the subject application should be approved as long as there are sufficient safeguards to ensure that the injected water enters only the proposed injection interval.

ORDERED

(1) That Finding (4) on Page 1 of Order No. R-4158 is hereby amended to read as follows:

"(4) That the injection should be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 10,000 feet; that the casing-tubing annulus should be filled with inert fluid; that a pressure gauge should be attached to the annulus at the surface in order to determine leakage in the casing, tubing, or packer; that the injected water should be treated with a corrosion inhibitor; and that corrosion levels should be monitored by continuous coupon tests with the results of those tests to be reported annually to the Commission's Artesia District Office.

(2) That Order No. (1) on Page 2 of Order No. R-4158 is hereby amended to read as follows:

"(1) That the applicant, Roger C. Hanks, is hereby authorized to use his Monsanto Foster Well No. 1, located 660 feet from the North line and 660 feet from the West line of Section 5, Township 20 South, Range 25 East, NMPM, Eddy County, New Mexico, to dispose of pro duced salt water into the Devonian formation, injection to be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 10,000 feet, with injection into the perforated interval from approximately 10,220 feet to 10,504 feet.

PROVIDED HOWEVER, that the casing-tubing annulus shall be filled with an inert fluid; that a pressure guage shall be attached to the annulus in order to determine leakage in the casing, tubing, or packer; that the injected water shall be treated with a corrosion inhibitor; and that corrosion levels in the well shall be monitored by continuous coupon tests with results of those tests to reported annually to the Commission's Artesia District Office.

(3) Jurisdiction

Dockets Nos. 17-74 and 18-74 are tentatively set for hearing on June 19 and July 10. Application for hearing must be filed at least 22 days in advance of hearing date.

DOCKET: EXAMINER HEARING - WEDNESDAY - JUNE 5, 1974

9 A.M. - OIL CONSERVATION COMMISSION CONFERENCE ROOM, STATE LAND OFFICE BUILDING - SANTA FE, NEW MEXICO

The following cases will be heard before Daniel S. Nutter, Examiner, or Richard L. Stamets, Alternate Examiner:

CASE 5249: Application of Read & Stevens, Inc., for Pool Extension, Eddy County, New Mexico. Applicants, in the above-styled cause, seek the extension of the Cemetery-Morrow Gas Pool to include therein all of Sections 20, 29, and 30, Township 20 South, Range 25 East, Eddy County, New Mexico.

CASE 5250: Application of Penroc Oil Corporation for a dual completion, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval for the dual completion (conventional) of its Allied "A" Com Well No. 1 located in Unit N of Section 22, Township 20 South, Range 27 East, Eddy County, New Mexico, in such a manner as to produce oil from the Bone Spring formation through the tubing and gas from the Morrow formation through the casing-tubing annulus by means of a cross-over assembly.

CASE 5251: Application of Pierce & Dehlinger for the Amendment of Order No. R-4560, Lea County, New Mexico. Applicant, in the above-styled cause, seeks the amendment of Order No. R-4560 to provide for an extension of time in which to comply with the schedule set forth in said order for the drilling and completion of the third well covered by said order, to be located in the NE/4 of Section 24, Township 9 South, Range 33 East, Vada-Pennsylvanian Pool, Lea County, New Mexico.

CASE 5252: Application of Roger C. Hanks for the Amendment of Order No. R-4158, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks the Amendment of Order No. R-4158 which authorized use of applicant's Foster Well No. 1, located in Unit D of Section 5, Township 20 South, Range 25 East, Eddy County, New Mexico, as a salt water disposal well with injection through 2 3/8-inch plastic lined tubing set in a packer at 10,000 feet. Applicant seeks authority to dispose through 2 7/8-inch non-plastic lined tubing set in a packer at 10,000 feet.

CASE 5253: Application of The Petroleum Corporation for an unorthodox gas well location, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval for the unorthodox gas well location of its Superior Federal Well No. 3 to be drilled to the Morrow formation at a point 660 feet from the South and West lines of Section 4, Township 20 South, Range 29 East, Eddy County, New Mexico.

CASE 5254: Southeastern nomenclature case calling for the creation, abolishment, and extension of certain pools in Eddy and Lea Counties, New Mexico.

(a) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the Forty Niner Ridge-Morrow Gas Pool. The discovery well is the Skelly Oil Company Forty Niner Ridge Unit Well No. 1 located in Unit J of Section 16, Township 23 South, Range 30 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 30 EAST, NMPM
Section 16: S/2

(b) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the Kennedy Farms-Morrow Gas Pool. The discovery well is the Hanson Oil Corporation Kennedy Farms Com Well No. 1 located in Unit F of Section 34, Township 17 South, Range 26 East, NMPM. Said pool would comprise:

TOWNSHIP 17 SOUTH, RANGE 26 EAST, NMPM
Section 34: N/2

(c) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Wolfcamp production and designated as the Logan Draw-Wolfcamp Gas Pool. The discovery well is the Amoco Production Company Arco Federal Gas Com Well No. 1 located in Unit L of Section 26, Township 17 South, Range 27 East, NMPM. Said pool would comprise:

TOWNSHIP 17 SOUTH, RANGE 27 EAST, NMPM
Section 26: SW/4

(d) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the Los Medanos-Morrow Gas Pool. The discovery well is the Belco Petroleum Corporation James Ranch Unit Well No. 3 located in Unit J of Section 1, Township 23 South, Range 30 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 30 EAST, NMPM
Section 1: E/2

TOWNSHIP 23 SOUTH, RANGE 31 EAST, NMPM
Section 6: W/2

(e) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Strawn production and designated as the Los Medanos-Strawn Gas Pool. The discovery well is the Belco Petroleum Corporation James Ranch Unit Well No. 3 located in Unit J of Section 1, Township 23 South, Range 30 East, NMPM. Said pool would comprise:

TOWNSHIP 23 SOUTH, RANGE 30 EAST, NMPM
Section 1: E/2

(f) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the Malaga-Morrow Gas Pool. The discovery well is the Phillips Petroleum Company Malaga A Well No. 1 located in Unit L of Section 2, Township 24 South, Range 28 East, NMPM. Said pool would comprise:

TOWNSHIP 24 SOUTH, RANGE 28 EAST, NMPM
Section 1: W/2

(g) Create a new pool in Eddy County, New Mexico, classified as a gas pool for Morrow production and designated as the Quahada Ridge-Morrow Gas Pool. The discovery well is the Perry R. Bass Big Eddy Unit Well No. 38 located in Unit C of Section 34, Township 21 South, Range 29 East, NMPM. Said pool would comprise:

TOWNSHIP 21 SOUTH, RANGE 29 EAST, NMPM
Section 34: N/2

(h) Abolish the Chambers-Wolfcamp Pool in Lea County, New Mexico, described as:

TOWNSHIP 15 SOUTH, RANGE 35 EAST, NMPM
Section 26: SW/4
Section 35: N/2 and SW/4

(i) Extend the Townsend-Wolfcamp Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 15 SOUTH, RANGE 35 EAST, NMPM
Section 26: SW/4
Section 35: N/2 and SW/4

(j) Extend the Antelope Ridge-Morrow Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 24 SOUTH, RANGE 34 EAST, NMPM
Section 11: N/2

(k) Extend the Grayburg-Morrow Gas Pool in Eddy County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 29 EAST, NMPM
Section 15: SE/4
Section 22: E/2 NE/4, SW/4 NE/4 and
NE/4 SE/4

(l) Extend the Hare-San Andres Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 21 SOUTH, RANGE 37 EAST, NMPM
Section 27: W/2
Section 28: S/2

(m) Extend the Humble City-Strawn Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 17 SOUTH, RANGE 37 EAST, NMPM
Section 15: NE/4

(n) Extend the Sawyer-San Andres Gas Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 9 SOUTH, RANGE 37 EAST, NMPM
Section 24: SW/4

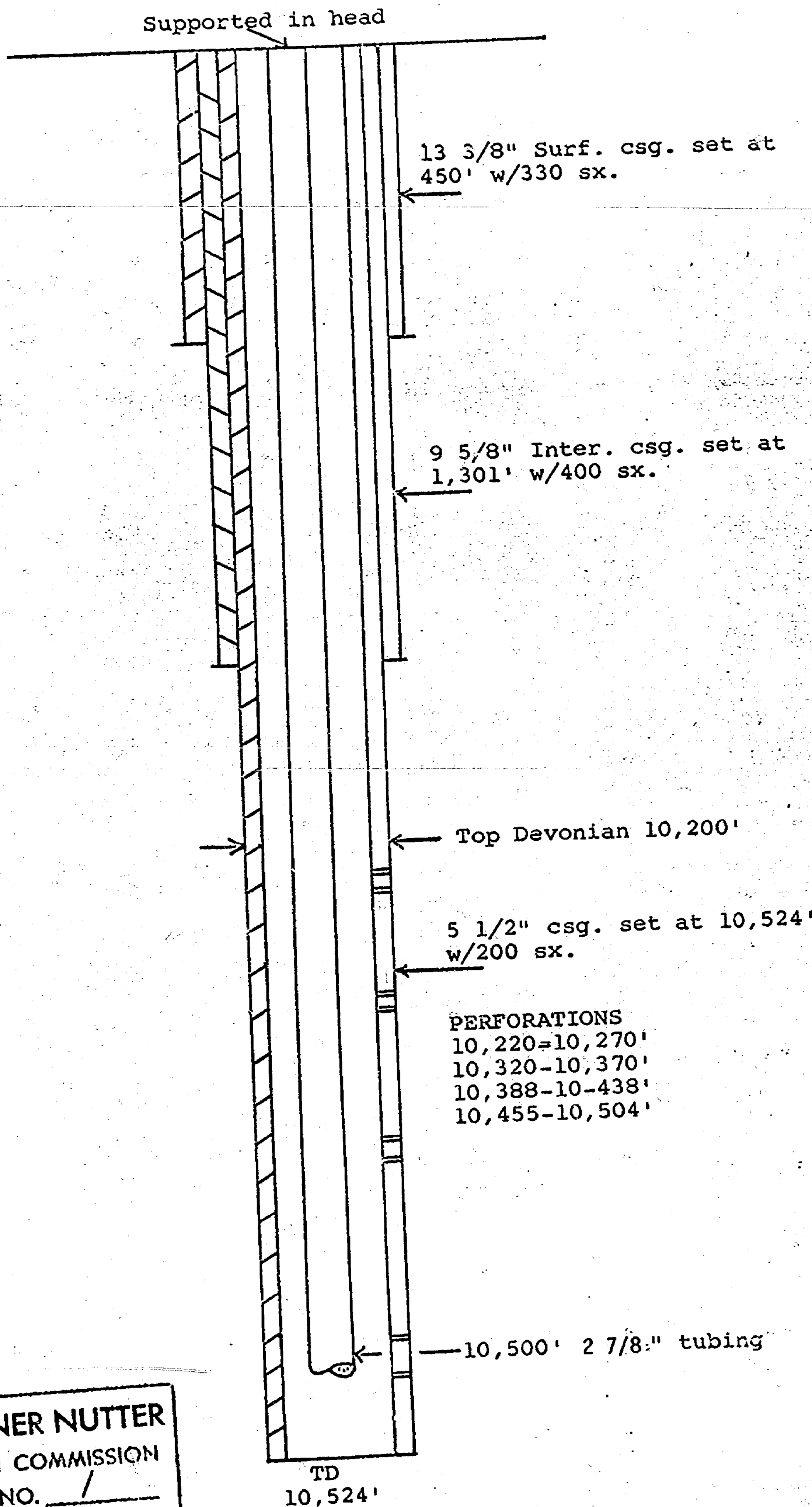
(o) Extend the North Shoebar-Wolfcamp Pool in Lea County, New Mexico, to include therein:

TOWNSHIP 16 SOUTH, RANGE 36 EAST, NMPM
Section 7: SE/4

(p) Extend the Townsend-Morrow Gas Pool in Lea County, New Mexico, to include therein:

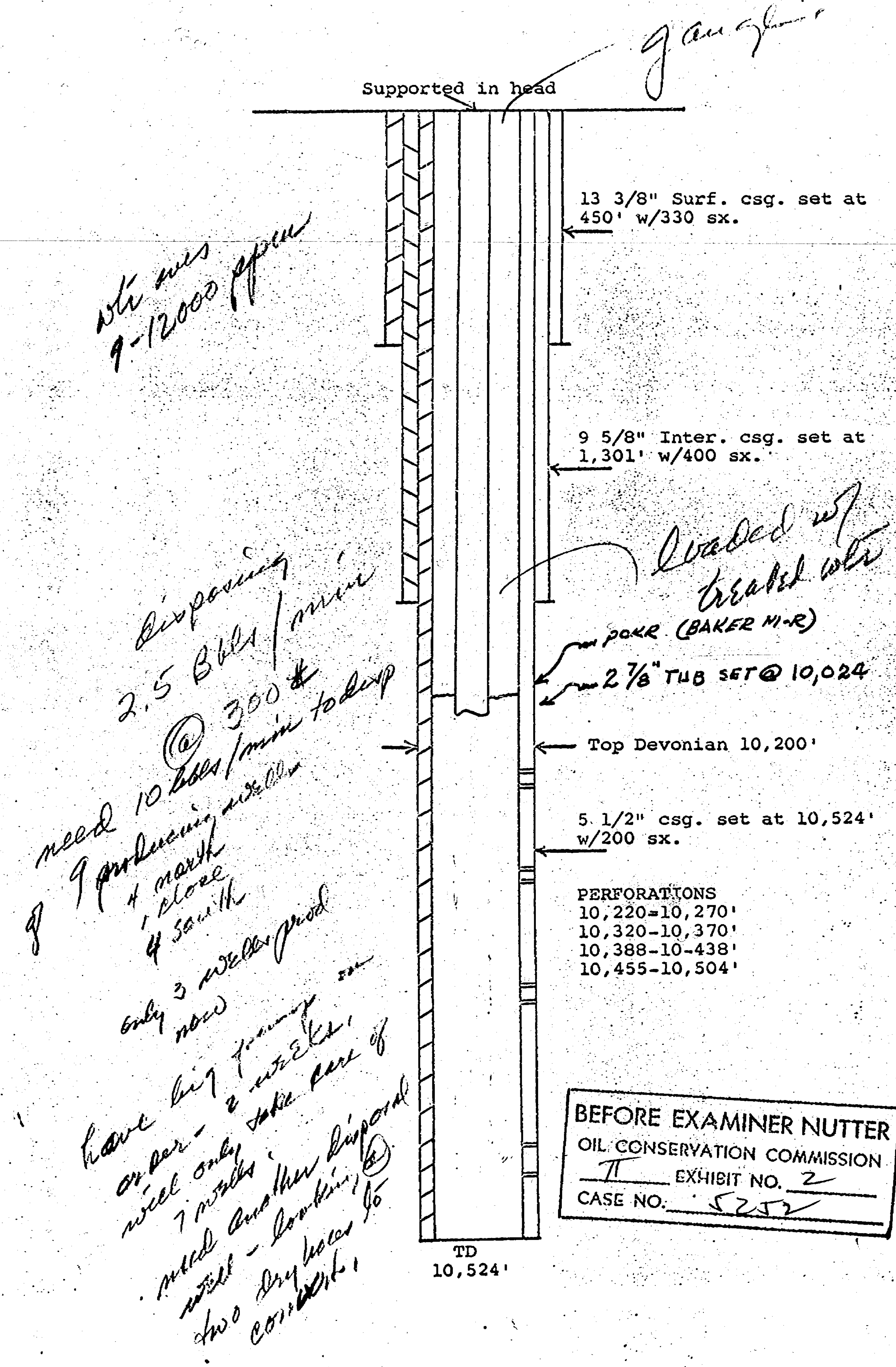
TOWNSHIP 16 SOUTH, RANGE 35 EAST, NMPM
Section 14: All

DIAGRAMMATIC SKETCH
ROGER C. HANKS #1 FOSTER



BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
II EXHIBIT NO. 1
CASE NO. 5252

ROGER C. HANKS #1 FOSTER



BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
II EXHIBIT NO. 2
CASE NO. 5252

BAROID DIVISION
N L Industries, Inc.
P.O. Box 1675 Houston, Texas 77001

BAROID TREATING CHEMICALS

WATER ANALYSIS TEST REPORT

SHEET NUMBER			
COMPANY: Roger C. Hanks			DATE: 6-30-73
FIELD	COUNTY OR PARISH: Eddy		STATE: N.M.
LEASE OR UNIT	WELL(S) NAME OR NO.	WATER SOURCE (FORMATION): Holding Tank	
DEPTH, FT. / BHT, F / SAMPLE SOURCE: Top / TEMP, F	WATER, BBL/DAY	OIL, BBL/DAY	GAS, MMCF/DAY
TYPE OF OIL	API GRAVITY °	TYPE OF WATER ☐ PRODUCED WATER ☐ INJECTION WATER	OTHER

WATER ANALYSIS PATTERN
(NUMBER BESIDE ION SYMBOL INDICATES me/l* SCALE UNIT)

	20	15	10	5	0	5	10	15	20	
Na^+										Cl^-
Ca^{++}										HCO_3^-
Mg^{++}										$SO_4^=$
Fe^{+++}										$CO_3^=$

DISSOLVED SOLIDS

CATIONS	me/l*	mg/l*
Total Hardness	32	
Sodium, Na^+ (calc.)	165	3795
Calcium, Ca^{++}	24	480
Magnesium, Mg^{++}	8	98
Iron (Total), Fe^{+++}		
ANIONS		
Chloride, Cl^-	141	5000
Sulfate, $SO_4^=$	33	1575
Carbonate, $CO_3^=$		
Bicarbonate, HCO_3^-	16.5	1006
Hydroxyl, OH^-		
Sulfide, $S^=$	6.5	104
Phosphate-Meta, PO_3^-		
Phosphate-Ortho, $PO_4^{\equiv}$		

DISSOLVED GASES

Hydrogen Sulfide, H_2S		mg/l*
Carbon Dioxide, CO_2		mg/l*
Oxygen, O_2		mg/l*

PHYSICAL PROPERTIES

pH	7.1	
Eh (Redox Potential)		MV
Specific Gravity		
Turbidity, JTU Units		
Total Dissolved Solids (Calc.)	12061	mg/l*
Stability Index @ ___ F		
@ ___ F		
$CaSO_4$ Solubility @ ___ F		mg/l*
@ ___ F		mg/l*
Max. $CaSO_4$ Possible (Calc.)		mg/l*
Max. $BaSO_4$ Possible (Calc.)		mg/l*
Residual Hydrocarbons		ppm(Vol/Vol)

SUSPENDED SOLIDS (QUALITATIVE)

Iron Sulfide ☐ Iron Oxide ☐ Calcium Carbonate ☐ Acid Insoluble ☐

REMARKS AND RECOMMENDATIONS:

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
II EXHIBIT NO. 3
CASE NO. 5252

* NOTE: me/l and mg/l are commonly used interchangeably for epm and ppm respectively. Where epm and ppm are used, corrections should be made for specific gravity.

BTC ENGINEER	DIST. NO.	ADDRESS	OFFICE PHONE	HOME PHONE
Joe T Lewis	21			
TESTED BY: M. W. Gardner	DATE: 6-30	DISTRIBUTION: ☐ CUSTOMER ☐ BTC ENGINEER OR ☐ BTC LAB ☐ AREA OR ☐ DISTRICT OFFICE ☐ BTC SALES SUPERVISOR		

FORM BR-2 (4)A

BAROID DIVISION
N L Industries, Inc.
P.O. Box 1675 Houston, Texas 77001

WATER ANALYSIS TEST REPORT

BAROID TREATING CHEMICALS

			SHEET NUMBER
COMPANY Roger C Hanks			DATE 6-30-73
FIELD		COUNTY OR PARISH Eddy	STATE N.M.
LEASE OR UNIT	WELL(S) NAME OR NO.	WATER SOURCE (FORMATION) Holding Tank	
DEPTH, FT. / BHT, F / SAMPLE SOURCE middle / TEMP, F		WATER, BBL/DAY / OIL, BBL/DAY	GAS, MMCF/DAY
TYPE OF OIL / API GRAVITY °	TYPE OF WATER ☐ PRODUCED WATER	☐ INJECTION WATER	OTHER

WATER ANALYSIS PATTERN
(NUMBER BESIDE ION SYMBOL INDICATES me/l* SCALE UNIT)

	20	15	10	5	0	5	10	15	20	
Na^+										Cl^-
Ca^{++}										HCO_3^-
Mg^{++}										$SO_4^=$
Fe^{+++}										$CO_3^=$

DISSOLVED SOLIDS

CATIONS	me/l*	mg/l*
Total Hardness	48	
Sodium, Na^+ (calc.)	144	3312
Calcium, Ca^{++}	32	640
Magnesium, Mg^{++}	16	195
Iron (Total), Fe^{+++}		
ANIONS		
Chloride, Cl^-	141	5000
Sulfate, $SO_4^=$	32	1550
Carbonate, $CO_3^=$		
Bicarbonate, HCO_3^-	10.5	640
Hydroxyl, OH^-		
Sulfide, $S^=$	8.2	132
Phosphate-Meta, PO_3^-		
Phosphate-Ortho, $PO_4^≡$		

DISSOLVED GASES

Hydrogen Sulfide, H_2S		mg/l*
Carbon Dioxide, CO_2		mg/l*
Oxygen, O_2		mg/l*

PHYSICAL PROPERTIES

pH	7.3	
Eh (Redox Potential)		MV
Specific Gravity		
Turbidity, JTU Units		
Total Dissolved Solids (Calc.)	11469	mg/l
Stability Index @ ___ F		
@ ___ F		
$CaSO_4$ Solubility @ ___ F		mg/l*
@ ___ F		mg/l*
Max. $CaSO_4$ Possible (Calc.)		mg/l*
Max. $BaSO_4$ Possible (Calc.)		mg/l*
Residual Hydrocarbons		ppm(Vol/Vol)

SUSPENDED SOLIDS (QUALITATIVE)

Iron Sulfide ☐ Iron Oxide ☐ ~~Calcium Carbonate~~ ☐ Acid Insoluble ☐

REMARKS AND RECOMMENDATIONS:

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
II EXHIBIT NO. 4
CASE NO. 5252

* NOTE: me/l and mg/l are commonly used interchangeably for epm and ppm respectively. Where epm and ppm are used, corrections should be made for specific gravity.

BTC ENGINEER Joe Lewis	DIST. NO. 21	ADDRESS	OFFICE PHONE	HOME PHONE
TESTED BY Will D Gardner	DATE	DISTRIBUTION ☐ CUSTOMER ☐ BTC ENGINEER OR ☐ BTC LAB	☐ AREA OR	☐ DISTRICT OFFICE ☐ BTC SALES SUPERVISOR

BAROID DIVISION
N L Industries, Inc.
P.O. Box 1675 Houston, Texas 77001

WATER ANALYSIS TEST REPORT

BAROID TREATING CHEMICALS

						SHEET NUMBER
COMPANY Roger C. Hanks						DATE 6-30-73
FIELD				COUNTY OR PARISH Eddy		STATE N.M.
LEASE OR UNIT		WELL(S) NAME OR NO.		WATER SOURCE (FORMATION) Holding Tank		
DEPTH, FT.	BHT, F	SAMPLE SOURCE Bottom	TEMP, F	WATER, BBL/DAY	OIL, BBL/DAY	GAS, MMCF/DAY
TYPE OF OIL		API GRAVITY °	TYPE OF WATER ☐ PRODUCED WATER	☐ INJECTION WATER	OTHER	

WATER ANALYSIS PATTERN
(NUMBER BESIDE ION SYMBOL INDICATES me/l* SCALE UNIT)

	20	15	10	5	0	5	10	15	20	
Na^+										Cl^-
Ca^{++}										HCO_3^-
Mg^{++}										$SO_4^=$
Fe^{+++}										$CO_3^=$

DISSOLVED SOLIDS

CATIONS	me/l*	mg/l*
Total Hardness	44	
Sodium, Na^+ (calc.)	147	3381
Calcium, Ca^{++}	16	320
Magnesium, Mg^{++}	28	342
Iron (Total), Fe^{+++}		
ANIONS		
Chloride, Cl^-	141	5000
Sulfate, $SO_4^=$	34	1650
Carbonate, $CO_3^=$		
Bicarbonate, HCO_3^-	11.4	695
Hydroxyl, OH^-		
Sulfide, $S^=$	4.8	77
Phosphate-Meta, PO_3^-		
Phosphate-Ortho, $PO_4^≡$		

DISSOLVED GASES

Hydrogen Sulfide, H_2S		mg/l*
Carbon Dioxide, CO_2		mg/l*
Oxygen, O_2		mg/l*

PHYSICAL PROPERTIES

pH	7.3	
Eh (Redox Potential)		MV
Specific Gravity		
Turbidity, JTU Units		
Total Dissolved Solids (Calc.)	11465	mg/l*
Stability Index @ ___ F		
@ ___ F		
$CaSO_4$ Solubility @ ___ F		mg/l*
@ ___ F		mg/l*
Max. $CaSO_4$ Possible (Calc.)		mg/l*
Max. $BaSO_4$ Possible (Calc.)		mg/l*
Residual Hydrocarbons		ppm(Vol/Vo

SUSPENDED SOLIDS (QUALITATIVE)

Iron Sulfide ☐ Iron Oxide ☐ Calcium Carbonate ☐ Acid Insoluble ☐

REMARKS AND RECOMMENDATIONS:

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
TI EXHIBIT NO. 5
CASE NO. 5252

* NOTE: me/l and mg/l are commonly used interchangeably for epm and ppm respectively. Where epm and ppm are used, corrections should be made for specific gravity.

BTC ENGINEER Joe Lewis	DIST. NO. 21	ADDRESS	OFFICE PHONE	HOME PHONE
TESTED BY Olive B. Gardner	DATE	DISTRIBUTION ☐ CUSTOMER ☐ BTC ENGINEER OR ☐ BTC LAB	☐ AREA OR ☐ DISTRICT OFFICE	☐ BTC SALES SUPERVISOR

A/C 915 ~~682-1764~~ 682-4364

ROGER C. HANKS
2100 WILCO BUILDING
MIDLAND, TEXAS 79701

May 1, 1974

Ira Williams

Test: Texas A & M Extension Service
Agronomy & Irrigation Specialist

Water Sample:
From storage tank at Monsanto Foster Disposal Well

Salt: 4,200 parts per 1,000,000

Hydrogen Sulfide: High

Possibly O.K. for date palms, plumb granets, desert plants

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
π EXHIBIT NO. 6
CASE NO. 5252

1042-A

HALLIBURTON DIVISION LABORATORY

HALLIBURTON COMPANY
LOVINGTON, NEW MEXICO

LABORATORY WATER ANALYSIS

No. W74-327

To: Roger C. Hanks
Wilco Building
Midland, Texas 79701

Date: 5/9/74

Submitted by: ____ Date Rec. 5/9/74

Well No. Dagger Draw # 1 Depth 7700+ Formation Cisco

County Eddy Field Dagger Draw Source Heater Treater

Resistivity	1.00 @ 85° F.		
Specific Gravity	1.004		
pH	6.5		
Calcium (Ca)	550		*MPL
Magnesium (Mg)	120		
Chlorides (Cl)	2,500		
Sulfates (SO_4)	2,700		
Bicarbonates (HCO_3)	1,110		
Soluble Iron (Fe)	Nil		
Total	5,320		

Remarks:

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
II EXHIBIT NO. 7
CASE NO. 5252

*Milligrams per liter

Respectfully submitted,

Analyst: Lansford
cc:

HALLIBURTON COMPANY

By [signature] CHEMIST

NOTICE

This report is limited to the described sample tested. Any user of this report agrees that Halliburton shall not be liable for any loss or damage, whether it be to act or omission, resulting from such report or its use.

13421X

HALLIBURTON DIVISION LABORATORY

HALLIBURTON COMPANY
LOVINGTON, NEW MEXICO

LABORATORY WATER ANALYSIS No. W74-326

To Roger C. Hanks
Wilco Building
Midland, Texas 79701

Date 5/9/74

Submitted by ____ Date Rec. 5/9/74

Well No. Robin Fed. # 1 Depth 7700+ Formation Cisco

County Eddy Field Dagger Draw Source Well Head

Resistivity	1.26 @ 85° F.		
Specific Gravity	1.004		
pH	6.7		
Calcium (Ca)	450		*MPL
Magnesium (Mg)	120		
Chlorides (Cl)	2,500		
Sulfates (SO_4)	2,500		
Bicarbonates (HCO_3)	1,074		
Soluble Iron (Fe)	Nil		
TOTAL	5,120		

Remarks:

BEFORE EXAMINER NUTTER
OIL CONSERVATION COMMISSION
TT EXHIBIT NO. 8
CASE NO. 5252

*Milligrams per liter

Respectfully submitted,

Analyst: Lansford
cc:

HALLIBURTON COMPANY
By R. W. Lansford
CHEMIST

NOTICE

This report is limited to the described sample tested. Any user of this report agrees that Halliburton shall not be liable for any loss or damage, whether it be to act or omission, resulting from such report or its use.

An Engineered Approach to Cement-Lined Tubing

E. E. Runyan

Permian Enterprises

Midland, Texas

SOCIETY OF PETROLEUM ENGINEERS
AIME

An Engineered Approach to Cement-Lined Tubing

E. E. RUNYAN
MEMBER AIME

PERMIAN ENTERPRISES
MIDLAND, TEX.

Abstract

This paper presents previously unavailable data on the physical properties of cement-lined tubing. Using these properties, calculations are made to predict tubing behavior under field conditions. The results of these calculations are verified by laboratory and field tests. The principal conclusions reached are: (1) cement-lined tubing strings are effective to 9,000 ft, and calculations indicate that satisfactory performance will be obtained at depths to 14,000 ft; (2) hairline cracks do form in deep tubing strings, but they cause no break in corrosion protection; and (3) sour water systems offer no hazard to cement-lined tubing.

Introduction

Lining injection-well tubing with cement is an old and proven approach to protecting tubing strings from internal corrosion. However, little work has been done in determining the actual physical properties of cement lining, and even less work has been done in applying these properties to engineering calculations to describe and predict its behavior. It is the purpose of this paper to contribute to the correction of this situation.

The approach taken toward this goal is an examination of basic information on cements, with a cement lining being clearly defined. The properties of the lining are then examined. Engineering calculations are made to predict performance of the lining system. Laboratory and field-test results confirming these calculations are presented. Finally, applications and limitations are discussed along with recommended installation methods. A presentation of case histories concludes the paper.

Background

A wealth of basic information on cements and their application is available in the literature. This information is widely known and used by the other engineering sciences. Petroleum engineers, however, have not had ready access and exposure to this information; and, consequently, it has not been effectively applied to many oilfield problems.

Some facts pertinent to the cement lining of tubing are:

1. Properties of cement mortars vary widely, and, therefore, they can be adapted to meet many applications.
2. Cement mortars in themselves are effective corrosion inhibitors.
3. Within limits, cracking of cement lining has no effect on corrosion protection.
4. Cement linings are self-repairing.
5. An excellent bond can be obtained between the walls of the steel tube and the cement sheath.

Properties of cement mortars will vary almost as widely as properties of the constituents used in them. Examples are the new epoxy-cement patching mortars and the new high-temperature mortars. In addition, properties are affected by the method of placing and curing the mortar in the pipe. Obviously then, cement linings can be engineered to many specific applications.

The effectiveness of concrete in protecting steel from corrosion in marine structures has been recognized for many years. This same protective mechanism will protect steel pipe with a lining of cement. Basically, this protective mechanism results from moisture in the cement absorbing calcium hydroxide and maintaining the pH in the steel-contact area above 12. At this pH, corrosion of the steel is prevented by the formation of a protective iron-oxide film on the steel surface.[1,2] The protective mechanism is effective even in the presence of oxygen as long as the pH is maintained in the inhibitive range. This fact can be easily illustrated by placing common steel nails in two jars of tap water. To one jar add a few pieces of cement mortar. After allowing time for corrosion to occur, observe the nails. The nails in the jar containing fragments of cement will be unaffected while the nails in the second jar will be badly corroded. The protection will be due to the pH rise and consequent steel passivation in the jar containing the cement.

Cement linings always contain some moisture and when in water service are completely saturated. They are occasionally cracked during installation and are usually applied to surfaces which have not been sandblasted. Yet, they give effective protection. Again this protection is due to two properties of cement commonly known to structural engineers but often overlooked by petroleum engineers. The first of these is the passivation of the exposed steel in the crack by the pH rise of the water in the crack as discussed earlier. During installation a tension crack is formed, water immediately fills the crack, it absorbs calcium hydroxide from the freshly exposed cement surfaces, the pH rises and the steel is passivated. Of course there are limits to this process, but authorities agree that cracks of up to 2 mils offer no problem.[3]

The second property of cement linings that results in the continued protection is the unique property of self-

Original manuscript received in Society of Petroleum Engineers office June 14, 1964. Revised manuscript received April 1, 1965. Paper (SPE 995) presented at SPE Annual Fall Meeting held in Houston, Oct. 11-14, 1964.

[1]References given at end of paper.

repair.[4] This property is due to the continuing hydration of the cement over long periods as well as the continuing reaction between the free lime and pozzolan to form new cement. For these reactions to continue, a supply of moisture must be available. This condition is always fulfilled in water-injection lines. This property can also be easily illustrated. Construct a cement bar long enough to be conveniently broken. Break it, tape it back together so the broken ends are in contact, and place it in a bucket of water and leave for a few weeks. At the end of this time remove and carefully untape. The bar will have "grown" back together sufficiently to support its own weight.

On the above two items, passivation and self-healing, some authors have commented that pressure surges tend to purge the cracks so passivation and self-healing cannot occur. On very large cracks this is true, but it is due primarily to convection currents across the face of the crack. For cracks up to 2 mils, simple calculations show that purging is impossible when capillarity is taken into account.

An excellent bond can be obtained between the cement lining and the walls of the pipe. The bond can be of two types—mechanical and chemical. The mechanical bond is best achieved by high-speed rotation of the pipe during placement of the cement mortar. The centrifugal force of the lining operation forces cement mortar into every pore and crevice of the pipe surface, thus creating a strong mechanical bond upon hardening. This mechanical bond can be supplemented by a chemical bond if some atmospheric rust is present on the pipe surface. To quote directly from a paper by Unz:[5]

> Cement mortar has the particular property of removing all rust and loose scale particles from the steel during curing. The particles are dissolved, owing to a superficial corrosion process, and form iron salts. These salts are diffused in the mortar and then precipitated.
>
> Owing to this absorption process, an excellent bond is obtained between concrete and reinforcement. The bond is particularly strong when some atmospheric rust has been present on the steel surface.

Again, this property can be easily illustrated by lining both pieces of sand-blasted pipe and rusty pipe, splitting them longitudinally and noting the relative problem in removing the lining from each. The lining from the sand-blasted pipe will slip out easily after the mechanical bond is broken, whereas the lining from the rusty pipe must be forcibly pounded out.

Definition and Properties

The most common and best-accepted lining material now in use for tubing strings and the one discussed in this paper is the cement-pozzolan lining material. Specifically this lining consists of 60 per cent high-early-strength sulfate-resistant cement with 40 per cent pozzolan. Typical analyses of the cement and pozzolan are shown in Table 1 and Table 2, respectively.

This lining has become widely accepted for several reasons, but some of the more important are:

1. It gives a smooth lining surface which in turn results in a favorable friction-loss factor.

TABLE 1—TYPICAL CEMENT ANALYSIS

Component	Percent
Silicon Dioxide	20.8
Aluminum Oxide	3.1
Iron Oxide	5.6
Calcium Oxide	65.2
Magnesium Oxide	1.0
Sulfur Trioxide	2.6
Sodium Oxide	0.8

TABLE 2—TYPICAL POZZOLAN ANALYSIS

Component	Percent
Silicon Dioxide	45.5
Iron Oxide	13.7
Aluminum Oxide	16.7
Calcium Oxide	9.1
Magnesium Oxide	2.2
Sodium Oxide	6.9
Potassium Oxide	2.9

2. It is conducive to high-speed application because of uniform particle size and density. This results in maximum mechanical bond and minimum water-cement ratio.

3. It results in a dense, non-porous, low-permeability lining.

4. It is extremely resistant to attack from anything normally found in oilfield waters and is moderately acid resistant.

5. It has excellent self-healing properties since it is rich in cement and contains pozzolan.

This type of lining requires some type of moist cure. Both steam (hot water vapor) and the water submersion methods are used.

The physical properties of this type lining are as follows: density, 135 lb/cu ft; porosity, 8 per cent; permeability, less than 0.01 md; compression strength*, 5,200 psi; tensile strength*, 520 psi; and modulus of elasticity,* 1.564×10^6.

Theory

To accurately calculate the performance of cement-lined tubing, one assumption, which can be adequately verified from experience, must be made. This assumption is that the cement lining is in intimate contact with the steel tube and that a mechanical bond exists between them. This bond insures that stresses induced in the steel tube are also induced in the lining. This assumption has been verified in three ways: (1) the lining must be forcibly pounded from the steel tube even though the tube has been completely split; (2) examination of the lining sheath shows every detail and pore of the steel tube, indicating mechanical bond; and (3) photographs of linings under stress have shown multiple-crack formation, indicating only very short areas are stress relieved when a crack occurs.

Cement-lined tubing is subjected to three types of stress during installation and operation as an injection string: (1) bending and torsional stresses while running; (2) internal pressure stresses; and (3) tensional stress due to load. Of these, only tensional stress is of sufficient magnitude to be considered. Under normal conditions, either of the first two stresses will be small by comparison.

Considering tensional stress, the following questions must be answered: Do cracks form as a result of tension loads? Are they of sufficient magnitude to cause the protective system failure?

Until formation of first crack, elongation of the cement and elongation of the steel must be equal.

$$\delta c = \delta s,$$

also

$$\delta = \frac{PL}{AE} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where δ = elongation
P = load
L = length
A = area
E = modulus of elasticity

*Seven-day values

c = cement
s = steel,

therefore

$$\delta c = \frac{P_c L_c}{A_c E_c} = \frac{P_s L_s}{A_s E_s} = \delta s,$$

but $L_c = L_s$,

so
$$\frac{P_c}{A_c E_c} = \frac{P_s}{A_s E_s} \quad \ldots \ldots \ldots \ldots \quad (2)$$

The critical, or breaking load, of the cement may be calculated from

$$P_c = S_c A_c, \quad \ldots \ldots \ldots \ldots \quad (3)$$

where S = stress.

Substituting in the previously described physical properties, the value is

P_c = 469 lb (2⅜-in. 4.7-lb tubing).

Substituting this value in Eq. 2 we find the steel load at the formation of the first crack in 2⅜-in. cement-lined tubing is 13,000 lb. Obviously hairline cracks do form in deep cement-lined tubing strings.

It now becomes necessary to determine if these cracks cause any break in protection. Experience has shown that hairline cracks occur at approximately 1-in. intervals under high load conditions. This has been verified by laboratory photographs (see Figs. 1 and 2) and dye-marking tests on several occasions.[5,6]

When the first crack forms, stress relieves its respective section of the lining, so the lining carries no load. It then becomes a simple matter to apply the elongation Eq. 1 and calculate the separation between blocks or width of cracks. This has been done in Tables 3 and 4 for 2⅜- and 2⅞-in. tubing, respectively. Note that at extremely high load conditions, equivalent to 14,100 ft of 2⅜-in. cement-lined tubing, the 2-mil limit for width of crack has just been reached.

In summary, calculations indicate that hairline cracks do form, but that under normal load conditions they are not of sufficient magnitude to cause any break in protection.

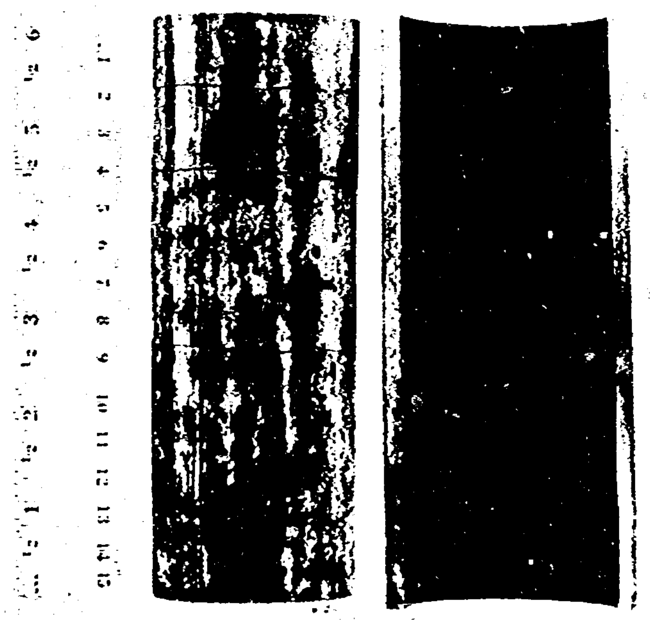


Fig. 1—Photograph of 1-in. interval cracks.

Testing

Laboratory Test

In an effort to more adequately test the mechanical strength and physical changes in cement-lined tubing under high impact and tensional loads, an extensive laboratory test was performed in 1958.[4]

The first portion of this laboratory test was to investigate the handling characteristics of cement-lined tubing. To do this, three 6-ft J-55 cement-lined tubing subs were made up between two 30-ft joints of EUE tubing. The two joints were picked up by rig elevators and pulled through the V-door of the rig. In addition, the tubing was flexed with only end support to an 8-ft center deflection. The test joints were then inspected and no cracks, scaling or other damage was found.

The second portion of this test was an attempt to duplicate conditions encountered in running a long string of cement-lined tubing. This was accomplished by running 6-ft cement-lined J-55 tubing subs at 500-ft intervals in a 2,000-ft tubing string with three 6-ft subs at the top of the string. Immediately below each sub a tubing disc

Fig. 2—Photograph of 1-in. interval cracks.

TABLE 3—WIDTH OF FRACTURE
(2⅜-In., 4.7-lb Tubing)

Total Load (lb)	Width of Fracture (mils)
13,000	0.33
15,000	0.38
20,000	0.51
25,000	0.64
30,000	0.76
35,000	0.89
40,000	1.02
45,000	1.15
50,000	1.28
55,000	1.40
60,000	1.53
65,000	1.66
70,000	1.79
75,000	1.91
78,267	2.00

TABLE 4—WIDTH OF FRACTURE
(2⅞-In., 6.5-lb Tubing)

Total Load (lb)	Width of Fracture (mils)
18,077	0.33
20,000	0.37
25,000	0.46
30,000	0.55
35,000	0.65
40,000	0.73
45,000	0.83
50,000	0.92
55,000	1.02
60,000	1.10
65,000	1.19
70,000	1.29
75,000	1.38
108,755	2.00

was run to catch scaled or cracked cement. A tubing tension packer with a 30,000-lb tension sleeve was installed on the bottom of the string. After the tubing was run and the packer set, pulls of 35,000 lb each were made three times. On the fourth pull the load was increased to 45,000 lb, where the tension sleeve broke. Approximately 20 in. of stretch was noted when the sleeve failed. Failure of the sleeve caused violent vibration of the string. As the string was pulled from the well, each test sub and its respective tubing disc was carefully examined. There were no particles of cement on any of the discs and no visible damage to any of the test joints.

To inspect the lining while stress was being applied, samples 20-in. long were cut from new tubing subs and threaded for testing on the Baldwin testing machine. The samples were then slotted for visual observation of the lining under stress. A laboratory camera was set up to take pictures through the slot. Visual observation and photographs revealed that the cement lining opened visible hairline cracks at ½- to 1-in. intervals along the tubing at about 45,000 lb pull (see Fig. 3). As the pull was increased to 60,000 lb, additional cracks appeared (see Fig. 4). No longitudinal cracks appeared. When the load was removed the cracks disappeared.

Chemical tests were also run. These tests indicated that cement-lined tubing was not affected by any naturally occurring oilfield waters, nor was erosion of the lining any problem. The tests did conclude, however, that high-rate acid treatments would damage the cement lining.

The conclusions of the complete laboratory test were: (1) cement-lined tubing is not affected by normal handling above ground; (2) there is no apparent damage to the lining below 45,000 lb pull; (3) loads of 60,000 lb open hairline cracks in the lining; and (4) water has no effect on the cement lining.

All of the above conclusions verify predicted conclusions based on the physical properties of the lining. This is true even for the formation of the first crack, since it is very difficult to observe cracks of less than 1 mil inside of 2-in. tubing in artificial light. As can be seen in Table 1, loads of 40,000 lb are necessary to create cracks of 1-mil width. Later, more precise testing has verified very faint cracking at 20,000 lb.

Field Tests

Since all of the above testing was done in the laboratory or under simulated conditions, it was felt that additional testing under actual field conditions was necessary—specifically, testing under high-load, sour-water conditions. To conduct this program, a portable tension-test machine was built. This machine consists basically of a hollow, heavy-wall steel tube capable of holding 30 ft of cement-lined tubing in any desired tension .The tubing is placed under tensional load by a hydraulic jack. For long-term tests the load is transferred to four 1-in. stud bolts and secured. A photograph of the machine is shown in Fig. 5.

On Oct. 12, 1962, the field test of cement-lined tubing was assembled. The assembly consisted of the make-up and insertion into the tension machine of 30 ft of cement-lined tubing subs consisting of two 4-ft, two 6-ft and one 10-ft J-55 2⅜-in. OD tubing subs.

After make-up, the test assembly was positioned in the machine and axially loaded to 50,000 lb, equivalent to a 9,000-ft cement-lined string, by means of a hydraulic jack. The load was transferred to four 1-in. stud bolts and the jack was released. Blue dye was added, the system filled with water and pressured to 500 psi. The following day the machine was transported to the Mobil Oil Co. Parks Pennsylvanian unit, Tract 14, Well 5, and installed in the water injection system. This system utilizes sour San Andres water and operates at a pressure of 1,400 psig.

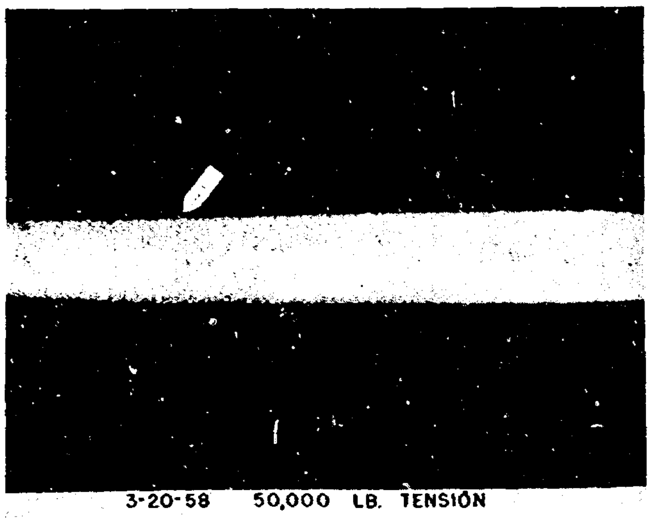


Fig. 3—Cracks at ½- to 1-in. intervals induced by 45,000 lb tensile stress.

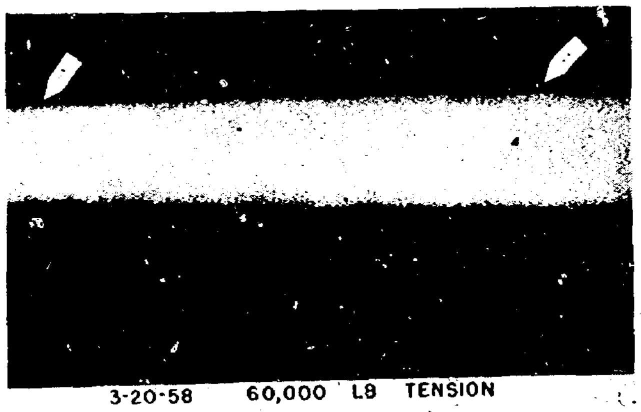


Fig. 4—Cracks induced at 60,000 lb stress.

On Dec. 4, 1963, 420 days after initial installation, the test was disassembled for inspection. The following day each sub in the test was sectioned and split longitudinally for detailed examination.

Preliminary examination revealed that all subs contained a slight deposition of soft scale consisting primarily of iron sulfide and silt (see Fig. 6, left). This material was soft and was easily removed by brushing. Upon cleaning, the lining surface showed some surface crazing but no evidence of any cracking of the cement lining itself (Fig. 6, right). A longer segment of lining was similarly examined with still no evidence of cracking found (Fig. 7, left). The lining from one half of this segment was removed (pounding with a hammer was required) to allow examination of the steel surface. Faint lines where the steel had brightened gave an indication of previous hairline cracking at about 1-in. intervals, but there was no evidence of steel corrosion (Fig. 7, right).

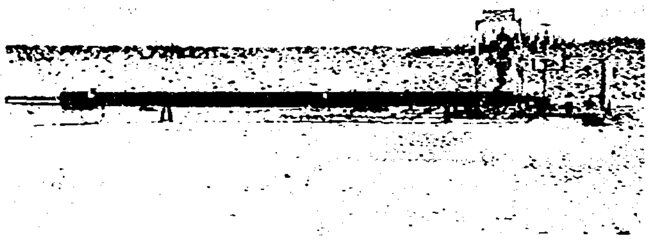


Fig. 5—Portable tension test machine.

Fig. 6—Cement-lined subs showing deposition of iron sulfide and silt scale after field test.

Pieces of the lining broken out failed in 1-in. segments, indicating pre-existing planes of weakness.

To better define the location of the hairline cracks, one 6-in. segment of the lining was oven dried for four days to completely dehydrate and shrink the lining in an effort to cause the hairline cracks to re-open. The results are shown in Fig. 1, right. The hairline cracks did reappear and occurred at the same 1-in. interval. Again, however, there was no evidence of corrosion of the steel underlying these cracks (Fig. 1, left).

From this field test it was concluded that:

1. Cement-lined tubing systems are proven satisfactory at depths up to 9,000 ft (the limit of this test) even in the presence of sour waters.

2. Although tensional hairline cracks do form in the cement lining, they are self-healing and are not of sufficient magnitude to cause any break in protection.

3. A definite mechanical bond exists between the cement lining and the steel tube.

Therefore, the conclusions of the field test confirm the conclusions reached both by laboratory testing and theoretical calculations.

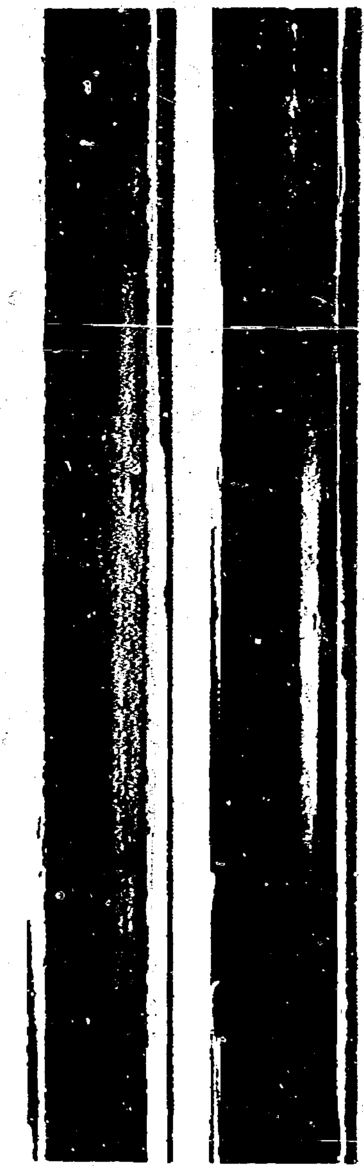


Fig. 7—Segment of lining after test showing no evidence of cracking.

TABLE 5—DIMENSIONS AND SETTING DEPTHS, CEMENT LINED EUE TUBING

Tubing Size OD (in.)	Tubing Wall Thickness (in.)	Tubing Weight (lb/ft)	Lining Thickness (in.)	Lining Weight (lb/ft)	Total Cement Lined Tbg. Wt. (lb/ft)	Cement Lining ID (in.)	Setting Depth SF=1.8 (ft)	Tubing Grade
2⅜	0.190	4.7	0.1562	0.85	5.55	1.682	5200	H
							7100	J
							10400	N
2⅞	0.217	6.5	0.1562	1.05	7.55	2.128	5300	H
							7300	J
							10600	N
3½	0.254	9.3	0.1875	1.55	10.85	2.617	5300	H
							7200	J
							10600	N
4½	0.271	12.75	0.2187	2.41	15.16	3.520	5200	H
							7200	J
							10500	N

Applications and Limitations

Cement lining is at its best in the presence of moisture. It is here that its unique self-healing and passivation properties can function. Cement-lined tubing strings are applicable in all water-injection wells at total loads of up to 78,000 lb for 2⅜-in. tubing or the limit of the tubing. If the normal safety factor of 1.8 is applied, the strength of the steel will be the limiting factor (see Table 5). Hairline cracks will form, but they will cause no break in protection.

Cement-lined tubing is impervious to any normal oilfield water, including very sour waters. Erosion due to high flow rates presents no problems. Cement lining does reduce the internal diameter of the tubing, but the increase in friction-factor number tends to offset any diameter loss.

Cement lining facilitates rather than hinders the use of wire-line tools in injection wells. Most applicators now work on such close thickness tolerances that they can guarantee an internal diameter sufficient to pass wire-line tools. With only normal care wire-line tools will not damage cement-lined tubing, nor will the wire cut through the lining.

Cement linings are not susceptible to mechanical damage during normal stresses encountered in transportation, and are easily adapted to many different types of tubing joints.

Cement linings, however, are not a cure-all. High volume, high rate or repeated acid jobs will destroy conventional cement linings. There are, however special cement additives in use by some applicators which will increase the acid tolerance of cement linings. Any application where the atmosphere is continually drying is not appropriate for cement-lined tubing. Sour gas wells are an example.

Installation and Joint Protection

Cement-lined tubing is not easily damaged. Normal care will insure a satisfactory installation. The following are recommended handling practices.

1. Tie downs should secure the load to the extent that it does not shift during transportation.

2. To avoid undue flexure, tubing being transported should be supported at least every 10 ft. In the case of pole trailers, the double bolster type is recommended.

3. The legal overhang on trailers should not be exceeded.

4. When unloading, avoid dropping tubing from truck and avoid putting insert hooks, pick-up pipe or other devices into the ends of the pipe.

5. To avoid crushing when running, use wrap-around tongs and backups; avoid sudden jerks or stops; stop tubing before setting slips; and avoid applying excessive torque.

In field work with cement-lined tubing, only two additional factors need be considered for normal operations. These are the increased weight of the tubing string and the reduced internal diameter of the tube. Physical constants for both are shown in Table 5.

In cement-lined tubing, it is common practice to bring the cement only to the midpoint of the collar (Fig. 8). This allows tolerance for additional wear as the tubing is pulled and re-run and insures clearance for proper make-up. The protection for this stand-off area previously has been a problem but recent advances in rubber technology have provided two excellent compounds for this purpose. They are butyl-rubber compound for water systems and a neoprene-rubber compound for oil or oil-water systems. These compounds can be plant-applied since they do not harden or interfere with make-up. They will completely seal the stand-off area and are impervious to any substance normally encountered. Fig. 8, right, shows the condition of the butyl-rubber com-

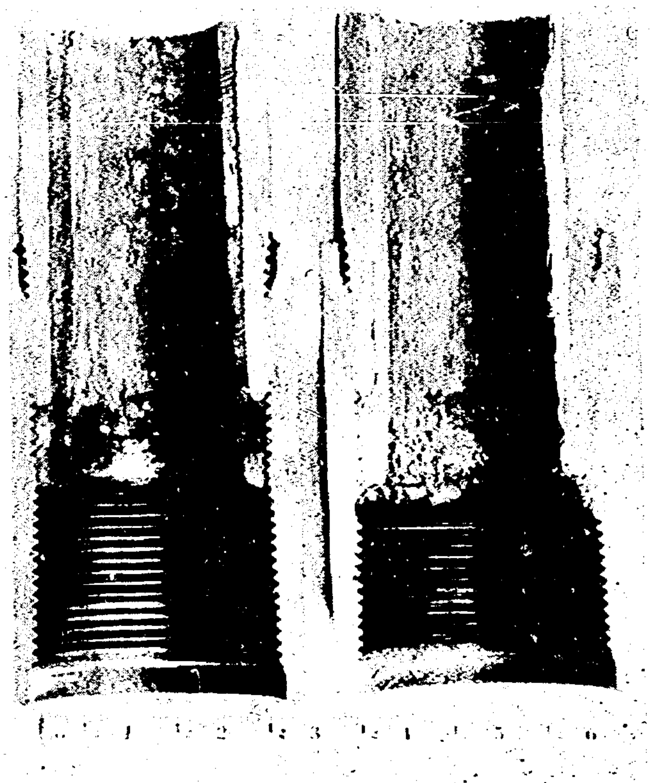


Fig. 8—Photograph showing cement deposited only to midpoint of collar.

TABLE 6

Field	County and State	Number of Wells	Depth (ft)	Date Run
South Ward	Ward, Texas	8	2400	1952
Payton	Ward, Texas	80	2400	1956
KMA	Wichita, Texas	28	4000	1957
Keystone-Colby	Winkler, Texas	9	3250	1957
South Ward	Ward, Texas	15	2400	1959
Jameson	Coke, Texas	5	6000	1959
Pecos Valley	Pecos, Texas	15	2800	1959
Keystone	Winkler, Texas	25	3300	1960
Page	Schleicher, Texas	14	5600	1960
Goldsmith	Ector, Texas	9	5600	1961
Johnson	Ector, Texas	15	5000	1961
No. Concho Bluff	Upton, Texas	6	4000	1961
Dorward	Garza, Texas	5	2500	1961
So. Ward	Ward, Texas	8	2400	1961
Keystone	Winkler, Texas	150	3000	1961
Spraberry Trend	Reagan, Texas	1	7500	1961
Quanah	Hardeman, Texas	1	6000	1961
Aneth	San Juan, Utah	5	6700	1961
Welch	Dawson, Texas	5	5000	1962
Cummins	Ector, Texas	14	5600	1962
Horseshoe Gallup	San Juan, New Mexico	3	5000	1962
Panhandle	Gray, Texas	2	3000	1962
KMA	Wichita, Texas	15	4000	1962
Spraberry Trend	Glasscock, Texas	5	7500	1962
Nena Lucia	Nolan, Texas	1	7000	1962
Buckeye	Lea, New Mexico	10	4500	1963
Panhandle	Gray, Texas	13	2500	1963
Two Freds	Culberson, Texas	6	3000	1963
Pegasus	Midland, Texas	3	10500	1963

pound after being in sour water service 420 days, and the left side of Fig. 8 shows the protection it afforded.

Case Histories

Cement-lined tubing strings are not rare. Table 6 shows only some of the strings which are in service and upon which records have been adequately maintained.

As can be seen in Table 6, the trend is deeper each year as water floods and pressure maintenance projects go deeper and as operators gain confidence in cement linings at depth.

Summary and Conclusions

The basic properties of cements and cement lining have been examined and a cement lining defined. Properties of the lining have been determined and these properties applied to engineering calculations and behavior has been predicted. These predictions have been verified by both laboratory and field tests and the following conclusions drawn:

1. Cement-lined tubing systems are effective to 9,000 ft.
2. Calculations indicate that satisfactory performance will be obtained at depths up to 14,000 ft or 78,000 lb total load.
3. Sour water systems offer no hazard to cement linings.
4. Hairline tension cracks do form in cement-lined tubing, but they are self-sealing and are not of sufficient magnitude to cause any break in protection.
5. A definite bond exists between the cement and the steel in cement-lined tubing.

From these conclusions and knowledge of advantages and limitations of cement-lined tubing, efficient and economical application can be made.

Acknowledgment

The author wishes to express his appreciation to Halliburton Oil Well Cementing Co. for allowing use of its laboratory test data, to Mobil Oil Co. for use of its field facilities and to Permian Enterprises, Inc. for time, men and materials to make this paper possible.

Special appreciation is expressed to R. F. Weeter of Mobil Oil Co., whose suggestions, guidance and editing contributed invaluable assistance.

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EDWARD E. RUNYAN *is vice-president of Permian Enterprises, Inc. in Midland Tex. In 1955 Runyan graduated from the U. of Tulsa, where he earned BS and MS degrees in petroleum engineering. He then joined Sohio in Baton Rouge, La. as a junior engineer. In 1962 he joined Permian Enterprises as assistant to the president.*

Case 5252

LAW OFFICES OF
JENNINGS, CHRISTY & COPPLE
1012 SECURITY NATIONAL BANK BUILDING
P. O. BOX 1180
ROSWELL, NEW MEXICO 88201

JAMES T. JENNINGS
SIM B. CHRISTY IV
ROGER L. COPPLE
BRIAN W. COPPLE
ROBERT G. ARMSTRONG

TELEPHONE 622-8432
AREA CODE 505

RECEIVED
MAY 15 1974
OIL CONSERVATION COMM.
Santa Fe

May 14, 1974

New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Attention: Mr. Dan Nutter

Re: Case No. ~~4550~~ 5252
Order No. R-4158

Gentlemen:

We enclose herewith in triplicate Application for Amendment to Order of the Commission in the captioned case.

Our understanding is that the next available Examiner Hearing is June 4, 1974, and it is requested that the matter be set for Examiner Hearing at that time.

Respectfully,

JENNINGS, CHRISTY & COPPLE

By S B Christy IV
S. B. Christy IV

SBC:pv
Encl.
cc: (w/c of Application)
Mr. Roger C. Hanks

Case 5252

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

APPLICATION OF ROGER C. HANKS
FOR SALT WATER DISPOSAL, EDDY
COUNTY, NEW MEXICO.

CASE NO. ~~4550~~ 5252
Order No. R-4158

APPLICATION FOR AMENDMENT TO ORDER OF THE COMMISSION

COMES NOW Roger C. Hanks ("Applicant"), the owner and operator of the Monsanto Foster Well #1, located 660 feet from the North line and 660 feet from the West line of Section 5, Township 20 South, Range 25 East, N.M.P.M., Eddy County, New Mexico, and hereby makes application for anamendment to Order R-4158 entered in the above case on June 21, 1971, and states:

1. Paragraph (4) of said Order requires injection through 2-3/8 inch plastic-lined tubing installed in a packer set at approximately 10,000 feet subsurface. In lieu thereof Applicant proposes that such injection should be accomplished through 2-7/8 inch tubing, not plastic lined, installed in a packer set at approximately 10,000 feet subsurface.

2. Applicant believes that the granting of an amendment to said Order to permit the foregoing proposed installation would be in the interest of conservation and would not cause waste or violate the correlative rights of any interested party.

WHEREFORE, Applicant prays that, after notice and hearing, Order R-4158 be amended to permit accomplishment of injection of water through 2-7/8 inch tubing, not plastic lined, installed in a packer set at approximately 10,000 feet subsurface.

ROGER C. HANKS

By S. B. Christy IV

S. B. Christy IV, as a
Member of the Firm of
Jennings, Christy & Copple
P. O. Box 1180
Roswell, New Mexico 88201
(505) 622-8432

DOCKET MAILED
Date 5/23/74

DRAFT

dr/

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

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

CASE NO. 5252

Order No. R-4158-A

APPLICATION OF ROGER C. HANKS FOR THE AMENDMENT OF ORDER NO. R-4158, EDDY COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on June 5, 1974, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this ______ day of July, 1974, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

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

(2) That Commission Order No. R-4158, entered June 21, 1971, authorized the applicant, Roger C. Hanks, to utilize his Monsanto Foster Well No. 1, located in Unit D of Section 5, Township 20 South, Range 25 East, Eddy County, New Mexico, as a salt water disposal well with injection to take place through 2 3/8-inch plastic-lined tubing set in a packer at 10,000 feet.

(3) That the applicant seeks amendment of Order No. R-4158 to allow injection to take place through unlined 2 7/8-inch tubing set in a packer at 10,000 feet.

(4) That applicant has alleged that the plastic lining in the tubing currently used in the subject well is flaking away from the tubing and is clogging the perforations in the well.

(5) That the water to be injected through the subject well is relatively non-corrosive.

(6) That the subject application should be approved so long as there are sufficient safeguards to ensure that the injected water enters only the proposed ~~injected~~ injection interval.

IT IS THEREFORE ORDERED:

(1) That Finding (4) on Page 1 of Order No. R-4158 is hereby amended to read as follows:

"(4) That the injection should be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 10,000 feet; that the casing-tubing annulus should be filled with inert fluid; that a pressure gauge should be attached to the annulus at the surface in order to determine leakage in the casing, tubing, or packer; that the injected water should be treated with a corrosion inhibitor; and that corrosion levels should be monitored by continuous coupon tests with the results of those tests to be reported annually to the Commission's Artesia District Office."

(2) That Order No. (1) on Page 2 of Order No. R-4158 is hereby amended to read as follows:

"(1) That the applicant, Roger C. Hanks, is hereby authorized to use his Monsanto Foster Well No. 1, located 660 feet from the North line and 660 feet from the West line of Section 5, Township 20 South, Range 25 East, NMPM, Eddy County, New Mexico, to dispose of produced salt water into the Devonian formation, injection to be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 10,000 feet, with injection into the perforated interval from approximately 10,220 feet to 10,504 feet.

" PROVIDED HOWEVER, that the casing-tubing annulus shall be filled with an inert fluid; that a pressure gauge shall be attached to the annulus in order to determine leakage in the casing, tubing, or packer; that the injected water shall be treated with a corrosion inhibitor; and that corrosion levels in the well shall be monitored by continuous coupon tests with results of those tests to be reported annually to the Commission's Artesia District Office."

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

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