STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO

28 September 1988

EXAMINER HEARING

IN THE MATTER OF:

Application of Blackwood & Nichols Co., Ltd. for salt water disposal, San Juan County, New Mexico. CASE 9489

BEFORE: Michael E. Stogner, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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I N D E X

WILLIAM F. CLARK

E X H I B I T S

E X H I B I T S Cont'd

MR. STOGNER: Okay, call next Case Number 9489 which is the application of Blackwood and Nichols Company, Limited, for salt water disposal, San Juan County, New Mexico.

At this time I'll call for appearances.

MR. CARR: May it please the Examiner, my name is William F. Carr with the law firm Campbell & Black, P. A., of Santa Fe. We represent Blackwood and Nichols Company, Limited, and I have one witness.

MR. STOGNER: Are there any other appearances in this matter?

Will the witness please stand and be sworn?

(Witness sworn.)

Please continue, Mr. Carr.

WILLIAM F. CLARK,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. CARR:

Q Will you please state your name and place of residence?

A William F. Clark, Durango, Colorado.

Q Mr. Clark, by whom are you employed and in what capacity?

A Blackwood and Nichols Company, Limited, as the Operations Manager.

Q Have you previously testified before this Division and had your credentials accepted and made a matter of record?

A No, I have not.

Q Would you briefly summarize your educational background and then review your work experience for Mr. Stogner?

A I graduated from the Colorado School of Mines in 1977 with a BS degree in petroleum -- and a petroleum engineering degree.

After graduation I worked for one year for Pennzoil Company in their Denver office as a drilling and production engineer.

Then in 1978 I went to work for El Paso Exploration in Farmington as a drilling engineer. After Two years I transferred to the Production Department.

Then in 1984 I went to work for Blackwood and Nichols Company as a petroleum engineer,

responsible for drilling and production activities. In 1986 I became the Operations Manager and look after what needs to be done.

Q Mr. Clark, are you familiar with the application filed in this case on behalf of Blackwood and Nichols?

A Yes, I am.

Q Are you familiar with the subject well?

A Yes, I am.

MR. CARR: We tender Mr. Clark as an expert witness in petroleum engineering.

MR. STOGNER: Mr. Clark is so qualified.

Q Will you briefly state what Blackwood and Nichols seeks with this application?

A Blackwood and Nichols is requesting approval to use the Northeast Blanco Unit No. 206 Well as a produced water disposal well. Basically we want to inject water produced from unit Fruitland coal wells in to the Nacimiento formation.

Q Have you prepared certain exhibits for introduction in this case?

A Yes, we have.

Q Would you refer to what's been marked as Blackwood and Nichols Exhibit Number One, identify this and

then just briefly summarize what it shows?

A Exhibit Number One is the OCD Form C-108, an Application For Authority to Inject, for the No. 206 Well. The formation to be injected into is the Nacimiento at a depth of approximately 1798 to 2250 feet.

The No. 6 Well was drilled in 1981 to be completed in the Pictured Cliff sand zones.

Q And what is the present status of this well?

A Please refer to Exhibit Number Two is a well history which will start in the 108 application as Attachment No. 2.

Briefly summarizing the first three paragraphs, in 1981 the lower, or the main Pictured Cliff sand, was completed and was found to be noncommercial. A subsequent workover operation in 1982 abandoned the lower Pictured Cliff zone and an upper Pictured Cliff tongue was completed; however, this zone has also been found to be noncommercial, illustrated by the fact from 1982 to 1984 this upper Pictured Cliff zone produced less than 28,000 MCF of gas.

In early 1988 Blackwood and Nichols became more interested in developing the Fruitland Coals in the Northeast Blanco Unit. Water disposal methods for the produced coal water were evaluated and we believe there's a

reasonably good possibility that a shallow disposal horizon could be developed and utilized. Towards that end permission to abandon the Upper Pictured Cliff perforations in the No. 206 Well was obtained from the Bureau of Land Management.

In May, 1988 these PC perforations were squeezed off with cement and also isolated with a bridge plug at 2700 feet in the 4-1/2 inch casing.

Then a casing leak from 788 to approximately 1200 feet was found and repaired by squeeze cementing with 300 sacks.

Returning now to the last two paragraphs on Exhibit Two. Next, the Ojo Alamo was perforated with one shot per foot from a gross interval of 2427 to 2536. These perforations were broke down with (unclear) and 500 gallons of 7-1/2 percent hydrochloric acid. The total load on that breakdown job was 84 barrels.

Subsequent swabbing for water samples were primarily on May 16th, 1988, after 112 barrels of load water were recovered, the formation water was analyzed and found to have a 6040 parts per million total dissolved solids.

On May 17th, 1988, a step rate test was performed on the Ojo Alamo formation perforations. This test indicated poor reservoir quality.

On June 20th, 1988, a 4-1/2 inch bridge plug was set at 2370 and the casing did not pressure test.

A casing leak between 76 feet and the surface was found. Then the Nacimiento formation was perforated with two shots per foot from 1798 to 1830, a 32-foot sand. Subsequently, the Nacimiento was swabbed for water samples, which will be presented later.

I'd like to point out two things. The isolation of the Ojo Alamo perforations and the subsequent perforating of the Nacimiento was done with the permission of the BLM and the May 17th step rate test was witnessed by Mr. Ernie Bush of the Aztec District Office. On his suggestion that the water sample and the step rate test information be presented at the upcoming hearing (sic).

Q Now, Mr. Clark, you haven't run a step rate test on the Nacimiento formation, is that correct?

A That is correct.

Q And why is that?

A Let us go to the proposed work and I believe it will be come apparent.

Page 2 of Exhibit Number Two is the proposed work Blackwood and Nichols would do assuming that this application for disposal to inject (sic) is approved.

The first thing we would do would be isolate the Nacimiento perforations with a bridge plug.

We would then repair the shallow surface casing leak with cement and get gasing integrity above the upper perforations.

We would then drill out that bridge plug and then move down the hole and squeeze off the Ojo Alamo formations, the Ojo Alamo perforations, with cement. We will then test that part of the casing below the existing perforations and the Ojo perforations to 1000 pounds and do any remedial work that would be necessary.

We would then perforate the remaining zones as indicated on Exhibit Five in the Nacimiento. We will obtain an additional water sample from all seven zones of the Nacimiento that we would like to inject into. We would break those zones down with acid. We would then do a step rate test, witnesses by the OCD, and we would request that non-run plastic tubing be installed in this well for about 120-day injectivity test and if the well has reasonable capacity, then plastic-lined tubing would be installed.

Now, specifically looking at why we didn't repair the surface casing leak before we perforated the Nacimiento, unless we received OCD approval, we were wanting to minimize our expenses on this well.

If we receive the approval and since we don't have a water sample and we know what we're dealing

with, then Blackwood and Nichols will fix this well up as much as needed to be, because we desperately need this water disposal.

Q Mr. Clark, before you conducted the step rate tests on the Ojo Alamo you did obtain approval from the Aztec Office, is that correct?

A That's correct. As I mentioned before, that test was witnessed by the OCD. Mr. Bush's advice to us was to go into the hearing with that information.

Q Now subsequent to that time it was your understanding, was it not, that the Santa Fe office might prefer that you come before them prior to conducting a step rate test on other formations?

A Yes, that is correct.

Q All right. Would you now refer to Exhibit Number Three, identify this and review it for Mr. Stogner?

A Exhibit Number Three is an area land map which shows the location of the No. 206 Well in Section 10, Township 31 North, Range 7 West, San Juan County, and all the other wells in a 2-mile radius of the subject well. This plat also indicates lease ownership in the area. A circle one-half mile in radius around the subject injection well outlines the area of review.

We apologize that this, in the reproduc-

tion, the 2-miles is not exactly to the south; however, we'll point out on an Exhibit Twelve a similar map covers about 5 or 6 miles to the south, if there is any question. We point out that all that area is within the Northeast Blanco Unit operated by Blackwood and Nichols.

Q And there are no other wells that would be shown if, in fact, this plat did include the additional acreage to the south.

A There are no other shallow wells. There are other producing Mesaverde and Pictured Cliff wells to the south.

Q Will you now identify Blackwood & Nichols Exhibit Number Four?

A Exhibit Number Four is a summation of the wells located within the area of review.

Q Would you review the information on that exhibit?

A We have for each well the well name, the location, the well's current status, its spud date, the completion date, the total depth, the casing and cementing record, where the perforations are, and the stimulation records.

I will point out to you under the common label Casing and Cementing Record on the righthand side of that it says depth of where the casing was cemented or

depth of where the casing was set, and Cement, the volume of cement that was used.

On all the appropriate intermediate strings the -- we show amount of cement used to -- in these operations. Our calculations indicate that the cement top in these wells would be between 1300 and 1700 feet and that it is not likely that these would provide a migration avenue for any injected fluids in the proposed well.

Q Are there any plugged and abandoned wells within the area of review?

A No, there are not.

Q Will you now go to your schematic drawing, Exhibit Number Five, and review that for Mr. Stogner?

A Exhibit Number Five is a wellbore schematic of the No. 206 Well, and as you can see, the Pictured Cliff perforations are squeezed with cement and the Ojo Alamo perforations are isolated with a bridge plug at 2370. Only the uppermost sand in the Nacimiento has been perforated, 1798 to 1830.

If the OCD approved this application then six additional deeper Nacimiento sands will be perforated as indicated -- at the indicated depths.

After the proposed work listed on page 2 of Exhibit Two has been completed, then the 4-1/2 inch by

2-3/8ths inch tubing annulus will be filled with water and corrosion inhibiting chemicals.

Also this annulus will be pressure tested as required by the Federal Underground Injection Control Program and state regulations.

As noted before, Blackwood and Nichols is requesting that initially plastic-lined tubing not be employed for a test period of no more than 150 days. If positive injection results are experienced, then plastic-lined tubing will be installed, and also we will have a packer within 50 feet of the to Nacimiento perforation.

Q What's the thickness of the Nacimiento formation in this are?

A Blackwood and Nichols proposes to inject in the Nacimiento, which is approximately 1055 feet thick as interpreted from the Northeast Blanco Unit No. 64 Well logs. Note: Open hole logs were not run in the No. 206 Well because it is only approximately 200 feet away from the No. 64 Well.

Q And, Mr. Clark, what is the source of the water you propose to inject?

A Produced water from unit Fruitland coal wells will be injecting into the No. 206 Well. Please refer to Exhibit Six. This is an additional attachment in the 108 application.

Item No. 4 is a listing of water analyses on Fruitland Coal Wells that are currently producing in this area. Please note that these water -- this water has an average total dissolved solids of less than 9000 parts per million.

Q And what are you presently doing with this water?

A Currently Blackwood & Nichols is trucking this produced water to the Rea No, 1, a salt water disposal well operated by Tenneco Oil Company in La Plata, Colorado. The Rea Well is over 20 miles away and hauling expenses are significant, in that we're paying approximately $2.00 a barrel for trucking and the disposal fee.

We would anticipate that being able to utilize the subject well as a disposal would drop our costs to less than 25 cents a barrel, which would significantly help us in our Fruitland Coal development program.

Reinjection of this produced Fruitland Coal water into the formation would defeat the purpose of dewatering coalbed methane wells.

Q Now, what volumes do you actually propose to inject?

A We do not know at this time what volumes we'll be injecting because it is uncertain -- there's uncertainty in the receiving capacity of the Nacimiento for-

mation.

Q What would be the maximum daily injection rate that you would propose?

A Blackwood and Nichols propose to inject at the maximum rate that that formation is capable of accepting within the approved pressure limitations. We estimate this will be approximately 1500 barrels of water a day.

Q Now will this be an open or a closed system?

A This will be operated as a closed system.

Q Will you now go through what has been marked as Blackwood & Nichols Company Exhibit Six-A. identify this, and review for the Examiner?

A Exhibit Six-A is a water analysis from the No. 218 Well, which is an open hole Fruitland Coal completion in the Northeast Blanco Unit, approximately 2 miles from the No. 206 Well.

This is typical coal water in that that chlorides are relatively low and the bicarbonates are relatively high. Overall this water is not very nasty and has a total dissolved solids of 86,000 ppm.

Q Now, is injection -- is the injection fluid compatible with the water that exists in the

injection interval?

A Yes. Produced Fruitland Coal water is compatible with the water in the Nacimiento.

Exhibit Number Seven is a water analysis from the Nacimiento Unit No. 206 Well. We do not anticipate any adverse chemical reactions when these waters mix.

Q And this shows a total dissolved solids of 6370?

A That is correct.

Q Now, are the -- are there fresh water zones in this area?

A To my knowledge there are no fresh water zones in this area. Below the Nacimiento we found the Ojo Alamo formation to have a total dissolved solids of 6040 parts per million and this water test is indicated and presented as Exhibit Number Eight.

Q Now when you say there are no fresh water zones in the area, what -- what do you mean when you define fresh water zone?

A Fresh water zones in terms of water wells, horizons that are deeper, that people are getting -- that are pumping are getting water out of and utilizing, and this will be with the State definition of 10,000 less -- 10,000 or less parts per million.

Q Will you now -- have you concluded

Exhibit Number Eight?

A Yes, we have.

Q Are you ready to go to Exhibit Number Nine?

A Actually, we --

Q Or do you first want to discuss the existence of fresh water wells within a mile of the proposed injection area?

A Yes.

Q All right.

A There are no fresh water wells within a mile of the 206. In fact the closest water well is over 6 miles away in Section 12, Township 32 North, Range 7 West, as is shown on Exhibit Number Nine.

This well is approximately 300 feet deep and produces less than a gallon per minute. In the general area north of the No. 6 Well five families live. Two have no wells after several attempts, and others have wells 2-to-300 feet deep and poor producers.

(Unclear) what we're trying to make here is there are no water wells that are -- people are using in the vicinity.

Q About how densely populated is the area around that 206 Well?

A The No. 206 Well is located on Middle

Mesa which is created by Navajo Lake. If you'll look at Exhibit Number Nine you'll see the San Juan arm of the Navajo Lake and the Pine River arm of the Navajo Lake and the 206 Well is quite a ways down the peninsula.

This water well up here would be the closest family that's residing in that area, so you can say this area is remote.

Q Would you now review Exhibits Ten and Eleven with the Examiner?

A Exhibit Ten is an open hole density log from the Northeast (unclear) Unit No. 64, which is located approximately 200 feet to the west of the No. 206 Well.

The perforations and the proposed perforations have been indicated on the righthand side. Altogether there are seven Nacimiento sand intervals, approximatly 132 feet of net sand with an average porosity of 12.5 percent.

Above the Nacimiento formation to at 1355 is the Animas formation. Exhibit Number Eleven is an open hole induction log from the No. 64 Well. Note, there are three large shale sections from 1415 to 1493, a 78-foot shale section; from 1560 to 1622, a 62-foot section; and from 1750 to 1800 feet, a 50-foot shale section, that are above the sand zones that would be receiving injected water. We believe this will be a great benefit in provid-

ing confinement of the water in the injection zones.

Q Mr. Clark, will you to go Exhibit Number 12 and first of all identify what this exhibit is and then review the information contained on the cross section?

A Exhibit Number Twelve is a geologic cross section of the Nacimiento sands in the area of the 206 Well.

Q It is intended to show that the Nacimiento has reasonably good areal extent and should be capable of accepting a significant water volume.

The line A-A' is an east/west cross section. Three main sands, A, B and C, are outlined. The No. 64 Well is indicated, which is the twin to the 206 and we see that these sands terminate a little bit to the west but stay fairly strong heading toward the east.

Then B-B' is a north to south cross section and again we see these sands staying fairly consistent consistent, though some of them tend to start and go.

Q Okay, will you now identify Exhibit Number Thirteen and review that for Mr. Stogner?

A Exhibit Number Thirteen addresses the question of confinement. Since the No. 206 Well is within a few miles of Navajo Lake we wondered how much interval between the Nacimiento sand and the bottom of the lake, or the old river bed, there was.

If we look here on this map we can see this arrow indicates the No. 206 Well and the top of the injection zone is indicated.

Approximately 2-1/2 miles we see the Pine River. From the top of the injected zone to the base of the old river bed there's approximately 1,150 feet of sediments. That's on an east/west structural.

Looking at a north/south structural cross section, we see that from the top of the injection zone in the No. 206 Well, approximately 3 miles to the old San Juan riverbed bottom, we have approximately 1000 feet of sediment.

Q Have you examined the available geologic and engineering data on this area and as the result of that examination have you found any evidence of open faults or other hydrologic connections between the injection zone and any other source of drinking water?

A To my knowledge there are no faults or fracture systems in this area and therefore it is reasonable that this produced injected water will be confined.

Q What is the maximum injection pressure that you propose to use and how should this figure be determined?

A Blackwood and Nichols recommends that a step rate test be performed after all the Nacimiento zones

are perforated. The results of this test will be submitted to the OCD and the formation parting pressure would be the maximum injection pressure.

The standard injection pressure limit of 0;2 psi per foot gives a maximum pressure of 360 psi. We do not have any experience in using the Nacimiento for water disposal so we really do not know what the parting pressure will be.

In summary, Blackwood and Nichols requests the OCD work with us in this matter. We believe there is strong evidence that the well will be confined. Additionally, this is a very remote area and at this depth considering the quality of the water we found in the Nacimiento it is doubtful it would ever be developed.

Q Have you estimated the effect of injecting coal water into this particular formation?

A Yes. Let's assume that we inject 1-million barrels of water. From open hole logs we know the sand zones have a net thickness of 132 feet and an average porosity of 12.5 percent.

Assuming the pore space in the Nacimiento is empty, we we inject 1-million barrels of water, then the radius of the affected area would be 1784 feet, or about a third of a mile. Clearly the Nacimiento pore space is saturated and the actual affected radius of the injec-

tion cannot be calculated without knowing the injection pressures.

Q Mr. Clark, would you identify Exhibits Fourteen, Fifteen and Sixteen for Mr. Stogner?

A Exhibit Fourteen and Fifteen are copies of letters sent to two offset operators, Northwest Pipeline Corporation, and Quinoco Petroleum. These are operators within the area of review. Attached to these letters are the return receipts. These parties have not objected to this application.

Exhibit Number Sixteen is an affidavit of publication in the Farmington Daily Times.

Q In your opinion will granting this application be in the best interest of conservation, the prevention of waste, and the protection of correlative rights?

A Yes, it will.

Q Do you request that the Division expedite its consideration of this application?

A We would greatly appreciate such consideration. The cost of $2.00 per barrel is dry weather cost. We would like to try to finish our work on this 206 before we get into the bad winter weather where we experience much higher water disposal cost.

Q Were Exhibits One through Fifteen pre-

pared by you or compiled under your direction and supervision?

A Yes, they were.

MR. CARR: At this time, Mr. Stogner, we would offer into evidence Blackwood and Nichols Company, Limited, Exhibits One through Fifteen.

MR. STOGNER: Exhibits One through Fifteen will be admitted into evidence.

MR. CARR: And that concludes my direct examination of Mr. Clark. And we also would move admission of Exhibit Sixteen.

MR. STOGNER: Exhibit Sixteen will be admitted.

CROSS EXAMINATION

BY MR. STOGNER:

Q Mr. Clark.

A Yes, sir.

Q Refer to Exhibit Number Nine. In your search for water wells in the area, could you please explain to me a little bit further your search in this area; how it was done?

A Well, we contacted the individual who has the grazing permits on the Middle Mesa and I said, fine, are there are water wells within this area, and he

told me of this one that we've identified and additionally he said there was a 40-foot hand dug well about two miles away from this subject well that's on an old abandoned farm. He's just a long time rancher up there and we're aware that there's no population out there. We're also aware that several years back the Bureau of Land Management attempted to drill a water well for stock and were unsuccessful in the attempt.

Q Did you -- your search take you to the New Mexico engineering -- Engineer's office?

A We did not contact the New Mexico Engineer, no.

Q Why?

A I would have to frankly say that it was overlooked. We felt confident that we know what's out there. The majority of this acreage is BLM and state. There's a few pieces of private land. To our knowledge none of those pieces of private land have water wells, nor do they have full time residents.

Q Isn't this a state park out there by (unclear) also?

A The state park would be indicated by the stippled area. Actually it would be within the stippled area; the stippled area on Exhibit Number Nine is ground which is managed by the Bureau of Reclamation. The -- if

you'd look down over, it says Navajo Dam and then immediately over there you see Pine River Campground and Simms Mesa Campground are the actual state parks.

Q Isn't there a water well at Simms Campground?

A There possibly may be, but I don't believe so. I believe they take their water out -- I know the Pine site marina takes their water out of Navajo Lake and pumps it up onto the top of a tank. They do not to -- I'm aware of a person that lives on the other side of the Pine, perhaps where it says about Lewis Canyon there, and that person has to truck his water to his residence from the marina.

Q In the San Juan Basin area is there not -- is this formation utilized as fresh water very much?

A In this area --

Q I'm talking about the San Juan Basin as a whole.

A I cannot address that. I'm not familiar with the -- it being developed any place as a water resource, but that does not preclude that it is.

Q Okay. Let's talk about the source water. Now, in your Exhibit Number Six you show five wells, is that correct/

A Yes, sir.

Q And are these five wells going to be the only water source for this disposal?

A There will be additional wells producing coal as we get these wells on line. We've drilled two additional wells and they are not producing at this particular time.

We would anticipate that their water analysis would be reasonably similar to what we show in these wells.

Q Okay. How many wells would we be talking about, maximum?

A The maximum number of wells that Blackwood and Nichols could drill on the Middle Mesa (unclear) is approximately 55. Clearly the No. 206 Well is a short term disposal facility for the existing wells plus the additional four wells that we're currently in the process of drilling and completing. We're anticipating drilling more wells next year, where at that time time we will be developing additional water disposal capabilities.

Q Now you said temporary. What do you mean?

A Temporary means in terms of taking care of us through this immediate time, to find out how applicable this zone is to receive water. It's possible if we

have very possible results we'd be back in to drill additional wells to take care of additional development wells.

Q So it's possible that this well can turn from a temporary to a permanent basis, is that correct?

A If I said permanent, I'd like to withdraw that and say that this is -- we would like to use this 206 as a disposal well as long as it meets the OCD standards and regulations, but in terms of temporary as handling our needs right now. Clearly, if we drill 55 wells up there, we will need a much greater water disposal capability and that's what I mean by a more permanent solution, additional wells.

Q Okay, the OCD -- I'm still trying to get temporary here -- the OCD has approved salt water disposal wells down in the southeast, oh, some 35 years ago. Now, they're still disposing. Could 35 years be temporary?

A Again, I withdraw the word "temporary" and say that in terms of the volume this well would handle our immediate needs but as our needs grow we will have to develop more capability. That's the point I'm trying to make; temporary was a poor choice of words.

Yes, we would like this, we'd very much like this to be a permanent installation.

Q Of the five wells that are shown as producing from the coal, which one has produced for the

longest period of time?

A The No. 218 and the No. 212 were drilled and completed in 1985.

The 213, 14 and 15 wells are being completed in '85. Well, I take it all of them were completed at that time, though due to gas marketing situations these wells did not produce much during '86 or '87, but basically all five of those wells were drilled and completed at the same time.

Q Was water -- was a water analysis done to the produced water in the very beginning, at your initial time of production?

A Yes, that's correct and we have not indicated a significant change.

Q And what is not significant?

A Within the realms of the testing. We're basically in the same, you know, like on, say, the 218, we probably have four or five tests on that well and they are all in the neighborhood of this 8-to-9,000 tds. Some have dropped down as low as 8200; some will come up to this 8600. I'm not -- don't recall of one being higher at this particular time.

Q Do you know what the characteristics of water from a coal seam as quality versus time is? As these wells are produced longer and longer periods of time will

we see a sharp increase of dissolved solids?

A Not to my knowledge. I've never heard of that in the literature, and I would also point out that the characteristic of coal wells is as they produce longer and longer they produce less and less water. Initially this No. 218 Well was producing in excess of 300 barrels of water a day, whereas its current production is approximately 50 barrels of water a day.

Q But you don't know if the quality comes down substantially.

A I would assume that the quality would stay at the same and not precipitously go up or down, but again, I don't recall seeing anything in the literature. We haven't experienced it with our wells. The variation in the water disposal, or in tests that we see, I think, is more just due to laboratory variations and with time and the temperature as to where the water samples were recovered from, whether they be from the well flowing or from the separator or from the tank.

Q Okay. Let's look at the No. 14 and the No. 15 -- I'm sorry, 214 Well and the No. 215 Well. There seems to be -- all depends on how you look at it -- some difference between the total dissolved solids, one having 10,000 and the other having a little over 7000.

A Uh-huh. You see, to me it's fairly

clear that the greatest constituent difference is in the bicarbonates, the 214 having 7800 and the 215 having 1790, and so the source gas in the 215 appears to be more, perhaps, on a sandstone nature, whereas, on the 214 it is clearly more of a coal nature with the bicarbonate and the associated CO^2 in the gas flow.

Q Now your bicarbonates as you show here, 7,860, is that apart from any -- what kind of a value is that?

A I believe it says at the top "milligrams per liter".

Q Okay, and when I look over on Exhibit Number Seven, that is your water from your Nacimiento water, I believe that's 275, is that correct?

A Let me find that exhibit and give that to you.

Q I'm going to do some comparisons here --

A Okay.

Q -- so you might as well keep both of them out.

A No, again the question, please?

Q The bicarbonates. One is -- one of your test well -- I mean, I'm sorry, one of your producing wells is up to 7800.

A That's correct.

Q And your -- the water that you'll be injecting into has 275, is that correct?

A That is correct.

Q Let's look at some of the other ones, like your chlorides, your chlorides are up to 3,310 in your No. 215 Well?

A That's correct.

Q What is the chlorides in the --

A It looks like 1917 to me.

Q Oh, that's 1917? It's not 1.917?

A I don't believe that is correct.

Q No, okay. Now there seems to be a substantial difference of, what, about 1500 to 2000?

A Again it's the source of the water, this 215 being more PC oriented, whereas the water in the 206, Nacimiento, is fairly balanced in terms of the sodium and the chlorides, so it has a -- what we would say, a constant level of salt.

And then you move to -- basically you see the same type of comparison between the sodium and the chloride from the 215, 2500 versus 3300, so that's just in the -- to me, not being a chemist, is an indication of the saltiness. We're saying that when you're comparing these, that the water coming out of the 215 is somewhat more salty than the water currently in the 206.

If we look at, like, the 218 Well we see that the water in the 218 is not salty because we don't have both the sodium and the chlorides. We have the sodium coupled with the bicarbonate.

There's a markable difference and it's a very good reservoir identification characteristic, these differences that we're talking about. How high are the bicarbonates, how high are the chlorides?

Q And again I'm going to ask these questions about other chemicals besides total dissolved solids.

Do you know if any one or any group as quality versus time of these coal producing wells, do they vary? What kind of a change do we see? I do know that, like you said, the quantity goes down, but in losig that quantity do we see an increase in these chemicals in the water?

A Not to my knowledge do the salt constituents in the water change as a function of time as we produce the wells.

Additionally, I discussed these waters with the chemist in Durango and that's where I get my basis for the statement of no adverse chemical reaction when the waters mix.

Q Okay, refer to Exhibit Number Four. Let's look at your tops of cement, like you had said, down

in the bottom of this exhibit you show that the top of cement, assuming a 50 percent access, is that your percent still that you assumed in each of these wells?

A That's correct, assuming that your hole capacity was 150 percent from say 1500 feet, your hole capacity for 1500 feet to where the casing was set, multiplied by 50 percent excess, the volume of cement would have brought it up to that 1500 foot cement level, approximately, is the -- is the basis of that statement.

MR. STOGNER: I have no further questions of Mr. Clark.

Are there any other questions of this witness?

MR. CARR: No further questions.

MR. STOVALL: I have a couple questions I'd just like to ask.

CROSS EXAMINATION

BY MR. STOVALL:

Q Have you looked at all at any of the potential for filtering or purifying the water and using surface disposal pits?

A It's our understanding that the water disposal is the most cost effective means of handling the

proposed Fruitland Coal water.

Q Have you ever had any occasion to have any discussions with the Forest Service regarding other operators efforts to dispose of coal water or make it actually useful?

A It's my understanding that that is so energy intensive that a person does a reverse osmosis procedure. We do not feel comfortable with the surface evaporation pits due to our proximity to the Navajo Lake.

Filtering, I believe you're talking reverse osmosis there, which would require electricity in significant volumes. I don't -- am not aware of any other operators that are working with the Fruitland Coal in the San Juan Basin doing that type of handling of the water. I believe both Amoco and Meridian have explored those options and both are now aggressively pursuing water disposal.

MR. STOVALL: Nothing further.

CROSS EXAMINATION

BY MR. STOGNER:

Q You brought up a point. Let's go back on that.

In Mr. Stovall's question, you answered that water disposal by injection was most economical, is that correct?

A That's my understanding, yes, sir, from our calculations, that as opposed to an evaporation pit coupled with the environmental concerns associated with the operation of such pit, and a third option of a reverse osmosis, which would purify the water and then discharge a water of clean enough quality where you could do a surface discharge, clearly the water disposal would be the most economical.

Q Have you looked at any other formations or zones?

A Fortunately or unfortunately the Northeast Blanco Unit is blessed with hydrocarbons in the Pictured Cliff, Mesaverde, and in the Dakota.

To the south of the unit on Exhibit Number Nine, near the Simms Mesa Campground the OCD approved and Blackwood and Nichols has drilled and completed and will soon be finalizing our paperwork to begin injecting in the Northeast Blanco Unit No. 501, a Morrison Entrada salt water disposal well. That will cost us over a million dollars to drill and complete and equip.

The shallow disposal up on Middle Mesa, we felt was worth a try to minimize our costs.

MR. STOGNER: I have no other questions.

Are there any other questions

of Mr. Clark?

If not, he may be excused.

Mr. Carr, do you have anything further?

MR. CARR: Nothing further.

MR. STOGNER: Does anybody else have anything further in Case Number 9489?

The case will be taken under advisement.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C. S. R. DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 9489, heard by me on 28 September 1988.

Examiner
Oil Conservation Division