BEFORE THE

NEW MEXICO OIL CONSERVATION COMMISSION

Santa Fe, New Mexico

February 19, 1969

REGULAR HEARING

IN THE MATTER OF:

Application of Larry C. Squires for an exception to Order No. R-3221, as amended, Lea County, New Mexico.

Case No. 4047

BEFORE: A. L. Porter, Jr., Secretary, Director
Alex J. Armijo, Land Commissioner
George Hatch, Counsel

TRANSCRIPT OF HEARING

MR. PORTER: Case No. 4047.

MR. HATCH: Case 4047, application of Larry C. Squires for an exception to Order No. R-3221, as amended, Lea County, New Mexico.

MR. KELLAHIN: Jason Kellahin, Kellahin and Fox, appearing for the applicant. I would like to ask that this case be continued to the March 19th hearing.

MR. PORTER: Mr. Hatch, do you have any letter of communication from other interested parties?

MR. HATCH: I have a letter from U. S. Potash and Chemical Company from Earl H. Miller, Executive Vice President. I will read part of it. It says:

"U. S. Potash and Chemical Company strongly objects to any approval consideration for Case No. 4047, due to the fact it is imperative in our opinion that additional facts, information, and technical data must be secured concerning the presence of commercial minerals in the Lagoon areas prior to any decision. The additional time of at least one year is respectfully recommended and needed for procurement of facts and data, so this information can be capably evaluated in keeping with proper conservation of potential commercial mineral resources."

And then there is a letter from Jerome D. Matkins, and

there is a letter attached that says:

"Enclosed is the letter of U. S. Potash and Chemical Company which was furnished my client, who is protesting the referenced case. I was requested to forward the letter to you. My clients are protesting the case on substantially the same grounds as U. S. Potash and Chemical Company."

Signed, Jerome D. Matkins.

MR. KELLAHIN: Mr. Matkins advised me that he intended to be present to present testimony in this case, but did ask for a 30-day continuance in an effort to work out our problems. We would appreciate a 30-day continuance, but I would be quite unreasonable to the one-year continuance.

MR. PORTER: The Commission will continue Case 4047 to the Regular Hearing on March 19th. Commissioner Hatch, would you please notify the people who corresponded with us by letter that this action has been taken. I assume Mr. Kellahin will notify his client.

MR. KELLAHIN: I would like to ask Mr. Hatch to also notify the U. S. G. S. office in Carlsbad. I was talking with Mr. Anderson this morning, and I think they are in the case.

MR. PORTER: And possibly the Bureau of Land Management, also.

MR. KELLAHIN: I have already notified them.

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

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

Samuel R. Mortelette
COURT REPORTER

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TRANSCRIPT OF HEARING

MR. HATCH: Case 4047, continued from the February 19, 1969 Regular Hearing, application of Larry C. Squires for an exception to Order No. R-3221, as amended, Lea County, New Mexico.

MR. KELLAHIN: If the Commission please, Jason Kellahin of Kellahin and Fox, appearing for the applicant.

MR. PORTER: At this time, I would like to call for other appearances.

MR. MATKINS: If it please the Commission, I am Jerome D. Matkins of Carlsbad, attorney for protestants, D. S. Harroun, Russel Haworth, and E. W. Douglass.

MR. PORTER: Are there any other appearances to be made in this case? If not, the Commission recognizes the hearing for the applicant.

MR. KELLAHIN: We have two witnesses I would like to have sworn.

MR. PORTER: You have two witnesses?

MR. KELLAHIN: Yes, sir.

MR. PORTER: Let's have those witnesses sworn at the same time.

MR. MATKINS: Do you want to swear my witnesses at this time, also? I have two witnesses, also.

MR. PORTER: We might as well swear them all at once.

(Witnesses sworn.)

MR. KELLAHIN: I would like to call up my first witness, Mr. Larry Squires.

(Whereupon, Applicant's Exhibits Numbers 1, 2, and 3 were marked for identification.)

LARRY C. SQUIRES

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Larry C. Squires.

Q Are you the applicant in Case 4047 presently before the Commission, Mr. Squires?

A Yes, sir.

Q What business are you engaged in?

A I am a veterinarian and a rancher.

Q And in connection with your operations as a rancher, are the lakes which are the subject matter of this application located on your ranch?

A They are located on my family's ranch.

Q And that is the --

A W. M. Snyder Estate.

Q Are you the manager of the W. M. Snyder Estate?

A Yes, sir.

Q Insofar as their ranching operations are concerned?

A General manager over everything.

Q Are you familiar with the area involved in this application, Mr. Squires?

A Yes, I have been familiar with it for quite some time.

Q Just what is it you are proposing to do here?

A Realizing the need for safe, economical, or inexpensive ways to put produced salt water in the area, it seemed to me a logical assumption that the salt lake would be a good place to put it, if it didn't endanger any fresh water supplies.

Of course, being in the ranching business, and we are very cognizant of what water means to us, and we sure don't want to hurt any of it, so I propose to find out or set out to find out if it would, in fact, harm any fresh water reserves in this area, or any other area. And I hired Mr. Ed Reed, a hydrologist from Midland to do some technical work, and give me an opinion on the area, and if there was any water there, and water that we didn't know about. Our water wells have been bad for a number of years, and have been abandoned in this area.

Q Do you presently have any fresh water supply in the vicinity of these lakes?

A No, sir.

Q Have you attempted or has an attempt been made in past years to develop water supplies in the area of these lakes?

A Well, we have some old wells there that were drilled many years ago, that have gone or are bad; and since the Potash Company has laid their water lines, we were able to stop using them. We have got a good water well three miles north of this area that we had piped from our water well down to the house. The house sets right between these two large lakes.

Q It is your testimony that there is no usable water within the vicinity of the lakes?

A No, sir.

Q There are three lakes involved here, Mr. Squires, Laguna Plata, that is being used for water disposal at the present time.

A I understand that National Potash is putting brine in the lake now, yes.

Q And then Laguna Gatuna, that lake is not presently being used, is it?

A Not to my knowledge, no.

Q And then the third lake is Laguna Tonto, a small lake in Township 19 South, Range 33 East. Do you propose to use that lake for water disposal?

A No, I don't think so. It is the smallest of the three lakes, and we don't feel like it would ever be needed.

MR. PORTER: It is the northernmost lake, isn't it?

MR. KELLAHIN: That's correct.

THE WITNESS: Yes, sir.

Q Where will the water you propose to dispose of in these lakes come from, Mr. Squires?

A From produced oil wells in the area. It would be economical to get it there.

Q Would it be your intent to hold this open to any oil company for water disposal?

A Yes, sir, because many of us feel that the water should be put in a natural salt area instead of on the ground, and I think that some area needs to be provided for the oil companies in that area.

Q You are aware, are you not, Mr. Squires, that this Commission has approved continued surface disposal of salt water in the vicinity of Laguna Gatuna?

A Yes, sir, I am aware of this.

Q And you are aware, are you not, that the Commission has removed from the provisions of their salt water disposal order that portion of the land lying to the west of Laguna Plata?

A Yes, sir.

Q And it is not included in the requirements for salt water disposal?

A Yes, sir.

MR. KELLAHIN: That is all I have on direct examination.

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

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Squires, did I understand you to say you didn't propose to use Laguna Tonto?

A Mr. Reed, I think can clarify this better than I can. We decided that it wouldn't really be needed.

Q Now, the application and the advertisement for the case were for the three lakes, Laguna Plata, Laguna Gatuna, and Laguna Tonto, and I was wondering if you were proposing at this time to dismiss the portion of the application and the case relating to Laguna Tonto?

A I just don't feel like we would probably ever use this lake. Mr. Kellahin can sure answer that better than I can.

MR. KELLAHIN: If the Commission please, it is not our intent to abandon our application for approval of the use of Laguna Tonto, although the chances are quite unlikely of it ever

being used. If the Commission wishes to eliminate it, why, there would be no serious objection from us. We did apply for it, however, and we would like to leave it in there.

Q (By Mr. Nutter) In studying the application and being somewhat familiar with the area involved here, I think that Laguna Tonto is structurally somewhat higher than the other two lakes, and it might simplify your case if this one particular lake were not included.

MR. KELLAHIN: I think we will cover that in the other witness's testimony.

A I don't pretend to be an expert on where this water goes, or anything. That is why I have Mr. Reed. He will be here in a minute.

MR. PORTER: Does that conclude your examination of the witness, Mr. Nutter?

MR. NUTTER: Yes, sir.

MR. MATKINS: I have a question or two.

CROSS EXAMINATION

BY MR. MATKINS:

Q Have you entered into any preliminary negotiations with any oil companies at this time to dispose of water on these lakes?

A No, sir.

Q You do not have any notion at this time of the amount of water that might be placed upon these lakes?

A I feel that I have a notion. I feel like it won't be very much.

Q What makes you say that?

A Because there is not much water produced in this area. But I would much prefer that, rather than this water being put on our ranch, it be put in this lake, and there is some being put in an open pit on our ranch adjacent to this one lake, and I think it is far better to put it in this lake than it is to put it in that open pit.

Q Do you feel if there is not much water to be placed on the lake, there is a real need for this additional storage area?

A I think that there is a possibility that there will be a much greater need in the years to come. I don't have a crystal ball.

Q You don't have any fee land within these lakes, do you?

A I do.

Q Which one?

A The one next to the highway, Laguna -- the lake in the middle.

Q Laguna Gatuna?

A Gatuna. It is land that is bought by the W. M. Snyder on a State purchase contract.

Q You have it under purchase contract at this time?

A From the State, yes.

Q The vast majority of this land is either federal or state lease land, isn't that right?

A That's correct.

MR. MATKINS: That is all I have.

MR. PORTER: As I understand, we have three different ownerships in this area, federal, state, and fee.

MR: KELLAHIN: May I ask a couple of questions?

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Squires, have you made application from the Bureau of Land Management for a special use permit for the federal land involved here?

A Yes, I have.

Q And have you made an application to the State of New Mexico, Public Land Commissioner, for a business lease on the State lands located within these lakes?

A Yes, I have.

Q What information did you get from the Bureau of Land Management in regard to your application?

A They told me to go ahead and file a special land use permit. I told them what I wanted to do, and they said that whatever the Oil Conservation Commission said, that it was fine with them.

Q You haven't as yet received the permit, is that correct?

A No, sir, it is pending the outcome of this hearing, as I understand it.

MR. KELLAHIN: That is all.

MR. PORTER: Does anyone else have a question? The witness may be excused.

ED L. REED

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q State your name, please.

A My name is Ed L. Reed.

Q What business are you engaged in, Mr. Reed?

A I am a consulting hydrologist.

Q Where are you located?

A Midland, Texas.

Q Have you done hydrological work in the State of New

Mexico?

A Yes, sir.

Q Have you ever testified before the Oil Conservation Commission of New Mexico, and made your qualifications a matter of record?

A Yes, sir.

MR. KELLAHIN: Would the Commission care to hear the witness's qualifications?

MR. PORTER: The Commission considers Mr. Reed qualified, Mr. Kellahin, since his qualifications have been made a matter of record.

However, if Mr. Matkins would like to question Mr. Reed, why, that is all right.

MR. MATKINS: Is it a matter of having him qualified as an expert in hydrology?

MR. KELLAHIN: That's correct.

MR. MATKINS: I have no objection to that.

Q (By Mr. Kellahin) Mr. Reed, are you familiar with the application of Larry C. Squires in Case 4047 before the Commission at the present time?

A Yes, sir.

Q Have you done some work for Mr. Squires in connection with this application?

A I have.

Q Did you make an investigation of the three lakes involved in this application?

A Yes, I did.

Q Did you personally visit those lakes and make an inspection on the ground?

A Yes, sir.

Q Have you made a study of the subsurface information that is available in this area?

A Yes, I have.

Q Would you state for the Commission just what procedures you followed in making this study?

A Procedures we followed in examining the area of the three salt lakes was, first, to go to the published literature on this area, principally the Bureau of Mines publications in Lea County and Eddy County, produced in cooperation with the United States Geological Survey.

We then went to the well inventory records and maps of the State Engineer's Office in the four townships embraced by these four lakes, and examined the well inventory records, water level measurements, and chemical analysis data, and total depths of wells drilled within the four-township area.

We examined the two topographic quadrangle maps which

cover this area. We secured radiation logs and electrical logs on most of the oil wells that have been drilled in the four-township area; and from this data constructed two contour maps which are presented on one map, the upper one being the top of the Triassic sequence, which had previously been mapped by the U.S.G.S.; and a second contour map on the top of the Rustler, which would, for all practical purposes, be the base of the Triassic sequence.

We made two trips to the field, and examined on the ground in detail the three lakes, walking around substantial portions of the three. In the course of this field investigation, samples of springs were secured, samples of water in the lake, and soil in one of the lakes was secured. Additional water level measurements were made in wells which were still open and could be measured. Two additional water well samples were secured, and analyses made of this data.

Triassic outcrops were examined in Laguna Gatuna, which had not previously been so indicated on the reports in the Lea County Report, which is Report No. 6 of the State Bureau of Mines and Mineral Resources.

Earlier chemical analyses of wells, springs, and surface water which had been secured both by Mr. Kellahin and Mr. Squires were examined, and all of this data has been put on

a map, a composite map reflecting the total knowledge that we have of the geology and the groundwater of this area.

Q Will you have that marked as Exhibit 1, please?

Mr. Reed, directing your attention to Applicant's Exhibit 1, would you identify that exhibit?

A Yes, I will. Exhibit Number 1 is a sectionized map of Townships 19 and 20 South, Ranges 32 and 33 East. On this map, I have shown in blue the outline of the three salt lakes, Laguna Gatuna, Laguna Plata, and Laguna Tonto. A fourth lake which has been filled in, Laguna Toston, is also indicated.

I have shown on the map in yellow, contours reflecting the top of the Triassic; and in the broad dashed lines, contours on the top of the Rustler.

I have posted on the map all of the water wells, and all of the springs which I have any knowledge of, either from personal visits or from inventory records of the State Engineer's Office. I have indicated by a half circle those wells which we think are producing from Quaternary alluvial sediments, as distinguished from wells producing from Triassic sands.

On each of the wells, I have posted all of the data which is available, including the elevation where it is available, the total depth of the well, the water level where

available, and partial chemical analysis where available. Now, I have outlined in blue the water level elevations of those wells producing from Quaternary alluvial sands. I have indicated with red underlying those, water samples which are considered brackish or too high in chlorides or sulfates, or both, to be useful in domestic or stock purposes.

I have indicated in black, the areas of Triassic outcrops, the large one which is at the north side of Laguna Plata, three smaller areas which I have examined on the west side and south side of Laguna Gatuna. Finally, I have indicated with blue areas the general direction of groundwater movement in the shallow Quaternary alluvial sediment as determined from water level data in those wells.

Very briefly, this area is west of the most westerly outcrop of Ogalalla sediments, with the possible exception of an outlayer of Ogalalla to the southeast some several miles. The eastern edge of the -- the western edge of the Ogalalla would be along the so-called Mescalero Ridge at Monument. There are some remnants of Ogalalla material on the west side of Laguna Gatuna above the water table, very thin remnants of Ogalalla material as outlined, but well above the water table.

Groundwater in this area is contained in sediments of two different geological ages. Most of the water is derived,

and most of the potable water is derived from Triassic sands and gravels to depths of 600 or 700 feet below the land surface. In isolated areas, low areas, there are thin sequences of Quaternary alluvial sands above the Triassic, which produce good quality water.

The area structurally is occupied by a broad synclinal trough, as reflected at the top of the Triassic; this being the 3,500-foot contour, the 3,450-foot contour, a broad synclinal area, the lowest part of which is in the area of Laguna Plata, and the other two lakes being in the central portion of what is the regional synclinal area. The Triassic rises significantly to the southeast, culminating in a major northeast-southwest trending ridge, which is off the map, which serves to separate a southeasterly basin hydrologically from groundwater in this area. This northeast-southwest trending ridge extends clear over to the Ogalalla outcrop, and has been described in the U.S.G.S. Bureau of Mines Bulletin.

As far as the area of immediate concern, the area of immediate interest is concerned, the elevation of the Triassic, at least to this point where the Triassic is at an elevation of 3,600 feet, and perhaps to this point --

Q Would you state what point, Mr. Reed?

A The point extending diagonally across the central

portion of 20 South, 33 East, the Triassic would be above the regional water level in the Quaternary alluvial section. This Triassic ridge has had the effect of diverting the movement of water in the Quaternary from what would perhaps be a southerly direction to a southwesterly direction, there being no water over this Triassic ridge, Triassic divide. The general movement of water in the Quaternary section then would be from north to south, to southwest, the direction being diverted by this structural arch. The Rustler or the base of the Triassic dips to the east. The top of the Triassic, of course, is dipping to the west, as I have explained. This results in a divergence of the top of the Triassic, the top of the Rustler sequence going easterly, the interval on the top of the Triassic to the top of the Rustler is of the order of 850 feet on the west side of the area up to 1,400 feet on the east side.

I think this is a little bit more than academic, in that there has been some suggestion that the waters discharging into Laguna Gatuna, for example, might be leaking out of Laguna Gatuna into the Rustler. I think it is significant that Laguna Gatuna is underlain by a slump structure in the Rustler, involving undoubtedly solution of the underlying salado, and collapse of the Rustler sequence, and an overthickening of the Triassic in the same area.

This is a phenomenon that has been observed in other areas. For example, in the Half Way oil fields to the west, I studied slump structure of this same type, somewhat the same magnitude in 1943, where the Triassic has thickened to accommodate an additional thickness or additional elevation resulting from the solution and collapse of the underlying Rustler sequence. This solutioning and collapse of the Rustler would, of necessity, have taken place prior to or during the deposition of the Triassic. We now have in this area some 1,300 feet of Triassic sediment between the surface and the top of the Rustler, with Triassic still outcropping around the margin of Laguna Gatuna, even though there has been substantial solution and slumping of the Rustler.

Q Would that prevent any leaking of the Laguna Gatuna into the Rustler?

A Yes, because of the great thickness of impermeable playas into the Triassic sequence. The three lakes which we are discussing, Laguna Plata, Laguna Tonto, and Laguna Gatuna are true playas in that they are water table lakes, they are areas in which the land surface has been depressed to the point of intersection with the water table, and are receiving groundwater discharge both at the surface and by underflow, and discharging the water by evaporation. They are also

receiving surface water influx, which is discharged by evaporation. These are lakes of interior drainage, and as a result of no significant outlet, have accumulated thicknesses which, as far as I am concerned, of evaporides, particularly gypsum, calcium sulfate, magnesium sulfate, sodium sulfate, and sodium chloride, at least at the surface, of a typical lake deposit, fine-grained, highly organic.

Groundwater is discharging into Laguna Plata from the northeast. We have examined four springs. There are others, smaller ones, but we have examined four springs discharging into the northeast side of Laguna Plata, and we have had these samples analyzed, and the records of analyses will go into the record, by Southwestern Laboratories of Midland. The springs are generally of the same concentration, chlorides of the order of 7,500 to 8,000 parts per million; sulfates, 11,755 to 12,743; high both in chlorides and sulfates.

A shallow well, Well No. 13, on Mr. Squires' land, was drilled some years ago. This well has been abandoned, because it was not potable. We do not have an analysis of it, and it cannot be entered.

A well between Laguna Plata and Laguna Gatuna, Well No. 33, which was drilled to 130 feet, has a chloride concentration of 9,744, a sulfate concentration of 1,878, which would not

be considered potable.

A Triassic well on the northwest side of Laguna Gatuna with a deep water level, a water level of about 250 feet, nevertheless has a high chloride sulfate concentration, chlorides are 21,000 and a little more, the sulfates about 3,900.

There are two springs on the west side of Laguna Gatuna discharging into the lake. One which I have identified as No. 55 has a chloride concentration of 27,657, and sulfate concentration of nearly 38,000.

To the northeast, No. 56, the chlorides are about 11,000, and the sulfates nearly 14,000.

MR. PORTER: Is that a spring?

THE WITNESS: That is a spring. Now, I wish to point out that some of this water in the two springs, and some of the dissolved solids may be derived from a salt water disposal pit, which is situated just to the north and a little west of Spring 56, and which theoretically would seep out of the pipe and move southward toward this little arm or bay of Laguna Gatuna; and it is not possible to determine to what extent this spring flow is derived from the pits, or to what extent it is of consequence, except to say that the sulfate concentration of 37,979 is more than ten times as much as the sulfate concentration in the produced brines in this general field area. Brine in the oil well

to the north has a sulfate concentration of 2,250. Here is one well at 5,500, another oil well with sulfate concentration of 2,600.

MR. PORTER: So all the pit water could do would be to serve to dilute, as far as sulfates are concerned?

THE WITNESS: This is correct. It would also serve to dilute, as far as the chlorides are concerned, because the brines in the salt lake field, based upon the analysis we have, is substantially lower than the chlorides in the springs.

In the Bass No. 1, the chlorides are 6,600, the sulfates are 2,600.

In the Well T-74, which is another spring and can be related directly from the chemical analysis sheet, the chlorides are 5,900, the sulfates are 2,250.

The Well T-73, the chlorides are 6,700, the sulfates are 3,200. This seems to be about an average concentration of the brines in the field that could relate to the quality of water in the spring.

There is another spring on the south side of Laguna Gatuna south of the highway, which was sampled in October of 1968 -- not by me, but analysis furnished to me -- with a chloride concentration of 51,736, the sulfate concentration of 73,590. In attempting to duplicate this and get as near the

same locality as possible, we went into a ravine south of the highway, a tributary to Laguna Gatuna, and on one week in February of this year it was dry. We dug a hole and got very little water, insufficient to sample. We returned a week later and found water in the hole after a rain, which may have contributed some, but obviously not much. We took a sample then from this locality south of the highway, south of the bridge, and in February of this year the chlorides were 163,105, and the sulfates were 24,594. At the same time, a hole was dug north of the highway, north of the bridge, at the early date, and in a sample a week later the chlorides were 12,333, sulfates were 24,273.

We took another sample in February on the other southeast side of the lake, some standing water, the chlorides were 66,600, the sulfates were 29,728.

A sample taken somewhere in the lake -- and I can't give you an exact location for it, I put it in the middle because I don't know precisely where it was taken -- in 1968, had a chloride concentration of 158,000, and a sulfate concentration of 125,000.

Going then to -- well, let me summarize. In the case of Laguna Gatuna, we have Triassic outcrops along the northwest side which I have observed. Incidentally, an oil well at this

point has a water level almost precisely equal in elevation to the top of the Triassic, a very fine alluvial section discharging directly into the lake on top of the Triassic, Triassic outcrops in the west central part of the lake and just south of the spring sample south of the highway. I can't say that there are continuous Triassic outcrops along the west side of the lake, because most of it is covered and cannot be determined except by drilling.

The east side of the lake below the ridge just at the break of the hills coming out of the lake has a deposit of red sands which are derived from the Triassic. I would like to say they are bedded Triassic sands, but they are not. They are reworked Triassic sands. The indication is that the Triassic is near the surface on the east side of the lake, but I could not find any bedded material.

Going on to Laguna Tonto, I found no fresh water springs discharging into Laguna Tonto. Laguna Tonto is a deep lake, a small lake, substantial bluffs around it. There is an area on the northeast side which I walked to, where there are substantial oval travertine deposits situated at an elevation of ten or twelve feet above the present bed of the lake. These travertine deposits are spring deposits; they are evidences of at one time fresh water discharge into the lake at a time when

the water table was at least ten feet, perhaps higher, regionally than it is today.

Examining these travertine deposits would suggest that these springs have not been active for many years, perhaps a hundred years, perhaps longer. However, there are Indian remains around those springs, in further substantiation of the existence of at one time fresh water. This is characteristic that the water table has declined many hundred feet in the last hundred years.

We were not able to get a water sample, because it was just entirely too soft to get out, but we did take a sample of soil in the north part of the lake, and had a one-to-one extract made and analyzed, and in the one-to-one extract of the soil sample, the chlorides were 48,931, sulfates were 37,698. We also collected some samplesof the evaporites, the crystalline deposits that formed as a thin veneer on top of the lake during Triassic periods. These crystals, these evaporite deposits were analyzed with the results showing as a percentage by weight -- these were not corrected for water content, they were high in water content -- by weight, chloride is 4.2 per cent, and sulfates are 29.23 per cent by weight, a very high sulfate-chloride ratio.

The well southeast of Laguna Tonto, 24, has been sampled

twice. In 1965, chlorides were 2,382, and the electric conductivity was 10,175, which would convert to about 9 million parts per million.

The elevation of this lake at the bottom is about 3,525 feet above sea level. This is the highest of the three lakes; Laguna Gatuna being about 3,495, and the other one about 3,431.

The elevation of the groundwater near Well No. 24 is 3,520, which is lower than the bottom of the lake of Laguna Tonto, and would suggest -- in fact, it would strongly indicate, together with the quality of the water in Well 24, that water is escaping by underflow from Laguna Tonto in a southeasterly direction to the area of Well 24. Well 24, on the other hand, is higher than the bottom of Laguna Gatuna, and I have indicated a flow path from Well 24 into Laguna Gatuna.

MR. PORTER: Mr. Reed, your blue arrows indicate the direction of the flow?

THE WITNESS: Yes, sir.

MR. PORTER: Thank you.

THE WITNESS: Likewise for Well 34, the movement would be into Laguna Gatuna. From Well 21, there are three wells, 21, 22, and 23, which have an elevation of 2,541, fairly high, and does not quite fit the Triassic contouring, and I can't

resolve the question, so I left it alone.

Water is moving northward into Laguna Gatuna from the high point southwest of Laguna Gatuna Well No. 18, at an elevation of 2,538. The movement is northeasterly into Laguna Gatuna.

The wells at Half Way Bar are alluvial wells and extremely good quality. Chlorides are 85, the sulfates are 82. The water level is 3,516, as compared to our estimate of 3,495, or very close to it. These are not surveyed elevations. They have been taken from the topographic map. But it is evidence that water has never leaked out of Laguna Gatuna into the area of Well 17.

West of Well 18, the movement is probably regional to the west or southwest. There appears to be no flow across between Laguna Gatuna and Laguna Plata, as I once thought when I first started this investigation.

In summary, it is my opinion that the three salt lakes are three playas, into which both groundwater and surface water has discharged for thousands of years into the lake area. Wind action has continued to keep the surface elevation of these lakes within a very narrow limit of the elevation of the water table, by wind action in piling up of the debris on the eastern side with the characteristic dunes formed on the eastern side

of the lakes.

As the water table has risen or fallen, the lake bed has risen or fallen in accordance, except for Laguna Toston, which is a fossil playa lake. It has finally caught up and is being filled up.

It is my judgment that with the exception of Laguna Tonto, and with the possible exception of the west side of Laguna Plata, for which we have no data, the movement of water is into the lakes rather than away from the lakes.

It would be my judgment that it would be acceptable, and that no damage would occur to the quality of groundwater presently existing in the area to use Laguna Gatuna and Laguna Plata for salt water disposal; and Laguna Tonto, in my judgment, could be used since the movement, in my opinion, toward Laguna Gatuna in Well No. 24 is already high. But it is a small lake, about a quarter-section, a very deep one, and my client advises that he would not insist on this one being included.

MR. PORTER: Are these relatively deep lakes?

THE WITNESS: They are relatively deep. Water levels in the Triassic are substantially lower than the water levels in the Quaternary. The Triassic water is under artesian conditions, that is to say, it has a pressure exerted on it, as opposed to the Quaternary water which is under water table

conditions or conditions of gravity.

There is adequate thicknesses of clays, of an impermeable nature to isolate the alluvial water completely from the Triassic water, except or unless a well is drilled through both zones, with the upper zones remaining open. In this instance, with the Quaternary water having a higher head, the interchange would be from the Quaternary down to the Triassic.

It is my opinion that the use of these lakes in the disposal of oil field brine would be preferable to the use of salt water disposal pits on the lands; even in areas where locally there is no Quaternary water because there are patches of Quaternary water, such as the one at Half Way Back, which is this one, and this one here, and possibly one up in here, which would contain a good quality water, and into which water seeping down to the top of the Triassic, in finding no home, will continue to move in response to the topography of the Triassic surface until it reaches the groundwater.

MR. PORTER: Mr. Reed, in this exhibit there is a well located here, I believe. What is that, Section 21?

THE WITNESS: Yes.

MR. PORTER: In the northwest part of that section?

THE WITNESS: Yes.

MR. PORTER: The analysis of which shows 3,518 parts

per million of chlorides, and sulfates 905?

THE WITNESS: Yes, sir.

MR. PORTER: Do you have any idea why that well would have that higher chloride content?

THE WITNESS: I suspect it is in response to this general circulation of water from Tonto into Laguna.

MR. PORTER: You think it would be the influence of Tonto, perhaps?

THE WITNESS: Perhaps.

MR. PORTER: That would be a possibility?

THE WITNESS: Yes.

MR. PORTER: But the direction of flow here is into Laguna.

Q (By Mr. Kellahin) Mr. Reed, in examining this area, to sum this up, the only fresh water you found in the area is that lying south of the highway, is that correct?

A In the Quaternary?

Q Yes. Did you find any fresh water, also, in the Quaternary?

A Well 14, is north of the highway, and it is about what Midland used to drink when they used to complain, but it is acceptable.

Q Where is that located?

A Section 23, 20 South, 32.

Q Would the use of these lakes for salt water disposal have any effect on this salt water supply?

A In my opinion, it would not.

Q Would the use of these lakes have any effect on any fresh water supply in the vicinity?

A In my opinion, it would not.

Q What volume of water do you feel could safely be discharged into these lakes?

A Mr. Kellahin, in view of the fact that there has been no mention of a volume of water available to put into these lakes, and because Laguna Plata is so large, something more than 1,200 acres, I have not made a detailed study as to the potential maximum amount that any one lake could accept.

I have determined the area of Laguna Gatuna and Laguna Plata, and those numbers look like this. Laguna Gatuna has approximately 383 acres within the lowest closing contour. Laguna Plata has 1,241 acres within the lowest closing contour.

I believe in the case of Lane Lake in northwest Lea County, detailed studies of this lake were made, indicating that volumes, as I recall, up to 30,000 barrels per day could safely be disposed. Lane Lake is slightly smaller than Laguna Gatuna. The evaporite is slightly lower at Lane Lake than in Laguna Gatuna,

so I would say that within the limits of a foot of impounded water, the same maximum limits would apply to Laguna Gatuna, in the order of 30,000 barrels per day.

Laguna Plata, I haven't made an effort to calculate, because I should think it's safe rate would exceed the total volume of water that could conceivably be transported into this area.

Q In connection with the presentation of the case in Lane Lake, you recommended that observation wells be drilled at certain points around the lake to determine the effect of water disposal there. Do you feel that that is necessary in this case?

A Not really. Well, let me modify that. I think the necessity for a monitor hole or holes, assuming we are speaking only of Laguna Gatuna and Laguna Plata, necessity would be remote in the case of Laguna Plata. It would be my judgment that it would be desirable in the case of Laguna Gatuna, only if the discharge volumes would approach something like half of the suggested maximum rate, or 15,000 barrels per day. There is so much evidence of Triassic cutoff on the south and west side of Laguna Gatuna, there seems to be such a distinct possibility which has not been defined, and can't be without extensive core drilling, of a continuous Triassic ridge along the west side of

Laguna Gatuna. It would take very little imagination to connect the three outcrop areas up. I have not done it, because I am not certain of it.

But with the relative elevations of the groundwater in Laguna Gatuna and out spring discharges both from the south and from the west, I think the necessity of a monitor hole would not make itself known until substantial quantity of water were put into the lake, sufficient to raise the level of the lake four to six inches across the entire 370 acres. At that point, I think it might be desirable.

MR. PORTER: That is in relation to Laguna Gatuna?

THE WITNESS: Yes, sir.

Q In your testimony you have used some water analyses. Do you have those available?

A I do, yes. These are copies of all of the analyses that have been used, with the exception of the analyses that have been taken directly from a map prepared by the State Engineer's Office, from their records, and which is titled, Well Location, Well Depth, Depth to Water, and Chemical Quality of Water, Capitan Underground Water Basin, Lea and Eddy Counties, New Mexico, sheet 2 of 6, by the State Engineer's Office.

For the record, I have also used in the preparation of this map, the quadrangle Laguna Gatuna, New Mexico, 1963, and

the Clayton Basin, New Mexico, quadrangle, 1944, both at a scale of 1 to 62,500.

Q The maps to which you referred are presently here and available for inspection?

A Yes, sir.

Q I hand you what has been marked as Applicant's Exhibit Number 2, will you identify that, please.

A Applicant's Exhibit Number 2 is a series of 13 water and soil samples collected by my office, and analyzed by Southwestern Laboratories of Midland.

Q Are those the analyses you used in the preparation of Exhibit Number 1?

A Yes, sir.

Q I hand you what has been marked as Exhibit Number 3, and ask you to identify that, please.

A These are analyses of five water wells and springs, or surface samples; and six brines from six oil wells in the salt lake field, prepared by United Chemical Corporation and used in the preparation of the map.

Q Was Exhibit Number 1 prepared by you or under your supervision?

A Yes.

MR. KELLAHIN: At this time, I would like to offer in

evidence Exhibits 1, 2, and 3.

MR. PORTER: If there is no objection, the exhibits will be admitted.

(Whereupon, Applicant's Exhibits Numbers 1, 2, and 3 were admitted in evidence.)

MR. KELLAHIN: That completes the direct examination of the witness.

CROSS EXAMINATION

BY MR. PORTER:

Q Now, I would assume from your testimony here, Mr. Reed, that it is your opinion that just about 100 per cent of the water that goes into Laguna Gatuna goes out by evaporation?

A Yes, sir.

Q There is no other outlet?

A That's correct, yes.

Q Now, over in Laguna Plata, at the time you were making your examinations, did you find any water being discharged into that lake from National Potash Mine?

A I did not go to the west side of Laguna Plata, which I understand is the point that water is being introduced. I did not see it, no, sir.

Q And you say there is a possibility that the water from the west side of that lake might flow west?

A I just leave that as an open question.

Q You don't have information on it?

A No, sir.

MR. PORTER: Mr. Matkins, do you wish to examine?

MR. MATKINS: No, I have no further questions.

MR. PORTER: Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Reed, your map specifically identifies the water levels, and you have discussed them in considerable detail of the Quaternary wells. However, there are some Triassic water wells in the area also?

A Yes, sir.

Q Now, what is the source bed of the water in the Triassic beds in the area?

A The source of the water?

Q What sands or what zone produces this water?

A I suspect from the well records, there are several different zones. They might be lumped either as Santa Rosa equivalent or younger. I think there are probably shallower sands than the so-called Santa Rosa, if it can be identified over here and I rather think it can.

Q Now, the Triassic beds also include some non-permeable

clays, and things like this, don't they?

A For the most part, it is composed of non-permeable.

Q So then you would have maybe a streak of permeable sand, which would be carrying the water where you have water wells?

A Yes, sir. This is the reason for the Artesian head upon the Triassic sands. Each of these individual sand beds are overlain by impermeable red clays, which hold the water in under pressure, and the intake obviously is at some higher elevation.

Q Why is it that you believe that the water that is discharged into these lakes leaves only by means of evaporation, and doesn't flow out through the bottom of the lake or into the Triassic beds?

A Principally because the Triassic, at least in the outcrop, is quite impermeable. It is a red or gray clay, and a well drilled immediately on the west side of Laguna Gatuna found it necessary to go about 400 feet to get any water. As a matter of fact, it went 450 feet.

Q We take the difference between the two contour lines that you have drawn on your map, and we find that the Triassic bed would run anywhere from 850 to 1,000 feet thick.

A 1,400 feet on the east side.

Q Just in the vicinity of the two lakes?

A That's correct.

Q And so you would have approximately 1,000 feet, then, of impermeable clays or impermeable Triassic rocks, interlaced with possible aquifers containing Triassic water?

A That's correct, yes, sir.

Q On Plate 2 in Groundwater Report, Nicholson and Clebsch, shows a definite depression in the asymptomatic table there for the Triassic water, and then they theorize on page 57 of that report that there may be some enhanced verticle permeability because of this slumping, and you showed the slumping underneath Laguna Gatuna, and they think there is a possibility that the water discharged into this area does permeate downward into the Permian rocks.

What is your theory on this feeling?

A Well, in examining the logs, and I can't tell from their report, and I am not remembering the date of the drilling of these wells, but I rather think that there is some data available today that was not available at that time, showing the magnitude of the slumping of the Rustler under Laguna Gatuna. There have been wells drilled out in the lake that reflect this over-thickening of the Triassic sequence.

This is not greatly unlike the problem on the Colorado

River where it was postulated that because of faulting involving Triassic beds, salt water was moving upward along fault plains and escaping into the Colorado River.

It is my personal opinion that the Triassic, made up as it is primarily of extra-fine grained clays, there was very low permeability in the clays and relatively permeability in the sands, and are incompetent to maintain porosity, either by fracturing or by faulting.

I would also like to say that the chances of faulting occurring with respect to the slumping under Laguna Gatuna, in my judgment, are quite remote. In examining the structure of Rustler Hills in Eddy County, which is a similar product but where we can examine the Rustler at the surface, and examine the manner in which the Rustler responded to solution in slumping, it is quite evident that that took place at a time when there was a substantial amount of overburden; because the Rustler, rather than being fractured and faulted, is folded into structures upward of 45 degrees of depth. I think this of necessity would involve a massive amount of overburden. Very little faulting is exhibited in the competent and brittle Rustler dolamite.

I think here we have the same phenomena occurring essentially at the same time, and a thickening of the Triassic sequence over this slumped structure. Even though there may have been continued movement throughout the deposition of the Triassic, this movement would have been reflected by solid flow, rather than by faulting in the Triassic, or if it were faulted, it would seal itself up.

Q In other words, if you feel that the Triassic beds are incompetent to maintain porosity as a result of any slumping or faulting, that would also hold true for permeability? You feel that the beds would be incompetent to maintain permeability?

A That would be my opinion.

Q You don't ascribe to the theory that the movement would be downward into the Permian rocks?

A No, sir.

Q And all the outlet would have to be by means of evaporation?

A Yes, sir.

Q As far as we know the direction of movement with respect to Laguna Gatuna, we have some springs which would indicate the flow from the east side into the lake, and you don't have knowledge of the direction of flow on the south, west, or north side of the lake?

A It would be the other way around then. We have springs on the west side of the lake.

Q I am talking about Laguna Plata. You have springs on the east side there?

A That's correct.

Q And we don't have knowledge of the flow from the north, west or south?

A Except that there is a massive outcrop of Triassic on the north, which presumably would eliminate any flow in the Quaternary; and the U.S.G.S. did not indicate any springs on the topographic maps, other than three of the four that I have identified on the northeast side.

Now, this is not to say they are not there, because, as I recall, they did not indicate springs in the Laguna Gatuna, and these are rather small ones, and you would not be impressed by their size. The springs on the northeast side of Laguna Plata are substantial springs, flowing upwards perhaps five or six gallons per minute.

Q They are seeps, then?

A They are more than seeps. They are flowing into the lake bottom in rivulets carved into the evaporide sequence. The U.S.G.S. chose to identify these springs and show them on the maps. We simply verified their existence, and added one or two

to them, and took their samples.

Q Is there any evidence of Triassic formation on the south and southeast side of Laguna Plata?

A Not that I can identify, no, sir. I will have to say I didn't walk all that out.

Q That is a good-size lake?

A It really is.

Q Generally speaking, Mr. Reed, don't the surface contours follow the contours of your Triassic beds shown in yellow on your Exhibit 1? Just generally speaking, isn't the surface contour pretty much reflected by the Triassic contour?

A Yes, sir.

Q There is another depression to the west of here known as Williams Sink. Are you generally familiar with Williams Sink?

A Excuse me, Mr. Nutter, let me see if I can find it and see if I am familiar with it. By that name, I think I am not. I have not been to Williams Sink. We have been to Laguna Toston. We have not been to Williams Sink.

Q Well, the general surface contours here, this is the head, so to speak, of a cynclinal feature that flows to the west and on over into the Pecos River Valley, and what I was concerned with was if the outlet here to the Laguna Plata would be westward?

In response to a question by Mr. Porter, you didn't know just what the situation is on the west, and I was wondering if there would be a connection then from Laguna Plata westward into Williams Sink, and thence on down into the Pecos River Valley?

A Mr. Nutter, I can't answer that question. I don't know.

Q But the only evidence you do know of of Triassic beds around Laguna Plata would be those beds you show on your map on the north side?

A That's correct.

MR. NUTTER: I believe that is all.

MR. PORTER: Mr. Reed, did you have occasion to observe whether or not the west side of Laguna Plata, that is the base of the lake, was higher than the east side?

THE WITNESS: No. Let me see what the map reflects. I have not examined that precisely, no, sir. There is an elevation at the northwest corner of Section 10, 20 South, 32, of 3,431. And there is an elevation of a drill hole in the north center of the northwest quarter of Section 11 to the southeast, of 3,433, which is two feet higher.

MR. PORTER: So it is relatively level, apparently?

THE WITNESS: Yes, sir. And a little bit lower on the west, but essentially level.

MR. PORTER: Let's take a ten-minute recess.

MR. KELLAHIN: I want to ask one question, and perhaps we will be through with Mr. Reed.

MR. PORTER: Does anyone else have any questions of this witness?

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Reed, in connection with the question on the west side of Laguna Plata, did you take into consideration the fact that this Commission granted an areawide exception to the provisions of the salt water disposal Order R-3221, in considering the situation over there?

A I did.

Q Was that the reason you did not make an inspection of the west side of the lake?

A It is.

MR. KELLAHIN: If the Commission please, I would like the Commission to take notice of its own order which granted an exception on the Order R-3221, to the area immediately west of Laguna Plata.

MR. PORTER: The Commission will take administrative notice of that order.

Are there any further questions of this witness?

RECROSS EXAMINATION

BY MR. UTZ:

Q Mr. Reed, it is my understanding that your testimony was that there is some leakage from Laguna Tonto, which comes south and eventually ends up in Laguna Gatuna. Now, if there were surface disposal in the area of Sections 9, 10, 15, and 16, and 20 South and 33 East, would it be your opinion that that surface water would eventually find its way into Laguna Gatuna?

A Yes, sir.

MR. UTZ: That is all I have.

MR. PORTER: If there are no further questions, the witness may be excused, and we will take a ten-minute recess.

(Thereupon, a recess was taken.)

MR. PORTER: The hearing will come to order, please. The Commission will recognize Mr. Kellahin.

MR. KELLAHIN: If the Commission please, that completes our direct testimony in the application of Larry Squires. We may have some additional testimony to offer after the presentation of the other side, and the objections.

MR. PORTER: You will have the privilege of recalling the witness, if you feel it is necessary.

Mr. Matkins.

MR. MATKINS: Thank you. Mr. Harroun, would you take

the stand, please.

DANIEL S. HARROUN

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

DIRECT EXAMINATION

BY MR. MATKINS:

Q State your name and residence, please.

A Daniel S. Harroun, Carlsbad, New Mexico.

Q Mr. Harroun, are you in connection with the joint ownership of Mr. Russel Haworth, and individually owner of certain federal and state potasium leases and prospecting permits, and applications for potasium leases, both with the Bureau of Land Management and the State of New Mexico?

A Yes, sir.

Q And included in these leases, applications, and permits, are any of the lands covered by these leases in these three lakes which the applicant is applying to deposit water?

A Yes, sir.

Q Could you tell the Commission the lease number, and what section is involved in the Laguna Plata?

A In Laguna Plata, potasium lease 013298-D, Section 11, all of Section 11.

Q Do you have some applications for federal leases

relating to the lands covered by the Laguna Gatuna?

A Yes, sir.

Q What sections are covered by that?

A That is in Section 18, the northeast quarter, and the north half of the southeast quarter; and in Section 11, the northwest quarter, the south half of the northwest quarter, Township 20 South, Range 33 East.

Q Do you have both a lease and a prospecting permit covering lands under Laguna Tonto?

A Yes, sir.

Q And what are those?

A Lease number, New Mexico 013298-A, Section 5, Township 20 South, Range 33 East. And prospecting permit, New Mexico 3232, Section 33, Township 19 South, Range 33 East.

Q Now, is it your hope and intention from these leases and other leases which you own, to produce potasium and related products from these lands?

A Yes, sir.

Q And in connection with that desire, have you consulted with Mr. D. W. Douglass respecting a process whereby the grade of ore in these leases might be commercially produced?

A Yes, sir.

Q And in connection with his furnishing you with this

process, have you, subject to the approval of governmental agencies, agreed to allow Mr. Douglass, if he finds sodium and sodium salts in commercial quantities, to produce these products from these leases?

A Yes, sir.

MR. MATKINS: I have no further questions.

MR. PORTER: Does anyone have a question of Mr. Harroun?

CROSS EXAMINATION

BY MR. KELLAHIN:

Q As I understand, you hold potasium leases under the federal leases, is that correct?

A Yes, sir.

Q Is that lease on the form similiar, the same as that?

A Yes, sir, I believe so. I don't have a copy of the lease with me. They are fairly old leases.

MR. KELLAHIN: I would like to have this marked as Exhibit Number 4.

(Whereupon, Applicant's Exhibit Number 4 was marked for identification.)

Q Now, Mr. Harroun, directing your attention to Applicant's Exhibit Number 4, and particularly with reference to Section 1 of that lease form, do your leases cover anything

besides potash, disposal of all the potasium and associated deposits hereinafter referred to as lease deposits in and upon -- now, as I understand from your testimony, you are interested in sodium sulfate?

A Yes, sir.

MR. KELLAHIN: I would like to offer in evidence Exhibit Number 4.

MR. PORTER: If there is no objection, the exhibit will be admitted.

(Whereupon, Applicant's Exhibit Number 4 was admitted into evidence.)

Q You don't hold a sodium sulfate lease on any of this land?

A No, sir, potasium leases.

Q And associated deposits?

A And associated deposits.

Q Would the sodium sulfate with which you are concerned be associated with potasium?

A We believe so, yes.

Q You would believe so. Can you describe just how it is associated?

A We acquired our leases, the majority of them, from International Minerals. Mr. Douglass had tried to get

International to cooperate in the production of sodium. A hearing was held, International opposed it, it was carried to the Secretary, and Mr. Douglass was turned down on this very same matter.

Q He was applying for sodium sulfate leases, and they were denied?

A They were denied, that's right.

Q Then an appeal was taken to the Secretary, is that your testimony?

A Yes, sir.

Q And the denial was upheld by the Secretary?

A Yes, sir.

Q I have just one other question, Mr. Harroun. I didn't quite get your testimony in regard to your ownership in Laguna Tonto. Did I understand you to say you had Section 5 in 20 South, 33 East?

A Yes, sir.

Q And that doesn't lie within Laguna Tonto, does it? It touches on the border of it?

A It is close to it, yes.

Q You have also Section 4, do you not, or a portion of it?

A I will have to look at my map.

We have in Section 4 under a potasium prospecting permit, we have the north half of the northeast quarter, in the southeast quarter of the northeast quarter, and the -- let's see, the northeast quarter of the southwest quarter.

Q And that would not touch the lake at all, would it?

A No, sir.

Q You have, as I understand it, you have Sections 32 and 33, or the greater portion thereof, in 19 South, 33 East, is that right?

A 19-33?

Q Yes.

A Which --

Q Sections 32 and 33.

A Section 32, we have under a state lease.

Q Under a state lease?

A Yes, sir. And Section 33, we have all but 80 acres under a prospecting permit.

Q Under Laguna Gatuna, do you have leases covering substantially all of the lake bed?

A We have an application for a lease there.

Q You do not have a lease there, do you?

A No, sir.

Q You have no leases which would affect Laguna Gatuna at

the present time as to the lake bed, I am talking about.

A None other than this application for a lease.

Q So Laguna Plata, I believe you testified, covered Section 11 in 32 -- 20 South, 32 East?

A Yes, sir.

MR. KELLAHIN: That is all I have.

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

E. W. DOUGLASS

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

DIRECT EXAMINATION

BY MR. MATKINS:

Q Would you state your name and address, please?

A My name is E. W. Douglass. I live at 1113 Tracy Place, in Carlsbad, New Mexico.

Q What is your occupation?

A I am a chemical engineer.

Q How long have you been a chemical engineer?

A Since 1928, I guess.

Q What formal training have you had and education to qualify you for your profession?

A I have a degree in Chemical Engineering from what is now

Iowa University.

Q And when did you obtain that degree?

A In 1928.

Q What type of work have you done in your profession, and what types of companies have you worked for?

A All of my experience from the time I took my first job until the present time have been with soluble salts, sodium potasium, magnesium, and with the chlorides, sulfates, and nitrates of those salts.

Q Have you developed any process for developing or producing these salts?

A Yes, I have. My first experience in Chile, I was able to develop a process there for the graining of their sodium nitrate. When I came back to the States after four years with them, I went with the Ozark Mahoning Company, and did practically all of the development work on their plant and process at Monahans, Texas. I was with Ozark Mahoning for about ten years, and from there I went to the Potash Company of America, and was their Research Director until about 1955. I have been doing independent consulting work since that time.

Q Did you have any patents issued in your name?

A I imagine that there are at least ten or twelve patents covering various processes relating to the salt and the processing

of salts.

Q Specifically, Mr. Douglass, what experience and background have you had in the development and production of sodium sulfate?

A Well, with the Ozark Mahoning Company, of course, I was their only chemical engineer in the development of the process that they are using at Monahans, Texas, now. That same process has been transferred almost as designed to their plants at Seagraves, and also near Brownfield, Texas.

While I was with Ozark Mahoning, too, we also put into operation a plant for production of potasium sulfate by the reaction of salt and sulfuric acid, which later was converted to a plant to produce potasium sulfate.

Q Have you been called upon to investigate possible sources of sodium sulfate?

A While I was with the Ozark Mahoning Company, I investigated a great number of lakes in West Texas, some in Wyoming, and some in North Dakota, for the Ozark Mahoning Company.

On the Cedar Lake area, they have a plant now. The Brownfield area, I didn't investigate when I was with them.

Q Have you had some prior experience with attempts to produce sodium sulfate from the areas affected by this application?

A I have taken a number of samples from the area out there, and have convinced myself that there are processable brines there. The extent of these processable brines, I am not able to tell at the present time because there hasn't been extensive enough drilling.

Q Going back before that, my question was directed to your attempts to obtain sodium leases. Did you attempt to do this some years ago?

A In 1958, I made application for sodium prospecting permits for the area in and surrounding these lakes that I thought probably contained processable brines.

Q Were these applications made with the Bureau of Land Management of the Department of Interior?

A They were made with the Bureau of Land Management, because the major portion of the land in and around the lakes was held by the Bureau of Land Management. There is some State land there, of course.

Q Was there a protest made of your application?

A Yes, there was a protest made of my application by the National Minerals and Chemical Company, who held leases, potash leases in the area. The other chemical companies did not make any protest.

Q What was the basis of their protest?

A The basis of their protest is that they were the potash -- the sodium sulfate was related to the potash in that area, and that they held the sodium sulfate rights, as well as the potash rights in the area.

Q And who prevailed in this contest?

A I assume they did, because I was turned down by the Secretary of Interior. I made an appeal to the Secretary of Interior on the basis that these salts were not associated with the potash, but the Secretary of Interior turned it down, and it must have been on the basis that they belonged to the Potash Company, who held the potash lease.

Q And these are the leases which have subsequently been assigned to Harroun and Haworth?

A These are the leases that have later been assigned to Harroun and Haworth.

Q They are now in the position that International Minerals and Chemicals Corporation was in?

A They hold the leases exactly the same as International Minerals and Chemicals did at that time.

Q Mr. Douglass, you indicated that you have taken samples; have you taken recent samples to test for sodium sulfate from these areas?

A The last samples I took were on the 27th of January

past.

Q And where were these samples taken?

A I took a sample from Tonto from 18 inches under the surface; and I took a sample from a seep or spring in the lake bed at the west end of Lake Plata. Both of those are processable brines by direct chilling operations, as are used in the Monahans plant.

Q Tell the Commission how you take these samples, and how you test them for the presence of sodium sulfate?

A These two samples, I simply dug down to a depth of 18 inches in Tonto and took the water that seeped into the hole at that depth; and a sample from the seep was taken essentially at the surface. It was pretty muddy getting out there, but I took a sample.

Now, these two samples, I did nothing more than put them in my refrigerator, and to determine the depth of sodium sulfate crystals that were produced from the chilling operation there. Now, over the past years, I have chilled enough samples that way that I can recognize a commercial yield of sodium sulfate.

Q And what were the results of these two samples?

A These two samples when chilled gave a crystal depth of three-quarters of the depth of the total solution. Now,

sodium sulfate, of course, is a hydrate of sodium sulfate, and gives a very substantial crystal volume.

Q In your experience, did these results warrant, in your judgment, additional testing to determine if there is sodium sulfate in commercial quantities in these lakes?

A Well, yes. But prior to this, I have taken a number of samples that have been analyzed chemically, and they have all been taken from the lake beds, and been taken from all three lakes, and they show from ten to twelve per cent of sodium sulfate.

Of course, these units are present in the brine as ions, and are not associated; and depending on your method of calculation, and the method to which you might use in treating the brine, the total sulfate may or may not be calculated as sodium sulfate.

But in calculating the total sulfate as sodium sulfate, the brines run from ten to thirteen per cent of sodium sulfate, which is processable sodium sulfate. The plant at Monahans, Texas, is now operating on brines of the order of seven per cent sodium sulfate. I still have a little stock in Ozark Mahoning, so I have access to some of their records.

Q What needs to be done now to determine if the sodium sulfate is there in commercial quantities?

A The completion of the legal details necessary to allow someone to go in and do the sampling to determine the quantities of available brines in the area.

Q How is this sampling done?

A It will be done probably with churn-drilled holes to a depth of perhaps 200 or 300 feet.

Q And what would you consider to be commercial quantities of brine?

A Well, I have made an estimate, that if there is a column of as much as ten feet of brine over a square mile that is ten per cent sodium sulfate, that it represents approximately one million tons of sodium sulfate per square mile. And the lake beds, themselves, are approximately three square miles, so there is a possibility of three million tons of sodium sulfate, if we can develop only a porosity sufficient to develop a column of brine ten feet deep.

And at the very minimum selling price of sodium sulfate, it would represent something like $45,000,000 worth of sodium sulfate, assuming that there is that much there. Of course, we don't know how much is there at the present time, but it certainly shouldn't be overlooked.

Q How much time, in your judgment, would be required to make the determination as to the existence of commercial

quantities?

A I think this could easily be done within a year's time, after the go-ahead to do the investigation.

Q You were present, were you not, when Mr. Reed testified on behalf of the applicant in this hearing?

A Yes.

Q Was there anything in his testimony which would alter your opinion or support your opinion as to the existence of sodium sulfate?

A I think it would support my opinion as to the existence of sodium sulfate. He had indicated not only the sodium sulfate within the lake beds, but also the migrating sodium sulfate from one lake bed to another, which represents areas outside the lake beds, and this is certainly true in other areas.

At Monahans, Texas, most of the sodium sulfate that has been produced there has been produced from wells that have been well outside the little lake bed that they have there.

Q Mr. Douglass, did you hear Mr. Reed's testimony to the fact that in his judgment any water produced in connection with oil and gas production, and dumped on these lakes would evaporate? Did you hear that testimony?

A Yes. Would you like me to comment on it?

Q My question is: if that is true, in what manner would

the disposal of this water on the lakes damage the production of sodium sulfate or the testing for sodium sulfate?

A At the present time, I think any water that was put on the surface of the lakes would evaporate and simply leave sulfate there, because the water table is at the surface of the lakes. But I think, as soon as you went in to produce sodium sulfate from the area, that you would have a funnel to your well, and that any surface water would start migrating to your wells, both within and outside the lake, so that the salt water or partially salt water and other things would start coming to you, and would affect your production.

Q What effect would this salt water have on your sodium sulfate?

A Well, it would simply reduce your sodium sulfate production, and it might also effect it by having other salts, magnesium salts and other things in it that would be detrimental to your circuit and chilling circuit.

Q Now, in earlier testimony you heard the testimony about some disposal brine by National Potash, did you not?

A Yes, sir.

Q Have you seen that disposal?

A Yes, sir, I have seen that disposal, and I have talked to the National Potash people about it. That material runs in

at the west end of the lake, and runs along the south side --

Q You are speaking of which lake now?

A Lake Plata, runs along the south side, rather up toward the east end, and evaporates there. Of course, the amount of brines that they are putting in is nothing compared to the total evaporation that would come from the surface of that lake, if it were covered with brine.

At the present time, with these springs at the surface bringing sulfate into the area, it isn't damaging the thing. But if we put wells in there and start drawing brine from them, then that brine will start coming to the wells that we were to drill.

Q Do you know of any other way to determine the presence of sodium sulfate in commercial quantities, other than the drilling process you mentioned?

A I don't know of any other way of making an accurate determination, except to go in, drill wells, and do pumping tests on them, and determine what the quantity is that can probably be produced from them.

Q You heard some questions earlier in the applicant's case relating to the conditions on the western portion of Laguna Plata. Have you personally inspected that, and can you aid the Commission in what you saw there in any way?

A The western portions of Lake Plata, that is the one that is along the highway?

Q No, that is the large one up here.

A That is the large one. I have taken samples on several occasions from Plata, and all of them have been in the order of ten to twelve per cent of sodium sulfate, along with approximately nine per cent of sodium sulfate -- or sodium chlorides, with a small amount of magnesium.

Q Is there anything else you wish to state to the Commission in connection with your objection to this application?

A I don't know of anything, except that in my talks with the National Potash Company, I am certain that arrangements can be made with them in regard to the disposal of their salt water, because the presence of a sodium sulfate plant adjacent to them with cheap glauber salt, which would be a tremendous asset to them for the production of potasium sulfate. Potasium sulfate is one of the few potasium compounds that hasn't gone down too tremendously in value, and can't be produced from the Canadian operations, and the spread between potasium sulfate and potasium chloride now is something like $34, compared to about $12 or $13; and the incentive for making potasium sulfate from their potasium chloride is such that they are willing to consider, I think, probably any reasonable method of disposing of their salt water in

order to have available a possible source of sodium potasium.

In addition to that, this process which Mr. Harroun and Mr. Haworth are interested in, is a possible process for producing the potasium sulfate from the area where their mine is located. They are now producing all of their potasium chlorides from the government, or reserves that they purchased about 20 miles to the west of there, and are not producing from their deposits that they put their plant on. I think this new process is another thing that National Potash is keenly interested in.

Q Mr. Douglass, if you have the opportunity to test for sodium sulfate and it appears that it is not present in commercial quantities, then you would have no further interest in this property or in objecting to this application, is that correct?

A That is true.

MR. MATKINS: That is all I have.

MR. PORTER: Any questions?

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Douglass, as I understand, you say there is very little water going into Laguna Plata from the Potash Company?

A Relative to the total evaporation.

Q Do you know how much is going in?

A I had a figure, but I don't know whether I have it with me or not. But, as I recall, it amounted to about an inch or two annually over the total area of the lake.

Q It doesn't, in fact, spread over the total area of the lake?

A No, it doesn't spread over the total area of the lake.

Q Would you agree that testimony before this Commission by the Potash Company shows disposal of approximately 50 million gallons a year?

A I would go along with that.

Q And about 3,200 barrels per day?

A Perhaps, yes. I haven't figured it into barrels.

Q And you haven't objected to that?

A I wouldn't object -- I haven't objected to it. I have been out to talk to them about it, about what other method might be used for disposal. But I am not objecting to it at the present time. It is not, I don't think, affecting the brine that is flowing into the lake, the sulfate brines flowing in; and if it is stopped at the time sulfate brines are started to be taken out, I don't think it will seriously affect it. But if there is a deposit of sodium sulfate there, and they start taking brine out of the wells in the lake, I think the brine

will migrate to the wells, and will be detrimental to the operation.

Q As I understand, you would be operating under an agreement with Mr. Harroun and Mr. Haworth?

A That is true.

Q Then you heard Mr. Harroun's testimony as to what leases they held?

A Yes.

Q If we assume that his leases do, in fact, core sodium sulfate, which we do not concede, that will give you then only the right to go into Laguna Tonto in Section 11, in 20 South, 32 East, in Laguna Plata?

A That's right.

Q And you have no rights in Laguna Gatuna at all at the present time?

A Unless the present lease applications go to Harroun and Haworth.

Q Are those applications for sodium sulfate leases?

A They are applications for potash, potash leases.

Q Were you aware of the fact that subsequent to your application, applications for sodium sulfate have been filed?

A Yes. I know that Mr. Brown of Hobbs filed applications for sodium sulfate -- prospecting permits adjacent to Laguna

Gatuna.

Q And they were denied?

A They were denied, the same as mine were.

Q In connection with your denial, your name is E. W. Douglass?

A Yes.

Q And your wife's name is Cleo Douglass?

A Yes.

Q Is this the decision issued by the Secretary of Interior in connection with your application?

A Yes, I believe this is it.

(Whereupon, Applicant's Exhibit Number 5 was marked for identification.)

MR. KELLAHIN: At this time, I would like to offer Applicant's Exhibit Number 5, which is the decision of the Secretary of Interior, involving application of New Mexico 042594 and 042595.

MR. PORTER: Do you have any objection?

MR. MATKINS: No, sir.

MR. PORTER: It will be admitted.

(Whereupon, Applicant's Exhibit Number 5 was admitted into evidence.)

Q According to this decision, you did contend that the potasium deposits occurred separately from the sodium sulfate, did you not?

A Yes.

Q Mr. Douglass, you made one test hole, as I understand, in Lake Laguna Tonto, a hole about 18 inches deep?

A Yes.

Q Do you have any opinion or any basis for that opinion as to the productivity of the well drilled in Lake Plata?

A No, I don't have that -- actually, 18 inches, you don't know the depth of the sediment, and you don't know the horizontal stratification of your crystals, and there is --

Q If you had wells in the lake bottom, you would be dependent upon seepage into those well holes, is that right?

A Well, if there is a vertical strata, or vertical section sufficient to develop you ten foot of brine over, it would represent a quarter-million tons of sodium sulfate directly inside the lake.

Q Well, how fast could you produce this, though, from these lakes?

A Well, they vary a great deal. Over in Cedar Lake, I believe they have five or six wells producing 200 tons of sodium sulfate a day. We used to operate as many as twelve or

fourteen at Monahans to produce 100 tons a day.

Q Are these wells in a lake bottom, just like these lakes?

A They are at Cedar Lake. They are at Monahans. They are outside the lake.

Q As I understand, you also testified there is a possibility of developing the area, I take it, between Laguna Tonto and Laguna Gatuna, where Mr. Reed's testimony showed there was migration water across there?

A Yes, sir.

Q Using the lakes for water disposal would not interfere with that type of production, would it?

A Only when your well got below the level of the lake bed, your water table got below the level of your lake bed, migration would be from your lake bed to your well, I assume.

Q You haven't made any study of that problem, have you?

A Well --

Q You don't know whether it would occur or not?

A We haven't had an opportunity to do any drilling work out there.

MR. KELLAHIN: That is all I have. Thank you.

MR. PORTER: Does anyone else have a question?

THE WITNESS: In regard to the State land in this area,

I did consult with Mr. Jordan, and he told me that in order to produce sodium sulfate from the State lands, that what I would need would be a contract with the owners of the potash leases, a farmout arrangement similar to the oil arrangement.

MR. PORTER: Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Douglass, I would like to clarify a couple of numbers. You mentioned if you had a column of sodium sulfate ten feet deep, that would represent 1,000,000 tons per mile, per square mile?

A No, if you had a column of brine ten feet deep containing ten per cent sodium sulfate, you would have approximately one million tons, I believe, of sodium sulfate per square mile.

Q When you mentioned the figure $45 million, were you talking about the three square miles involved here, or is that per mile?

A The three square miles. It is about $15 a ton at a minimum price. Now, this process that they are using at Monahans does make a certain amount of very high grade potasium -- or sodium sulfate, which is used by special industries, and that demands a market price of around $24 per ton. But I believe most of the stuff, and they are able to satisfy that market, and

also make a lot of low grade material which runs around 96 per cent, which is used by the paper mills. Practically all of the salt cake that is produced in this country goes to the paper mills, and is used to make that brown paper that you get your groceries in, and the cardboard boxes that are used for handling materials.

Q Now, the $45 million, then, would represent refined sodium sulfate?

A It would be delivered at the railhead near the lakes there.

Q In making an economic evaluation of the sodium sulfate that is in the lake bed, then the $45 million would have to have the cost of extracting, processing, and refining deducted from that?

A Yes. There would be, of course, an overriding royalty to the government and to the state. They are the primary owners of the materials, and they would get their royalty.

Q Is there any sodium sulfate associated with the potasium sulfate that is mined down here, potasium chlorides, by the potash industry?

A There is a little potasium sulfate in all of the ore, I think, but it is very little in most of it. But there

are beds which contain substantial amounts of potasium sulfate.

Q Now, the effluent which goes from the National Potash Company's plant into Laguna Plata, does that effluent contain sodium sulfate?

A In no appreciable quantity.

Q If you were to put wells in these lakes or around these lakes, and withdraw these brines, and extract the sodium sulfate from them, what would you do with the water that was left?

A My initial proposal would be for the National Potash Company to use it for the disposal of their tailings, in place of the fresh water they are now using for tailing disposal.

Q It would eventually get into Laguna Plata, wouldn't it?

A It would if they continued to dump into Laguna Plata. If they found other methods of getting rid of this, they can, I think, return that salt water and use it for taking their tailings out. It isn't completely essential that they put that water into the lake there. That is, that water could circulate; the only reason for that water is to transport their tailings away from the plant, and they could use salt water to transport their tailings away from the plant, and they could use the salt water that they are pumping into Laguna Plata to transport

their tailings away from the plant.

I am not trying to run National's operation, but there are a lot of common interests between the National Potash industry and a sodium sulfate operation there.

Q Do the evaporides that are present in these lake beds contain substantial quantities of crystalized sodium sulfate?

A Yes, they do.

Q Would you extract them from the water that is leaching out, percolating through them toward your wells?

A I think the water that you get from natural rainfall is going to be sufficient to leave your evaporides and bring them to the wells there. That is another thing that you will have to contend with in the area, and the more salt you can leave on the surface from these present evaporides to build up the water that flows into your lakes, certainly you will be much better off from the standpoint of your sodium sulfate operation.

Q You mentioned over there at Cedar Lake they had eight or ten wells producing some 200 tons per day. How much water are they extracting in order to derive that 200 tons of sodium sulfate?

A How much water **are** they extracting? It is about a twelve per cent sodium sulfate brine there, I think. And they

probably make -- I am not completely familiar with their operations -- but I am sure they are making approximately 88 to 90 per cent recovery of the sulfate ion that is available. That is, I don't think they would accept anything less on the basis of the work that we used to do.

Q If it were a ten per cent brine, and they are extracting 100 tons, would that mean that ten times that or 1,000 tons of water would be necessary?

A Well, this water would come to their plant, yes, with their sodium sulfate.

Q What I was wondering about, was whether you have --

A Ordinarily, the brine that they process will contain a total of between 25 and 30 per cent of salts. Now, these salts will be sodium sulfate, and sodium chloride, and magnesium -- it may be either satisfied with the sodium or potasium radical; and they will base their extraction on the sulfate there, and they will make an attempt to convert all of their sulfate to sodium sulfate by adjusting the concentration of their brines.

Q Now, the limitation on the process, or on the extraction of the ore would be, if you don't have any extraneous source of inflow into the lake such as National Potash Company, or oil field brines, the limitation on the amount that you could extract would be the natural flow? You wouldn't want to remove more than

the natural flow coming into play, would you?

A Why, sure, it is an exploitable material, the same as the potash, or anything else. You would try to produce it in a reasonable time to take care of your plant depreciation. If you had a 200 ton plant there, I would think you would want to develop something like 3 million tons in order to depreciate the plant, and assure a plant life of something like 40 years, or something like that.

MR. NUTTER: I believe that is all.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Douglass, if in the event that the Commission should grant the applicant permission to use one or more of these lakes for salt water disposal, would that interfere with your testing?

A I don't think it would interfere with the testing. You could probably stay away from the brines, assuming they were reasonable quantities of brines.

Q And you say a year would be a reasonable period for you to conclude your testing and evaluation?

A A year after the legal aspects are worked out in regard to the Bureau of Land Management. We don't have a firm decision from the Bureau of Land Management yet regarding just

what conditions I could go in there and do the work. I think the State, if the opinion of the attorney for the land department here is valid, I think we have reason now to assume we can go in on the State land held by Harroun and Haworth, and probably by the U.S. Potash Company.

Q So, assuming that it is feasible to develop this sodium sulfate, it would be something more than a year before you could begin any kind of operations toward extracting the product?

A Yes, that's right. I think it would take about a year to do the investigation. And I think, personally, I would consider a contract for a plant within two years of the completion of the experimental work. I think three years for an operation there is a reasonable thing, but I think one year is sufficient for the investigation to determine whether there is sulfate there or not in sufficient quantities.

Q But it would actually be somewhat close to three years before you would start extracting any of the sodium sulfate on a commercial basis?

A I think that is probably true.

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

At this point, Mr. Kellahin, do you propose to recall

your witness?

MR. KELLAHIN: We probably will, yes, sir.

MR. PORTER: In that case, let's recess the hearing until one thirty this afternoon, at which time Mr. Douglass will resume the stand for further cross examination.

(Whereupon, the hearing was adjourned until one thirty o'clock, P.M.)

MR. PORTER: The hearing will come to order.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Douglass, as I understand, the provision you are proposing in this area, if it is practicable, would entail extraction of the sodium sulfate from the brine?

A That is true.

Q Do you have any opinion as to how much water you would produce from any hole or well, or excavation in the lake beds, gallons per minute, or any other basis?

A No, I think the minimum plant that would be possible to consider would be a plant that would produce 100 tons of sodium sulfate a day.

Q Let's say you are going to produce 100 tons of sodium sulfate a day, and you have a pretty good idea of the concentrates available in this area --

A Yes.

Q How much water would go through that plant per day?

A Well, the total brine would probably be about eleven times the production of sodium sulfate.

Q That would be eleven times 100 tons?

A Yes.

Q Could you give me that in barrels or gallons per minute, or some kind of a figure?

A Well, that brine would be composed of about, between 25 and 30 per cent of salts, and the remainder would be water. You would have about 75 per cent water; or per ton of production of sodium sulfate, you would probably have about seven and a half tons of water to take out of the well, per ton of sodium sulfate.

Q When you talk about a 100-ton plant, you mean 100 tons per day?

A Per day of production, yes, of course, one would want to get beyond that in production if they possibly could. That is, a plant producing 200 or 300 tons a day is no more expensive to operate from the standpoint of the manpower involved, than a 100-ton plant.

Q Well, what I am getting back to, though, Mr. Douglass, and if you can't answer it, I would appreciate it if you would

just say so, how much water would you have to produce out of these lake beds to achieve the production you are talking about?

A Well, it would be seven and a half tons of water, approximately, per ton of sodium sulfate; or in 100 tons of sodium sulfate production, there would probably be 750 tons of water coming along with it. In addition to that, there would be the salt in solution, the sodium chloride, and the magnesium salt.

Q So we understand what I am talking about, do you know how much water weighs?

A Water weighs about 62 and a half pounds to the cubic foot, about eight and a third pounds to the gallon. I don't deal in barrels, and it is pretty difficult for me to get the barrels.

MR. KELLAHIN: I understand this is not in your line of thinking, but I wanted the Commission to understand how much water we were talking about producing. I think we have the answer. Thank you, sir.

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

MR. MATKINS: I will call Mr. Raul Martinez.

RAUL E. MARTINEZ

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

DIRECT EXAMINATION

BY MR. MATKINS:

Q Would you state your name and address, please?

A My name is Raul E. Martinez, 522 Lucero, Santa Fe.

Q Where are you employed?

A I am employed by the Bureau of Land Management.

Q What are your duties with the Bureau?

A I am a land law examiner, and I do all of the adjudication for competitive oil and gas lease sales in the State of New Mexico, public domain, and the adjudication on all unit agreements, oil and gas, and all of the minerals adjudication with respect to any other mineral other than the oil and gas, which I have just recited.

Q How long have you been performing these duties for the Bureau?

A I have been an employee of the Bureau since 1957, but this particular duty since 1964, November of 1964.

Q Do you have a title?

A Just land law examiner; today I am Acting Chief, Branch of Minerals.

Q Mr. Martinez, have you been here throughout the testimony in this hearing?

A Most of it, yes.

Q And you have heard the testimony concerning the use or the development of sodium in connection with potasium leases? Have you heard that testimony?

A Yes.

Q And some question having been raised as to whether sodium can be produced under a federal potasium lease? Has this question been decided by the Bureau of Land Management?

A It is under consideration at the present time.

Q Do you know this of your own knowledge?

A Yes, sir.

Q Is it still a policy of the Bureau that where there exists a potasium lease, that a sodium lease will not be issued on the same land?

A That is true.

Q Were you also present when there was testimony relating to an application with your department for special land use permits?

A Yes, sir.

Q Are these given automatically, or what considerations are given for the issuance of these permits?

A I can't very well state policy on that, since those permits are handled in our district office. It is my understanding that special land use permits have been issued in the past where the Commission has approved certain contracts. They are not automatic, in other words, although we have been cooperating with the Oil and Gas Commission. But, possibly one explanation, that those special land use permits are cancellable immediately if an emergency arises, or there is some other conflict with a greater use -- application, you might say.

MR. PORTER: In other words, if conditions change from the time that they are issued, they may be cancelled?

THE WITNESS: Yes.

Q Do you happen to know if any of the considerations being reviewed at the present time to allow the production of sodium in connection with the potash leases, and the reasons they are considering them?

A I beg your pardon?

Q The reasons why they are considering them?

A Well, only that the possibility of minable sodium deposits exist, and it is something that the Bureau wants to look at very carefully, because if it is minable it is beneficial in two ways. It would bring in a new industry to the state, and apparently it would also benefit the potash industry

or the potash products that so far has maintained a higher price than, I believe, it is potasium sulfate, than other potash products.

MR. MATKINS: That is all I have.

MR. PORTER: Any questions of the witness?

MR. KELLAHIN: No questions.

MR. MATKINS: That concludes the witnesses on behalf of the protestants.

MR. PORTER: Mr. Kellahin, do you desire to recall Mr. Reed?

MR. KELLAHIN: I would like to recall Mr. Reed.

ED L. REED

recalled as a witness by the Applicant, having been previously duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Reed, in connection with the presentation of the testimony by Mr. Douglass, he stated that there is a possibility of producing fluid containing sodium sulfate between the lakes. Have you any information on that?

A Only to say that if the groundwater between the lakes contains minable sodium sulfate, it is my opinion that the use of the lakes for salt water disposal would not have any

deleterious effect upon these deposits in the groundwaters between the lakes, since the groundwater elevations between the lakes appears to be substantially higher than the lake beds, themselves.

Q Then will you say there would be no adverse effect by using the lakes for water disposal?

A That would be my opinion.

Q You heard Mr. Douglass testify as to the volume of water required to service a 100-ton plant which, as I understand, is seven and a half tons of water per ton of sodium sulfate to be extracted. Have you made a calculation of how many gallons per day that would be?

A Yes, sir.

Q How many would it be?

A In rough numbers, about 140 gallons per minute.

Q Would a series of wells in your opinion -- first, let me ask you, have you examined the contents of these lakes and the bottoms, the composition of them?

A In the upper portion I have, yes.

Q On the basis of your examination of the composition of these lake beds, would a series of wells drilled into the lake beds supply water in that volume?

A Unless there were sediments below the near surface

materials with a higher permeability than those which I have seen, it would be rather difficult. I would at least be apprehensive about the well producing any substantial quantities of water, and I don't know what the minimum rate per well would be to be economic. But I think it would be relatively simple to determine what the range of permeabilities would be in these lake deposits by drilling a well, and running a pumping test in a well which penetrates the entire lake sequence.

I think it might also be important to consider that if small wells could be completed in the lake deposits, we shall say the range of ten gallons per minute, which would require fourteen wells, this would be indicative of relatively low permeabilities, and it would be my judgment then that the lakes could be divided into areas which, because of the low permeabilities, could be considered hydrologically extinct. In the situation of low permeability, production of water at these rates and at these depths would create rather steep-sided cones of depression, and the area of influence of a given well or a group of wells would be measurable. Under these conditions, it would be my judgment that concurrently both operations could go on in a large lake like Laguna Plata without interference. If the permeabilities are less than would be required to yield ten gallons per minute per well, this would, of course, require

closer spaced wells, and would require more wells, and produce a situation which could almost be considered a vertical mining of a resource, which has little, if any, horizontal effect or drainage effect, as it were, upon adjoining lands.

Under these circumstances, which could only be determined by drilling a well and running pumping tests, and determining what the permeability of the aquifer truly is, this is the only way this could be resolved. I should think that one or two wells in a lake like Laguna Gatuna would at least begin to give a magnitude of the problem.

MR. KELLAHIN: That is all I have.

MR. PORTER: Any questions of Mr. Reed? You may be excused.

Does anyone else desire to present any further testimony in this case?

MR. MATKINS: May I be permitted to recall Mr. Douglass?

MR. PORTER: Yes.

E. W. DOUGLASS

recalled as a witness by the Protestants, having been previously duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. MATKINS:

Q Mr. Douglass, you have heard the testimony by Mr. Reed

which was just concluded?

A Yes, I heard it, and I agree with him that we need some test wells in the lakes, themselves, to determine what could be produced per well, and how much.

Now, I have had holes with a post auger to a depth of approximately ten feet out there, and this was in Lake Gatuna; and for the first three feet, I had relatively solid saturated mud, but after I got down to a depth of about four feet, I started running into horizontal layers of gypsum, well crystalized, defined, and loosely matted together, and by the time I was to a depth of six feet, the water flowed into the hole and up to within three inches of the surface, indicating, I think, that there is horizontal percolation through the lake, at least in the shallower depths, and that there would be substantial migration across horizontally through the lake beds.

MR. MATKINS: I have nothing further.

MR. PORTER: Do you have any questions?

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Douglass, what disposition would you make of this water after it runs through your plant?

A Well, I am not certain as to just what I will do at the present time. But my thinking at the present time is that

it will probably be used by the National Potash Company for their salt disposal operation and allow them to use that much fresh water, and from their fresh water operations.

MR. KELLAHIN: That is all.

MR. PORTER: Then it would eventually go into their disposal pits?

THE WITNESS: It would eventually go into their disposal pits, and I feel confident that as time goes on, and they realize the help that a sodium sulfate operation would be adjacent to their operation, that they will find a way of recycling their salt water so it need not go to a separate disposal area.

Q (By Mr. Kellahin) This would be a saturated brine you would be delivering to them, then, would it not?

A No, it wouldn't. Having taken the sodium sulfate out of it, and the process reheats the brine to approximately the temperature at which we receive it, it is unsaturated. We have taken the sodium sulfate out, and it will be an unsaturated brine. It will have some salt in it, and a very minimum amount of sulfate, but it will be not a saturated brine.

Q It would have a rather high content of sulfate?

A Will probably have a ten per cent or twelve per cent of sodium chloride.

Q Wouldn't they be able to use these oil field brines to better advantage than this brine you are going to deliver?

A Well, I don't think it would -- there would be the inducement to use the salt brines that there would be with a sodium sulfate operation in there.

MR. KELLAHIN: That is all.

MR. PORTER: Any further questions? You may be excused.

If that concludes the testimony, we will hear any closing statements you may have.

MR. KELLAHIN: If the Commission please, I would like to have those letters read into the record prior to making closing statements. I presume as applicant, I will be permitted to close.

MR. PORTER: Yes, we indicated earlier that the letters would be read.

MR. HATCH: Telegram received by the Commission on March 18, addressed to Mr. A. L. Porter: Regarding Case No. 4047, the Lea County Farm and Livestock Bureau strongly objects to the surface disposal of produced salt water into so-called salt lakes in Lea County. We urge that your Order No. R-3221, as amended, prohibiting surface disposal be enforced without granting exceptions. J. W. Spears, President.

Then a telegram was received on March 18th by the Commission, addressed to Mr. A. L. Porter: We protest the granting of the application of Larry T. Squires in Case No. 4047 to dispose of salt water into the three natural lakes in question, notwithstanding what the hydrologist, who will testify for the applicant, may say. It is our belief that disposal of salt water into the lakes will be no different than that disposal into open surface pits, just more concentrated in one area. We suggest it is a safer approach, even though more expensive, it is to use salt water disposal wells in accordance with Order No. R-3221. Mark Smith has land adjoining one lake, and all three of the undersigned ranchers are in the area, and fear condemnation of their fresh water supplies. Mark Smith, G. H. Bingham, Tom Lineberry.

MR. PORTER: That is apparently all the communications we have, Mr. Kellahin. Mr. Matkins, would you like to make a closing statement?

MR. MATKINS: Thank you, Mr. Commissioner. May I inquire if the Commission also received a letter from U.S. Potash and Chemical Company?

MR. HATCH: We have. The letter is addressed to the New Mexico Oil Conservation Commission, from the U.S. Potash and Chemical Company: It has been called to our attention that

Case No. 4047 will be brought before the New Mexico Oil Conservation Commission on February 19, 1969, to consider the disposal of salt brines into the Lea County areas known as Laguna Plata, Laguna Gatuna, and Laguna Tonto, all located in western Lea County, New Mexico. Continental American Royalty Company owns substantial potash leases, with U.S. Potash and Chemical Company designated the operator, on a portion of Laguna Gatuna, and in the vicinity of Laguna Tonto. In these areas, there is a very definite possibility that economic minerals in the form of sodium sulfate and possibly other minerals exist in economic quantities that must be carefully evaluated for the proper conservation of mineral resources. It is strongly felt that the discharge of salt brines into these lagoon areas could very materially adversely contaminate the potential economic value of commercial minerals that may be in place in the Laguna areas. Therefore, U.S. Potash and Chemical Company strongly objects to any approval consideration for Case No. 4047, due to the fact it is imperative, in our opinion, that additional facts, information, and technical data must be secured concerning the presence of commercial minerals in the Laguna areas prior to any decision. The additional time of at least one year is respectfully recommended and needed for procurement of facts and data so as this information can be capably evaluated, in

keeping with proper conservation of potential commercial mineral resources. Very truly yours, Earl H. Miller, Executive Vice President.

MR. PORTER: What is the date of receipt of that letter?

MR. HATCH: February 18, 1969.

MR. PORTER: That was prior to the February hearing. Thank you, Mr. Matkins, for calling that to our attention.

MR. MATKINS: Thank you, Mr. Commissioner.

Gentlemen of the Commission, I will not take much of your time. The application by Mr. Squires is to put this water in these lakes, and we are not told how much water is involved, nor do we know the exact composition of what might be in the water besides the brine. We protest, as Mr. Douglass has said, in order to allow adequate time to meet the requirements and seek the permission of the governmental regulatory agencies, and other leasehold owners, to determine whether the sodium sulfate which has been found by Mr. Douglass in these lakes, exist in commercial quantities, and if the conditions are such that sodium sulfate can be produced at a profit.

Mr. Douglass indicated that should they be found in a certain quantity, that could mean a million-dollar business to the State of New Mexico and western Lea County.

We feel this is of such importance that the application should not be granted at this time, in order that this additional discovery and these tests may be run. As Mr. Douglass has testified, in the event that the product is not found there in commercial quantities, then our protest in effect is withdrawn.

Linked with this is the possibility of further potash development with the process of Mr. Douglass in this area, and we feel that all of these considerations are significant to this state, and that the benefits to be received by the oil industry and by Mr. Squires by placing the waters on these lakes at this time does not warrant the doing away with the opportunity to investigate and show if the sodium sulfate can in fact be produced. Thank you very much.

MR. PORTER: Mr. Kellahin.

MR. KELLAHIN: If the Commission please, this is a water disposal case which has taken a little different turn than most. I think we have clearly established that the disposal of oil field brines in the three lakes involved here would cause no possible damage to any fresh water supplies, there being no fresh water supplies that could possibly be affected by such disposal toward it. This has already been considered by the Commission in previous cases, in that the Commission after notice and hearing deleted the western portion of Laguna Plata and the

lands lying to the west of that lake from the provisions of Order R-3221. In addition, exceptions permitting surface disposal of produced brines have been granted to the west of Laguna Gatuna and to the east of Laguna Gatuna.

The testimony which has been offered here today amply supports the conclusion the Commission reached in those cases, and goes even further to show that salt water disposal in these lakes is a practical means of oil field brines, and will cause no harm to any fresh water supplies.

Now, the only opposition we have here comes from a speculative approach based on the claim that there is present here in commercial quantities sodium sulfate. They are asking for time in which to determine whether this is a practical, economical operation or not. In that connection, I would like to point out that Mr. Harroun's leases under which Mr. Douglass says he will operate, is Permit NM-3232, and 3233, and are dated December 1, 1957. The expiration date on his federal leases appears to be 1964. On that basis, of course, they would appear to have had ample time as opposed to the situation faced by the oil companies, who are faced with the effective date of Order R-3221, March 1, 1969. Certainly, the companies must make some permitted disposal of their water, and we are attempting to offer them a method of making that disposition of water, and a practical

one.

Now, the opposition here actually, would be subject to an objection as having no stand in this case, in that they have no interest in at least two of the lakes which can be a basis for exploring for sodium sulfate in those lakes.

Admittedly, the state leases for potasium sulfate also includes sodium sulfate, and if they hold a state lease, they can explore for sodium sulfate and produce it under that lease.

I think the decision of the Secretary of Interior, which is in evidence as our Exhibit Number 5, clearly shows that the federal potasium leases do not cover sodium sulfate, and also shows that the policy of the Department of Interior is to preserve the right to mine and produce the potasium without interference from the sodium sulfate leases. That was the decision that was made in the case, which was appealed to the Secretary by Mr. Douglass.

In Laguna Tonto, in Section 32, Township 19 South, Range 33 East, Mr. Harroun owns the state lease, and under that state lease he can explore for sodium sulfate, and mine it, and produce it. The major portion of Section 32 -- no, Section 33, which would cover substantially all the rest of Laguna Tonto, is held under a federal potash lease, which does not include

sodium sulfate. There is an 80-acre tract in there that appears to belong to Jack E. Brown, and not any of the parties here today.

The testimony shows that they have no leases covering the rights in Laguna Gatuna, potasium sulfate, or anything else. In Laguna Plata, I believe the testimony shows they have a federal lease covering the portion of the lake in Section 11, in Township 20 South, Range 32 East, which again does not cover sodium sulfate.

We submit that they haven't any standing in this case, in any event, as to those two lakes. Be that as it may, the testimony would also show we feel that there would be quite an insufficient volume of water to meet the requirements of the minimum capacity plant that Mr. Douglass testified to, in any event, because there is just not that much water there as shown by the testimony offered by the applicant in this case.

We submit that the application should be approved for salt water disposal in all three lakes.

MR. PORTER: Does anyone else have any statement to make, or anything to offer in the case? If not, the Commission will take the case under advisement.

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

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

Samuel Mortelette
COURT REPORTER