EPWM - __2____

PERMITS, RENEWALS, & MODS

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

September 15, 2008

Ms. Monica D. Johnson
ConocoPhillips
San Juan Business Unit
P.O. Box 4289
Farmington, New Mexico 87402-4289

RE: Produced Water Pilot Project Permit # EPWM - 002
ConocoPhillips
San Juan 32-8 Unit # 237A – API # 30-045-32369-00-00
Location: Unit I, Section 23, Township 31 North, Range 8 West, NMPM
San Juan County, New Mexico

Dear Ms. Johnson:

The New Mexico Oil Conservation Division (OCD) has reviewed ConocoPhillips' request, dated September 10, 2008, to amendment Condition 2 and Condition 6 of the temporary approval granted by OCD for a produced water pilot project (Permit EPWM – 002) at the San Juan 32-8 Unit #237A well (API # 30-045-32369-00-00) located within Unit I of Section 23, Township 31 North, Range 8 West, NMPM San Juan County, New Mexico. OCD has reviewed the justifications for the requested amendments and hereby approves with the following understandings and amendment to the conditions below:

Condition 2:
ConocoPhillips shall test the raw or produced water influent prior to treatment and the effluent after treat *prior to any discharge onto the ground* for the constituents identified in Subsections A, B, and C of 20.6.2.3103 NMAC. The laboratory reportable limits shall not exceed the exceed the standards specified in Subsections A, B, and C of 20.6.2.3103 NMAC

Condition 6:
ConocoPhillips shall test the vadose zone, *down to the deepest extent possible but not to exceed three feet below the existing grade*, of the area in which produced water is applied. ConocoPhillips shall collect and analyze a minimum of one composite soil sample, consisting of four discrete samples from each test plot in which produced water is applied. ConocoPhillips shall analyze for the constituents listed in Subsections A and B of 20.6.2.3103 NMAC shall be determined by EPA SW-846 methods 6010B or 6020 or other methods approved by the division. ConocoPhillips shall backfill the vadose sample borehole with bentonite hole plug to seal the hole. Barite (barium sulfate) shall not be used to backfill or plug the sample hole.

This temporary approval will expire July 28, 2009. Renewal requests for temporary approvals shall be submitted 45 days prior to the expiration date. Temporary approval may be revoked or suspended for violation of any applicable provisions and/or conditions.

Please be advised that approval of this request does not relieve the ConocoPhillips of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve ConocoPhillips of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If you have any questions regarding this matter, please contact Brad A Jones of my staff at (505) 476-3487 or brad.a.jones@state.nm.us.

Sincerely,

For Wayne Price
Environmental Bureau Chief

LWP/baj

cc: OCD District III Office, Aztec

Jones, Brad A., EMNRD

From: Johnson, Monica [Monica.Johnson@conocophillips.com]
Sent: Thursday, September 11, 2008 9:24 AM
To: Jones, Brad A., EMNRD
Cc: Powell, Brandon, EMNRD; Dale_Wirth@nm.blm.gov; Sattler, Allan R; Cappelle, Malynda.A; Wirtanen, Bob A; Way, Ben D; Miller, Rebekah E.; Frank McDonald, B.E.S.T.; Poulson, Mark E; Rick Arnold
Subject: Produced Water Pilot Project Permit #EPWM-002 amendment request
Attachments: OCD pilot study amendment letter 9-10-08.pdf

Dear Mr. Jones,

Please find attached an electronic copy of a letter I will be sending to you via certified mail requesting permission to amend permit #EPWM-002 for the San Juan 32-8 Unit #237A water pilot project.

Should you have any further questions, please let me know.

Thank you!
Monica D. Johnson
Sr. Environmental Scientist
ConocoPhillips Company
3401 East 30th Street
Farmington, NM 87402
Office: (505) 326-9829
Cell: (505) 320-9056
Direct Fax: (918) 662-1826
Office Fax: (505) 599-4005

ConocoPhillips

San Juan Business Unit
P.O. Box 4289
Farmington, NM 87402-4289
(505) 326-9700

Sent Via Email & Certified Mail No. 7099 3400 0018 4215 2407

September 10, 2008

Mr. Brad A. Jones
Environmental Bureau Engineer
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Produced Water Pilot Project Permit # EPWM - 002 for the San Juan 32-8 Unit #237A

Dear Mr. Jones,

ConocoPhillips Company would like to request an amendment to the permit # EPWM – 002 for our San Juan 32-8 Unit #237A produced water pilot project issued by the New Mexico Oil Conservation Division (NMOCD) on July 28, 2008 in order to clarify Conditions 2. and 6. of the permit.

We ask that Condition 2. be amended to allow for a change in the frequency of the entire panel of required tests as defined in Subsections A, B, and C of 20.6.2.3103 NMAC. Instead of testing the raw or produced water influent prior to treatment and the effluent after treatment based upon the frequencies proposed in our June 2, 2008 request, we would like to request that we be allowed to run this entire panel of required tests on these two respective water types prior to any discharge of these waters onto the ground, at a minimum. It is anticipated that discharges of each water type will occur approximately two to four times between now and the expiration of the permit on July 28, 2009. We anticipate that many of the constituents in the entire panel of tests from the raw influent, and certainly from the treated effluent, will be below detectable limits. Any additional tests, which comprise a subset of the entire panel of tests, may be performed as outlined in our June 2, 2008 request letter only because it is necessary for our own information, although it is not required by the NMOCD.

In addition, we would like to also ask to amend permit Condition 6. which currently requires us to test the vadose zone, two to three feet below the existing grade, of the area in which produced water is applied. However, because of this pilot project's location situated on top of a primarily shallow sandstone layer, it is not possible for us to bore a sample hole two to three feet below the existing grade. In some areas, we can only bore down to a maximum of eight inches before reaching sandstone. To bore through the sandstone layer would require specialized drilling equipment, and so we are requesting that we be allowed to test the vadose zone down to the furthest extent possible, up to three feet deep, without compromising the sandstone layer.

Please let me know if you have any additional questions or concerns regarding this request. You can contact me at (505) 326-9829.

Sincerely,

Monica D. Johnson

Monica D. Johnson
Sr. Environmental Scientist

Cc: Brandon Powell - NM Oil Conservation Division District III
Dale Wirth - Bureau of Land Management
Rebekah Miller - ConocoPhillips
Mark Poulson - ConocoPhillips
Ben Way - ConocoPhillips
Bob Wirtanen - ConocoPhillips
Frank McDonald - BEST
Rick Arnold - NMSU
Malynda Cappelle - Sandia National Labs
Allan Sattler - Sandia National Labs

ConocoPhillips

San Juan Business Unit
P.O. Box 4289
Farmington, NM 87402-4289
(505) 326-9700

Sent Via Email & Certified Mail No. 7099 3400 0018 4215 2407

September 10, 2008

Mr. Brad A. Jones
Environmental Bureau Engineer
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Produced Water Pilot Project Permit # EPWM - 002 for the San Juan 32-8 Unit #237A

Dear Mr. Jones,

ConocoPhillips Company would like to request an amendment to the permit # EPWM – 002 for our San Juan 32-8 Unit #237A produced water pilot project issued by the New Mexico Oil Conservation Division (NMOCD) on July 28, 2008 in order to clarify Conditions 2. and 6. of the permit.

We ask that Condition 2. be amended to allow for a change in the frequency of the entire panel of required tests as defined in Subsections A, B, and C of 20.6.2.3103 NMAC. Instead of testing the raw or produced water influent prior to treatment and the effluent after treatment based upon the frequencies proposed in our June 2, 2008 request, we would like to request that we be allowed to run this entire panel of required tests on these two respective water types prior to any discharge of these waters onto the ground, at a minimum. It is anticipated that discharges of each water type will occur approximately two to four times between now and the expiration of the permit on July 28, 2009. We anticipate that many of the constituents in the entire panel of tests from the raw influent, and certainly from the treated effluent, will be below detectable limits. Any additional tests, which comprise a subset of the entire panel of tests, may be performed as outlined in our June 2, 2008 request letter only because it is necessary for our own information, although it is not required by the NMOCD.

In addition, we would like to also ask to amend permit Condition 6. which currently requires us to test the vadose zone, two to three feet below the existing grade, of the area in which produced water is applied. However, because of this pilot project's location situated on top of a primarily shallow sandstone layer, it is not possible for us to bore a sample hole two to three feet below the existing grade. In some areas, we can only bore down to a maximum of eight inches before reaching sandstone. To bore through the sandstone layer would require specialized drilling equipment, and so we are requesting that we be allowed to test the vadose zone down to the furthest extent possible, up to three feet deep, without compromising the sandstone layer.

Please let me know if you have any additional questions or concerns regarding this request. You can contact me at (505) 326-9829.

Sincerely,

Monica D. Johnson

Monica D. Johnson
Sr. Environmental Scientist

Cc: Brandon Powell - NM Oil Conservation Division District III
Dale Wirth - Bureau of Land Management
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Allan Sattler - Sandia National Labs

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

July 7, 2009

Ms. Monica D. Johnson
ConocoPhillips
San Juan Business Unit
P.O. Box 4289
Farmington, New Mexico 87402-4289

RE: Produced Water Pilot Project
ConocoPhillips
San Juan 32-8 Unit #237A – API# 30-045-32369-00-00
Location: Unit I, Section 23, Township 31 North, Range 8 West, NMPM
San Juan County, New Mexico

Dear Ms. Johnson:

The New Mexico Oil Conservation Division (OCD) has reviewed ConocoPhillips' renewal request, dated May 22, 2009 and the amendment emailed June 29, 2009, to continue to operate a produced water pilot project at the San Juan 32-8 Unit #237A well (API# 30-045-32369-00-00) located within Unit I of Section 23, Township 31 North, Range 8 West, NMPM San Juan County, New Mexico. OCD understands that the produced water pilot project involves the application of the produced water, of different degrees of treatment, to study the impact on the revegetation and soil rehabilitation of the well pad area. Controls, such as unimpacted areas with native vegetation that receives no watering, are incorporated into the pilot project in order to compare the final results.

This request is hereby approved with the following understandings and conditions:

1. The source of the produced water approved for this pilot project is ConocoPhillips' Juan 32-8 Unit #237A well (API# 30-045-32369-00-00) located within Unit I of Section 23, Township 31 North, Range 8 West, NMPM San Juan County, New Mexico.

2. ConocoPhillips shall test the produced water effluent after treatment, *prior to any discharge onto the ground,* for the constituents identified in Subsections A, B, and C of 20.6.2.3103 NMAC and based upon the conditions and frequencies proposed in the June 29, 2009 amended request. The laboratory reportable limits shall not exceed the standards specified in Subsections A, B, and C of 20.6.2.3103 NMAC

3. ConocoPhillips shall test the produced water influent prior to treatment and the effluent after treatment, based upon the frequencies proposed in the May 2, 2009 request.

4. ConocoPhillips shall test the vadose zone, *down to the deepest extent possible but not to exceed three feet below the existing grade*, of the area in which produced water is applied. ConocoPhillips shall collect and analyze a minimum of one composite soil sample, consisting of four discrete samples, from each test plot in which produced water is applied. ConocoPhillips shall analyze each sample for the constituents listed in Subsections A and B of 20.6.2.3103 NMAC as determined by EPA SW-846 method 6010B or 6020 or other EPA methods approved by the division. ConocoPhillips shall

backfill the vadose sample borehole with bentonite hole plug to seal the borehole. Barite (barium sulfate) shall not be used backfill or plug the sample borehole.

5. ConocoPhillips shall properly dispose of the liquid waste streams, such as concentrate from the treatment (ultrafiltration and reverse osmosis) system, in a ConocoPhillips injection well permitted by OCD for the disposal of RCRA exempt waste material.

6. ConocoPhillips shall properly dispose of the of produced water treatment cartridge filters and membranes at *an OCD permitted landfill* or *comply with the authorization request provisions and specified testing protocols of 19.15.35.8 NMAC* for the disposal of produced water treatment cartridge filters and membranes, if applicable.

7. ConocoPhillips shall characterize the material utilized in the field test kit as hazardous or non-hazardous to determine if such waste shall be disposed as domestic/municipal or hazardous waste.

8. ConocoPhillips shall provide the OCD a copy of the analytical results of each sampling event, produced water and vadose zone, within 30 days of receipt of the analytical results.

9. ConocoPhillips shall report all unauthorized discharges, spills, leaks, and releases of produced water and conduct corrective action pursuant to WQCC Regulation 20.6.2.1203 NMAC and OCD Rule 19.15.29 NMAC.

10. ConocoPhillips *shall report quarterly discharge volumes (produced water diverted) in gallons to the OCD via email no later than and within* ***three days*** *of the end of each of the following quarters*:

    - January 1st through March 31st
    - April 1st through June 30th
    - July 1st through September 30th
    - October 1st through December 31st

This authorization is approved for a period of one (1) year. **This temporary approval will expire July 28, 2010.** Renewal requests for temporary approvals shall be submitted 45 days prior to the expiration date. Temporary approval may be revoked or suspended for violation of any applicable provisions and/or conditions.

Please be advised that approval of this request does not relieve the ConocoPhillips of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve ConocoPhillips of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If there are any questions regarding this matter, please do not hesitate to contact me at (505) 476-3487 or brad.a.jones@state.nm.us.

Sincerely,

Brad A. Jones
Environmental Engineer

BAJ/baj

cc: OCD District III Office, Aztec

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

July 28, 2008

Ms. Monica D. Johnson
ConocoPhillips
San Juan Business Unit
P.O. Box 4289
Farmington, New Mexico 87402-4289

RE: Produced Water Pilot Project Permit # EPWM - 002
ConocoPhillips
San Juan 32-8 Unit # 237A – API # 30-045-32369-00-00
Location: Unit I, Section 23, Township 31 North, Range 8 West, NMPM
San Juan County, New Mexico

Dear Ms. Johnson:

The New Mexico Oil Conservation Division (OCD) has reviewed ConocoPhillips' request, dated June 2, 2008, to continue to operate a produced water pilot project at the San Juan 32-8 Unit #237A well (API # 30-045-32369-00-00) located within Unit I of Section 23, Township 31 North, Range 8 West, NMPM San Juan County, New Mexico. OCD understands that the produced water pilot project involves the application of the produced water, of different degrees of treatment, to study the impact on the revegetation and rehabilitation of the well pad area. Controls, such as unimpacted areas with native vegetation that receives no watering, are incorporated into the pilot project in order to compare the final results.

This request is hereby approved with the following understandings and conditions:

1. The source of the produced water approved for this pilot project is ConocoPhillips' Juan 32-8 Unit #237A well (API # 30-045-32369-00-00) located within Unit I of Section 23, Township 31 North, Range 8 West, NMPM San Juan County, New Mexico.

2. ConocoPhillips shall test the raw or produced water influent prior to treatment and the effluent after treat, based upon the frequencies proposed in the June 2, 2008 request, for the constituents identified in Subsections A, B, and C of 20.6.2.3103 NMAC. The laboratory reportable limits shall not exceed the exceed the standards specified in Subsections A, B, and C of 20.6.2.3103 NMAC

3. ConocoPhillips shall properly dispose of the liquid waste streams, such as concentrate from the ultrafiltration and reverse osmosis systems, in a ConocoPhillips injection well permitted by OCD for the disposal of RCRA exempt waste material.

4. ConocoPhillips shall properly dispose of the of produced water treatment cartridge filters and membranes at an OCD permitted landfill or comply with the authorization request provisions and

specified testing protocols of 19.15.9.712 NMAC for the disposal of produced water treatment cartridge filters and membranes, if applicable.

5. ConocoPhillips shall characterize the material utilized in the field test kit as hazardous or non-hazardous to determine if such waste shall be disposed as domestic/municipal or hazardous waste.

6. ConocoPhillips shall test the vadose zone, two to three feet below the existing grade, of the area in which produced water is applied. ConocoPhillips shall collect and analyze a minimum of one composite soil sample, consisting of four discrete samples from each test plot in which produced water is applied. ConocoPhillips shall analyze for the constituents listed in Subsections A and B of 20.6.2.3103 NMAC shall be determined by EPA SW-846 methods 6010B or 6020 or other methods approved by the division. ConocoPhillips shall backfill the vadose sample borehole with bentonite hole plug to seal the hole. Barite (barium sulfate) shall not be used to backfill or plug the sample hole.

7. ConocoPhillips shall provide the OCD a copy the analytical results of each sampling event, produced water and vadose zone, within 30 days of receipt of the analytical results.

8. ConocoPhillips shall report all unauthorized discharges, spills, leaks and releases of hydrostatic test water and conduct corrective action pursuant to WQCC Regulation 20.5.12.1203 NMAC and OCD Rule 116 (19.15.3.116 NMAC).

This authorization is approved for a period of one (1) year. **This temporary approval will expire July 28, 2009.** Renewal requests for temporary approvals shall be submitted 45 days prior to the expiration date. Temporary approval may be revoked or suspended for violation of any applicable provisions and/or conditions.

Please be advised that approval of this request does not relieve the ConocoPhillips of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve ConocoPhillips of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If you have any questions regarding this matter, please contact Brad A Jones of my staff at (505) 476-3487 or brad.a.jones@state.nm.us.

Sincerely,

Wayne Price
Environmental Bureau Chief

LWP/baj

cc: OCD District III Office, Aztec

ConocoPhillips

San Juan Business Unit
P.O. Box 4289
Farmington, NM 87402-4289
(505) 326-9700

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Sent Via Email & Certified Mail No. 7099 3400 0018 4215 2421

June 2, 2008

Mr. Brad Jones
Environmental Bureau Engineer
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

RE: Water Pilot Project – San Juan 32-8 Unit #237A

Dear Mr. Jones,

ConocoPhillips Company is requesting approval to again apply untreated produced water and treated produced water on portions of the San Juan 32-8 Unit #237A (T31N, R8W, Section 23, Unit I) location as part of a pilot project described in previous correspondence to the New Mexico Oil Conservation Division (NMOCD). The NMOCD previously granted permission in on July 2, 2007 to apply certain quantities of treated and untreated water to the subject location, but that permission expired on December 1, 2007. A request to continue this pilot project was submitted to Mr. Brandon Powell on February 21, 2008 and to Mr. Wayne Price on March 7, 2008. A briefing was also given to you, to Mr. Wayne Price, and to Mr. Mark Fesmire by Sandia National Laboratories, NMSU, and BEST on April 17, 2008 in Santa Fe. During this briefing, the NMOCD asked for several pieces of information needed to approve our request, which should all be addressed in the attached document, "Information for the New Mexico Oil Conservation Division in order to Continue Desalination Operations on the ConocoPhillips San Juan 32-8 Unit #237A Well Pad".

Please review the attached documentation at your earliest convenience and let me know what else you may need in order to approve our request. If you have any questions, please contact me at (505) 326-9829.

Sincerely,

Monica D. Johnson

Monica D. Johnson
Sr. Environmental Scientist

Attachment

Cc: Brandon Powell - NM Oil Conservation Division District III
Dale Wirth - Bureau of Land Management
Rebekah Miller - ConocoPhillips
Mark Poulson - ConocoPhillips
Ben Way - ConocoPhillips
Bob Wirtanen - ConocoPhillips
Frank McDonald - BEST
Rick Arnold - NMSU
Malynda Aragon - Sandia National Labs
Allan Sattler - Sandia National Labs
Correspondence

2.0 Background and Introduction

Coal Bed methane (CBM) accounts for about 9% of the total natural gas production in the U.S. Spurred by increased energy needs, environmental emission considerations, advantages of natural gas, and technology advances in exploration and production, CBM production could easily double in the next 8-10 years, accounting for up to, or even more than, 15% of our total natural gas production. CBM operators face increasing environmental problems and expense in hauling off and disposing of produced water (from $1-$5+ / barrel in the San Juan Basin) that has the potential of severely restricting the flow of natural gas needed by the nation. The aggregate water volumes from these gas wells, and the disposal and attendant environmental problems posed, are unprecedented. Operators relate that the problem of handling produced CBM water is very urgent.

3.0 Previous Pilot Study Information

3.1 Water Treatment Technologies Utilized

The technology chosen to treat CBM produced water to a suitable standard for rangeland and riparian improvement (or other end use or treatment requirement) depends both on the Total Dissolved Solids (TDS) and organic content of the particular CBM produced water. In this project the produced water from CBM wells was reclaimed (desalinated) and used in an alternative manner for rangeland improvement. The TDS of the treated water was significantly less than 1500 mg/L per enjoinment of the BLM and, in fact, was actually less than 300 mg/L TDS during the pilot operation conducted last fall.

The technical water treatment challenges for produced water are to pretreat the water for organic contaminants, to prevent scaling, and to remove coal fines prior to desalination. As of now, the organic content of the produced water is relatively low, which is typical of CBM produced water. The organic content of this produced water was lowered by filtration and membrane methods which appear to be all that is necessary for this produced water from this coal bed methane well. Coal fines were to be removed by "settling tanks". Use of a centrifuge for removal has proved unnecessary in this project. Minute amounts of antiscalent were used to prevent scaling. An ultrafiltration membrane was used to further lower the amount of small particulates (turbidity) and remove undissolved organic material (and even a portion of dissolved organic material). After the pretreatment, the salt content and dissolved organic carbon constituents were lowered by reverse osmosis. The chemical content, TDS, and total suspended solids (amount of coal fines), have already been measured by two laboratories in New Mexico.

3.2 Rangeland & Riparian Improvement Study

ConocoPhillips provided untreated water, which was desalinated by Sandia equipment. Both waters were stored in ConocoPhillips tanks and were provided to NMSU's Agricultural Science Center – Farmington and to USDA's Jornada Experimental Range – Las Cruces to conduct rangeland improvement and impaired riparian area improvement studies. Again, this work has been conducted with the approval of the BLM and the NMOCD. This water was used as described below.

In last fall's pilot activities, some of the existing grasses planted on that site for rehabilitation of much of the pad area were treated in the following manner:

~1/3 was spot watered with treated / desalinated water,
~1/3 was spot watered with untreated water (produced water) for purposes of comparison / control,
~1/3 received no spot watering at all.

Prior to and after watering, the soil was analyzed for the sodium absorption ratio (SAR), electrical conductivity (EC) and specific anions and cations. These include NO_3, P, Zn, Fe, Mn, Cu, Ca, Mg, Na, K, Al, and Cl.

Approximately 1.81 in of produced water and 0.68 in of treated water were applied to the 237A wellpad. The dates of application of produced water were October 24 and November 23, 2007 and November 23, 2007 for treated water. Below is a summary of all activities performed by the USDA and NMSU.

1. Took soil samples from both non-treated and treated areas before water was applied. Dates are 10-24-07 and 11-23-07 for non-treated and treated produced water.
2. Applied non-treated produced water on 10-24-07 and 11-23-07. Treated area was approximately 4500 square feet with approximately 60 barrels of non-treated produced water applied at each date for a total of 120 barrels.
3. Applied treated water on 11-23-07. Treated area was approximately 4500 square feet with approximately 45 barrels of treated water applied.

Initial soil samples were taken at a depth of one foot on October 24 and November 23, 2007 before treated and untreated water were applied. Samples were taken from both areas to be watered later and on the area that was not to be watered at all for comparison. Laboratory analysis ranges for the initial tests prior to watering activities were as follows: pH 8.0-8.18, Calcium 3630-3230 ppm, Magnesium 335-305 ppm, Sodium 48.6-28.8 ppm, and Sodium Absorption Ratio 1.64-1.12. The final analyses, not yet taken, would be taken at completion of the work but now from greater soil depths (see proposed sampling protocol in section 6.0).

4.0 New Pilot Operation Information

4.1 New Equipment Description

The proposed continuation of this pilot operation flow diagram is summarized in Figure 2.

This continuation is also to be conducted at the ConocoPhillips San Juan 32-8 Unit #237A wellpad. The new equipment should greatly enhance the output of treated water from that obtained last fall.

Raw CBM produced water will be sent to an ultrafiltration system (UF), which will remove most of the particulate matter and larger molecular weight organic matter. The UF filtrate will be dosed with minute amounts of an antiscalent (for barium sulfate, carbonate scale protection) and fed directly to a reverse osmosis system (RO). The RO is comprised of three membranes in series and

will require approximately 330 psi of pressure for desalination. The RO can also be operated with only two membranes for lower feed pressure and lower permeate production with similar water quality in the permeate stream. Finally, the potential for nanofiltration (NF) with the produced water may be tested toward the end of the pilot operation by changing out reverse osmosis membranes for NF membranes.

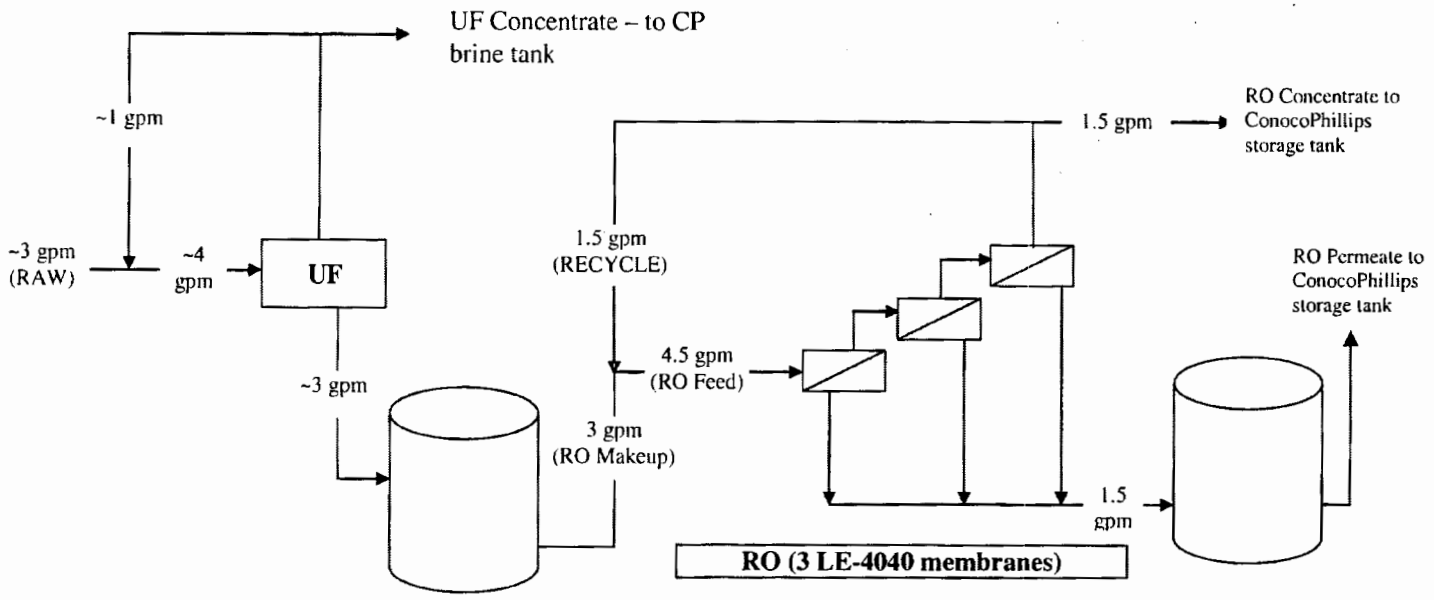

Figure 2, 2008 Pilot Equipment Flow Diagram

4.2 *Summarized Analysis Plan*

Each of the streams will be sampled regularly for water quality analysis to validate the operational effectiveness of the treatment equipment. Table 1 summarizes the anticipated water sample locations and sample analyses and frequencies to be used during the pilot. We plan to utilize Envirotech Laboratory and our in-house analytical laboratory at Sandia for these analyses. Assaigai Laboratories, Albuquerque, will be used also.

Table 1. Sample Plan for Pilot Test

P=Permeate, C=Concentrate, F=Feed

Parameter	Sampling Frequency (Start-up)	Sampling Frequency (During Pilot)	Test Streams to be sampled
Onsite Analyses			
Conductivity	At least 3x/day	At least 1x/day	Raw, UF(all), RO(all)
Temperature	At least 3x/day	At least 1x/day	RO(F, P)
pH	At least 3x/day	At least 1x/day	Raw, UF(all), RO(all)
Turbidity	At least 3x/day	At least 1x/day	Raw, UF(F,P), RO(F,P)
Total Iron	At least 3x/day	At least 1x/day	Raw, UF(F,P), RO(all)
Dissolved Iron	At least 1x/day	At least 1x/week	Raw, UF(F,P), RO(all)
Silica	At least 1x/day		Raw, RO(all)
Sulfate	At least 1x/day	At least 1x/day	Raw, RO(all)
Laboratory Analyses			
Cations			
NH_4	At least once		Raw, RO(all)
K	At least 1x/week		Raw, RO(all)
Na	At least 1x/week	At least 1x/week	Raw, RO(all)
Mg	At least 1x/week	At least 1x/week	Raw, RO(all)
Ca	At least 1x/week	At least 1x/week	Raw, RO(all)
Sr	At least once		Raw, RO(all)
Ba	At least once		Raw, RO(all)
Fe	At least 1x/week	At least 1x/week	Raw, UF(F,P), RO(all)
Mn	At least 1x/week		Raw, RO(all)
Anions			
CO_3	At least 1x/week	At least 1x/week	Raw, RO(all)
HCO_3	At least 1x/week	At least 1x/week	Raw, RO(all)
NO_3	At least once	At least 1x/week	Raw, RO(all)
F	At least 1x/week		Raw, RO(all)
Cl	At least 1x/week	At least 1x/week	Raw, RO(all)
Br	At least 1x/week		Raw, RO(all)
SO_4	At least 1x/week	At least 1x/week	Raw, RO(all)
PO_4 (total, ortho)	At least 1x/week	At least 1x/week	Raw, RO(all)
Other Tests			
SiO_2	At least 1x/week	At least 1x/week	Raw, RO(all)
TDS (gravimetric)	At least 1x/week	At least 1x/week	Raw, RO(all)
TDS (calculation)	At least 1x/week	At least 1x/week	Raw, RO(all)
TSS	At least 1x/week	At least 1x/week	Raw, UF(F,P), RO(all)
TOC, DOC	At least 1x/week	At least 1x/week	Raw, UF(F,P), RO(all)
GAB	Once	1x/month, if levels are high enough to warrant	Raw
Purgeable VOCs	At least once	1x/month	Raw, UF(F,P), RO(all)
Gasoline, Diesel Range Organics	At least once	1x/month	Raw, UF(F,P), RO(all)
Total Recoverable Petroleum Hydrocarbons	At least once	1x/month	Raw, UF(F,P), RO(all)
n-hexane extractable material	At least once	1x/month	Raw, UF(F,P), RO(all)

4.3 Waste Management Plan

We anticipate several types of waste streams during the 2008 pilot activities. These are each summarized below, along with the plan for disposal.

1. Liquid (water) waste streams. There will be a concentrate stream from both the UF and RO systems, which will be minimal in volume (i.e. less than 5 gpm for 4-6 hours per day, Monday-Friday). These streams will be similar to the feed stream, but concentrated somewhat due to the membrane processes. There will also be minute amounts of anti-scalant present. These streams will be stored in a ConocoPhillips storage tank. ConocoPhillips will coordinate final disposal of this water through existing activities and permits.
2. Used cartridge filters and membranes. We anticipate changing out cartridge filters throughout the pilot operation. These will be disposed of according to regulations in an NMOCD approved landfill and coordinated through ConocoPhillips (via Frank McDonald, BEST).
3. Other waste (paper towels, bottles, etc.). Sandia will be using field test kits, which will constitute an ordinary trash waste stream. These will be bagged and brought back to Sandia for disposal unless NMOCD prefers that this, too, go to an NMOCD approved landfill.

5.0 Interim Test on Chloride Build Up in the Soil (from Fall 2007 Pilot Activities)

A set of "interim" samples were taken to look for chloride build-up at a depth of one foot on April 11, 2008. See Table 2. These were taken "after the fact" since the soil was already treated with produced and desalinated water Pre-treatment / pre-watering data was approximated by sampling the soil close to (but not right next to) the treated areas. In Table 2 these are referred to as the "Treated / Before" or "Untreated / Before" cells. The "Control" cells of Table 2 were taken from the area where no water was added, as before. The "Treated / After" and "Untreated / After" cells of the table were again taken from their respective watered areas. That is not ideal, but this was attempted in order to approximate and reestablish a baseline "after the fact" and give an interim look at the chloride build-up.

As described previously, there are three areas being studied for rangeland and riparian improvement. These are described in Table 2 as "Control" (the area with no water applied to it), "Treated" (the area with treated water applied to it), and "Untreated" (the area with untreated water applied to it).

Table 2. Soil Analysis Summary, Interim Samples Taken 4/11/08

Area Tested	Before / After Treatment	Conductivity Micro-ohms/cm	Ca Mg/kg	Mg Mg/kg	Na mg/kg	SAR	Cl mg/kg
Control	N/A – no water added	122	142	3.9	14.9	0.3	18
Treated	Before	93.5	38.4	,0.1	3.2	0.1	14
Untreated	Before	184	119	<0.1	15.0	0.4	30
Treated	After	97.4	168	3.9	3.6	0.1	14
Untreated	After	202	286	15.8	10.7	0.2	18

These results show the need for more samples to be taken. Some semi-quantitative comments can be given. This was a winter of considerable snowfall, so soil minerals could have leached out. All "recent interim" samples were taken after the winter and again, the "prior" samples were taken very close to the area watered, but where no water fell. The effects of the snow should be uniform but could minimize the difference between the soil analyses from the treated and untreated water applications. The resultant conductivities rose only slightly after applying treated and untreated water. The SAR's are essentially unchanged. It is possible that the sodium and chloride are tied up in a shallow surface layer but no significant chloride build up is seen at the one fort depth from this one sample in the area watered with untreated water. Some increase in calcium and magnesium can be seen from the untreated water application from that one soil sample.

The more recent soil sample data in Table 2 were from analysis by Envirotech. The samples taken last fall in the Rangeland and Riparian Study Section above in this document were from analysis done by the Navajo Agricultural Products Industry (NAPI) Laboratory. A laboratory change, unfortunately, was necessary because NAPI does not perform chloride analysis.

6.0 New Soil Sampling Protocol

Heretofore samples were taken at a depth of one foot. Henceforth soil samples will be taken at three to five feet, depending on the depth that can be obtained on the ConocoPhillips San Juan 32-8 Unit #237A wellpad. After a soil sample is taken, the hole will be carefully backfilled and tamped. If necessary to prevent the hole itself becoming a conduit to lower horizons, suitable material such as barite shall be included in the backfill. Multiple samples will be taken.

Soils will be tested for pH, NO_3, Zn, Fe, Mn, Cu, Ca, Mg, Na, K, Cl, and Al. Samples will be gathered of the soil in each of the three test areas as described previously (control, treated, untreated). These tests will be taken, before and after watering, as well as a final measurement to be taken a minimum of one year after the final watering.