SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: VARIOUS SITES VISITED

CITY: GARDEN CITY STATE: KS COUNTY: FINNEY, HASKELL

BASIN: HUGOTON FIELD: STEWART

CONTACT NAME/TITLE: PETE KUNEYL – PRODUCTION FOREMAN/ PETROSANTANDER

CONTACT NUMBER: (620)275-2388

CONTACT NAME/TITLE: JIM HOLLAND & KEN JELHICK/ REGULATORY TECHNICIANS-KCC

CONTACT NUMBER: (620)225-8888

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: THE FIRST SITE VISITED WAS THE PETROSANTANDER WATER FLOOD IN THE STEWART FIELD JUST NORTHEAST OF GARDEN CITY A FEW MILES. PETROSANTANDER TOOK THE WATER FLOOD OVER ABOUT 10 YEARS AGO, AND HAS WORKED WITH THE DOE AND KANSAS GEOLOGICAL SURVEY (KGS) TO STUDY THE FLOOD AND IMPROVE EFFICIENCIES. IN TERMS OF WATER MANAGEMENT, PETROSANTANDER REINJECTS 100% OF THE WATER PRODUCED BACK INTO THE MORROW FORMATION FOR ENHANCED RECOVERY. PRIOR TO REINJECTION THE WATER IS FIRST RUN THROUGH A PHASE SEPARATOR, WHICH SEPARATES THE WATER FROM THE OIL AND GAS. CHEMICAL AMENDMENTS ARE THEN ADDED TO THE WATER (SCALE AND BACTERIA INHIBITORS) AND IT IS PUMPED TO A SERIES OF TANKS. THE WATER IS PUMPED CENTRIFUGALLY INTO THE TANKS TO PREVENT STAGNATION AND INCREASE RESIDENCE TIME IN EACH TANK. OIL IS SKIMMED OUT OF EACH TANK, AS NECESSARY. THE WATER IS THEN PUMPED THROUGH A 50 MICRON SOCK FILTER TO REMOVE SOILDS THAT MAY PLUG THE REINJECTION WELLS. THE WATER IS PUMPED BACK OUT INTO THE FIELD AND REINJECTED ALONG WITH ANY MAKEUP WATER THAT IS ADDED AS NECESSARY.

THE SECOND SITE VISITED WAS A WATER FLOOD OPERATED BY CHESAPEAKE. A NEARBY WELL (ONCE OPERATED BY MESA AND BOUGHT BY PIONEER) THAT WAS NOT PLUGGED PROPERLY HAD SEEPED SALTWATER INTO THE OGALLALA AQUIFER, WHICH IS A MAJOR DRINKING WATER AQUIFER. IN ORDER TO CONTAIN THE SALTWATER SEEP, SEVERAL WELLS WERE INSTALLED TO CAPTURE THE SALTWATER AND THEN REINJECT THE CONTAMINATED WATER AT A CENTRAL INJECETION WELL INTO A DEEPER AQUIFER. THE CENTRAL INJECTION WELL WAS PRESSURING UP, AND THEREFORE PIONEER WAS LOOKING TO CONTRUCT A SECOND INJECTION WELL. CHESAPEAKE WAS LOOKING TO INSTALL SEVERAL MORE WATER SUPPLY WELLS TO SUPPLY WATER TO THEIR WATER FLOOD. INSTEAD, PIONEER WAS ABLE TO SUPPLY CHESAPEAKE WITH THE OGALLALA WATER, AND PREVENT THE NEED FOR A SECOND INJECITON WELL, AND CHESAPEAKE DID NOT HAVE TO BUILD ADDITIONAL WATER

SUPPLY WELLS. CHESAPEAKE CURRENTLY USES ABOUT 2,200 BBLS/DAY OF THE CONTAMINATED OGALLALA WATER TO 1,400 BBLS/DAY OF WATER FROM SUPPLY WELLS.

THE THIRD SITE VISITED WAS A SERIES OF COMMERCIAL DISPOSAL WELLS. EACH DISPOSAL WELL CONSISTED OF A SERIES OF TANKS THAT ARE USED TO STORE THE WATER AS IT IS OFF LOADED FROM HAUL TRUCKS, AND SEPARATES ANY REMAINING OIL FROM THE WATER. THE WATER IS TYPICALLY STORED AT THE WELL HEAD IN CLOSED TANKS THAT MINIMIZE EVAPORATION (CRYSTALIZATION IS A CONCERN DUE TO HIGH TDS VALUES IN WATER) AND PREVENT WILDLIFE FROM COMING IN CONTACT WITH THE HIGH TDS WATER.

ENVIRONMENTAL IMPACTS/BENEFITS: OTHER THAN ENHANCED RECOVERY/WATER FLOOD, THERE ARE NO KNOWN BENEFICIAL USES FOR THE LOW QUALITY PRODUCED WATER IN WESTERN KANSAS. THE ONLY OTHER OPTION IS TO DISPOSE OF THE WATER IN DISPOSAL WELLS.

APPLICABILITY: ENHANCED RECOVERY/WATER FLOODING IS APPLICABLE WHERE THE QUALITY OF THE PRODUCED WATER IS LOW (AKA HIGH TDS) AND THE NEED FOR ENHANCED RECOVERY IN PRESENT DUE TO THE NATURE OF MATURE OIL AND GAS FIELDS.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE

DATE: 7/29/2005____ INFORMATION COLLECTED BY: _JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF A THREE PHASE SEPARATOR TANK AT PETROSANTANDER

VIEW OF THE CHEMICAL INJECTION TANKS THAT TREAT THE WATER BEFORE STORAGE

VIEW OF THE STORAGE TANKS AND ONE OF THE PUMPS

VIEW OF THE SOCK FILTER THAT REMOVES SOLIDS FROM THE WATER BEFORE REINJECTION

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF THE HEATER TREATER THAT SEPARATES THE WATER FROM THE OIL

VIEW OF A WATER SUPPLY WELL THAT PROVIDES MAKEUP WATER

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF A TYPICAL PRODUCTION WELL

VIEW OF A PROGRESSIVE CAVITY PUMP AT A PRODUCTION WELL HEAD

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF A TYPICAL STORAGE TANK AT A WELL HEAD

VIEW OF THE STORAGE TANKS THAT ARE USED IN THE REMEDIATION OF CONTAMINATED WATER

VIEW OF STORAGE TANKS AT A COMMERCIAL DISPOSAL SITE

VIEW OF A COMMERCIAL DISPOSAL WELL HEAD

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: PO BOX 1645

CITY: HAVRE STATE: MT COUNTY: BLAINE

BASIN: BATTLE CREEK FIELD: NORTH BATTLE CREEK

CONTACT NAME/TITLE: MARK HEDSTROM/ FIELD SUPERVISOR – HELIS OIL AND GAS

CONTACT NUMBER: (406)357-3639

CONTACT NAME/TITLE: GARY KLOTZ/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-4871

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED TWO CENTRALIZED EVAPORATION/AERATION PITS AND SEVERAL WELL SITES THAT HAVE BOTH LINED AND UNLINED EVAPORATION/AERATION PITS ADJACENT TO THE WELL HEADS. THE PRODUCING GAS WELLS (APPROXIMATELY 130 WELLS OPERATED BY HELIS) DISCHARGE WATER DIRECTLY TO A PIT ADJACENT TO THE WELL HEAD. PITS THAT ARE MORE REMOTE (IE NOT EASILY ACCESSIBLE WITH A VACUUM TRUCK) HAVE LARGER PITS ADJACENT TO THE WELL HEAD AND AERATORS IN THE PIT TO ENHANCE EVAPORATION. THIS MINIMIZES THE NEED TO HAUL THE WATER AWAY. FOR LINED AND UNLINED PITS THAT HAVE A SMALLER CAPACITY, VACUUM TRUCKS ARE EMPLOYED ON AN AS NEEDED BASIS TO HAUL THE WATER TO A CENTRAL EVAPORATION/AERATION PIT. THERE ARE APPROXIMATELY 21 AERATORS ON EACH OF THE CENTRAL EVAPORATION/AERATION PITS. THE AERATORS MOVE APPROXIMATELY 150 GPM (CUMMULATIVE) ON THE CENTRALIZED PITS, AND ABOUT 5 GPM ON THE REMOTE PITS. THIS CIRCULATION AND SPRAYING OF THE WATER ENHANCES THE EVAPORATION RATE. THE LEVEL OF ENHANCEMENT IS DEPENDANT ON WEATHER CONDITIONS (TEMP, WIND SPEED, CLOUD COVER, ETC).

ENVIRONMENTAL IMPACTS/BENEFITS: ALL WATER IS EITHER EVAPORATED AT THE WELL HEAD, OR EVAPORATED AT THE CENTRAL EVAPORATION/AERATION PITS. ALL PITS ARE FENCED TO PREVENT ENTRANCE OF LIVE STOCK AND WILDLIFE FROM CONSUMING THE WATER. NO OIL IS PRESENT IN THE WATER, SO HARM TO BIRDS AND MIGRATORY WATERFOWL IS NOT A CONCERN.

APPLICABILITY: THIS PARTICULAR TECHNOLOGY IS APPLICABLE TO GAS FIELDS, PRODUCING LOW VOLUMES OF WATER, IN AN ARID ENVIRONMENT THAT ENCOURAGES EVAPORATION.

COST: COSTS WERE NOT COLLECTED ON THE OPERATING COST FOR HAULING WATER. THE CAPITAL COST FOR INSTALLING THE AERATORS IS AROUND $4,000, WITH THE BIGGEST

SINGLE TICKET ITEM BEING THE CIRCULATOR PUMP, WHICH IS ABOUT $1,500. THE MONTHLY ELECTRIC COSTS FOR OPERATING THE PUMP AND AERATORS ON ONE OF THE EVAPORATION/AERATION PITS IS ESTIMATED TO BE $150/MONTH.

ADDITIONAL NOTES: NONE.

DATE: 7/14/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF CENTRALIZED EVAPORATION/AERATION PIT

VIEW OF EVAPORATION PIT ADJACENT TO EVAPORATION/AERATION PIT

VIEW OF AN UNLINED INDIVIDUAL EVAPORATION/AERATION PIT AT REMOTE WELL HEAD

CLOSER VIEW OF INDIVIDUAL AERATOR AT REMOTE WELL HEAD

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF SOLAR PANEL AT REMOTE WELL LOCATION

VIEW OF A LINED EVAPORATION PIT ADJACENT TO A WELL HEAD

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: SOUTHEAST OF BROADUS OFF OF 544

CITY: BELL CREEK STATE: MT COUNTY: POWDER

BASIN: BELL CREEK FIELD: BELL CREEK

CONTACT NAME/TITLE: DARRELL HYSTAD/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-4861

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE BELL CREEK FIELD WHERE 40-50 OIL WELLS ARE CURRENTLY PRODUCING. BELL CREEK HAS 27 INJECTION WELLS CURRENTLY ONLINE FOR ENHANCED RECOVERY. OF THE 13,000 BBLS/DAY OF WATER THAT IS PRODUCED, APPROXIMATELY 8,000 BBLS/DAY IS RE-INJECTED FOR ENHANCED RECOVERY AND 5,000 BBLS/DAY IS DISCHARGED THROUGH A SERIES OF TANKS AND PITS TO SEPARATE OIL FROM THE WATER PRIOR TO DISCHARGE.

ENVIRONMENTAL IMPACTS/BENEFITS: DISCHARGED WATER IS CONSUMED BY CATTLE, DEER, AND OTHER WILDLIFE, AND HABITAT IS CREATED FOR WILDLIFE WHERE NONE WOULD BE PRESENT DUE TO THE SEASONAL CONDITION OF THE DRAINAGE.

APPLICABILITY: THE COMBINATION OF INJECTION FOR ENHANCED RECOVERY AND DISCHARGE TO THE SURFACE IS APPLICABLE DUE TO THE QUALITY OF THE WATER OF THE MATURE NATURE OF THIS OIL FIELD TO REQUIRE ENHANCED RECOVERY.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE.

DATE: 7/12/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF THE FIRST OIL/WATER SEPARATOR PIT

VIEW OF SECONDARY PIT WITH T-SIPHON

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF SECONDARY PIT T-SIPHON TO PREVENT OIL FROM DISCHARGING

VIEW OF SECONDARY PIT DISCHARGE TO BELL CREEK

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: VISITED CENTRALIZED EVAPORATION PIT NORTH OF SACO

CITY: NORTH OF SACO STATE: MT COUNTY: PHILLIPS

BASIN: BOWDOIN FIELD: BOWDOIN

CONTACT NAME/TITLE: BOB SCHMIDT/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-5266

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED A CENTRALIZED EVAPORATION PIT CONSTRUCTED AND OPERATED BY FIDELITY. WATER IS COLLECTED AT INDIVIDUAL EVAPORATION PITS ADJACENT TO EACH WELL HEAD. AS THE INDIVIDUAL EVAPORATION PITS FILL WITH WATER, A VACUUM TRUCK COLLECTS THE WATER AND TRANSPORTS IT TO THE CENTRALIZED EVAPORATION PIT THAT IS LINED WITH A GEOSYNTHETIC LINER. THE CENTRAL EVAPORATION PIT WAS A SEPARATOR BOX THAT PREVENTS SOLIDS (SOIL, ROCKS, ETC) FROM DISCHARGING TO THE EVAPORATION PIT, THUS EXTENDING THE LIFE OF THE LINER. FIDELITY HAS THREE ADDITIONAL CELLS THAT CAN BE LINED, AS NECESSARY, ONCE THE FIRST EVAPORATION PIT REACHES CAPACITY. THE EVAPORATION PIT IS A FEW FEET DEEP, THUS ENHANCING THE HEATING AND EVAPORATION OF THE WATER, WHICH IS SPREAD OVER A LARGE AREA (APPROXIMATELY 100 FEET WIDE BY 300 FEET LONG).

ENVIRONMENTAL IMPACTS/BENEFITS: ALL WATER IS EITHER EVAPORATED AT THE WELL HEAD, OR EVAPORATED AT THE CENTRAL EVAPORATION PIT. ALL PITS ARE FENCED TO PREVENT ENTRANCE OF LIVE STOCK AND WILDLIFE FROM CONSUMING THE WATER. NO OIL IS PRESENT IN THE WATER, SO HARM TO BIRDS AND MIGRATORY WATERFOWL IS NOT A CONCERN.

APPLICABILITY: THIS PARTICULAR TECHNOLOGY IS APPLICABLE TO GAS FIELDS, PRODUCING LOW VOLUMES OF WATER, IN AN ARID ENVIRONMENT THAT ENCOURAGES EVAPORATION.

COST: COSTS WERE NOT COLLECTED ON THE EVAPORATION PIT OR THE TRUCKING COSTS FOR HAULING WATER.

ADDITIONAL NOTES: NONE.

DATE: 7/13/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF EVAPORATION PIT ADJACENT TO A PRODUCING GAS WELL

CLOSER VIEW OF EVAPORATION PIT ADJACENT TO PRODUCING GAS WELL

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF CENTRALIZED EVAPORATION PIT THAT IS LINED

VIEW OF CELL ADJACENT TO EVAPORATION PIT FOR FURTHER EXPANSION OF THE SYSTEM

VIEW OF TRUCK OFF-LOADING AREA WHERE WATER IS OFF-LOADED INTO THE EVAPORATION PIT FROM TRUCKS

CLOSER VIEW OF DISCHARGE WEIR WHERE SOLIDS ARE SEPARATED OUT AS THE TRUCK IS OFF-LOADED PRIOR TO DISCHARGE TO THE EVAPORATION PIT

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: 115 N. MAIN (BURLINGTON RESOURCES)

CITY: BAKER STATE: MT COUNTY: FALLON

BASIN: CEDAR CREEK ANTICLINE FIELD: EAST LOOKOUT BUTTE

CONTACT NAME/TITLE: DALE HINTON/ ENCORE

CONTACT NUMBER: (406)

CONTACT NAME/TITLE: JIM ARMENTROUT/ BURLINGTON RESOURCES

CONTACT NUMBER: (406)778-6401

CONTACT NAME/TITLE: DARRELL HYSTAD/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-4861

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE CEDAR CREEK ANTICLINE FIELD WHERE WATER IS PRIMARLY INJECTED FOR DISPOSAL AND ENHANCED RECOVERY. WATER THAT IS ENTRAINED WITH OIL IS RUN THROUGH A MOBILE OIL RECOVERY UNIT THAT FURTHER SEPARATES THE OIL FROM THE WATER. SOLIDS REMOVED FROM THE OIL RECOVERY PROCESS ARE APPLIED TO AN ALKALINE FLAT LANDFARM WHERE THE PROPERTIES OF THE SOIL ARE IMPROVED FROM THE LANDFARMING TECHNIQUE. WATER REMOVED IS INJECTED AND OIL REMOVED IS SOLD TO RECOVER THE COST OF THE OIL RECOVERY PROCESS.

ENVIRONMENTAL IMPACTS/BENEFITS: ALL WATER IS INJECTED FOR EITHER ENHANCED RECOVERY OR DISPOSAL.

APPLICABILITY: THE INJECTION FOR DISPOSAL AND ENHANCED RECOVERY IS APPLICABLE DUE TO THE QUALITY OF THE WATER AND THE MATURE NATURE OF THIS OIL FIELD TO REQUIRE ENHANCED RECOVERY.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE.

DATE: 7/12/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF AN INJECTION WELL

VIEW OF PUMPING UNITS THAT PUMP WATER TO INJECTION WELLS

VIEW OF PRODUCING WELL WITH AN EVAPORATION PIT ADJACENT TO IT

CLOSER VIEW OF THE EVAPORATION PIT

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF A MOBILE OIL RECOVERY UNIT

VIEW OF A BIN THAT COLLECTS SOLIDS FROM THE MOBILE OIL RECOVERY UNIT

VIEW OF LANDFARM WHERE ALKALINE SOILS ARE RECLAIMED

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF NATURAL ALKALINE SOILS ADJACENT TO LANDFARM

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: VARIOUS DISPOSAL SITES VISITED

CITY: SYDNEY AND MEDICINE LAKE STATE: MT COUNTY: RICHLAND AND SHERIDAN

BASIN: VARIOUS FIELD: VARIOUS

CONTACT NAME/TITLE: BOB SCHMIDT/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-5266

CONTACT NAME/TITLE: DARRELL HYSTAD/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-4861

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THREE DISPOSAL SITES.

LANDTECH, JUST NORTHWEST OF SYDNEY (APPROXIMATELY 12 MILES) WAS VISITED. LANDTECH HAS BEEN ALLOWED TO MAINTAIN THE NETTED CONCRETE PIT SYSTEM DUE TO GRANDFATHER LAWS. LANDTECH HAS THREE CONCRETE PITS IN SERIES THAT SEPARATE THE OIL FROM THE WATER. THEY ALSO HAVE SEVERAL TANKS ONSITE FOR TEMPORARY STORAGE PRIOR TO DISPOSAL INJECTION. LANDTECH DISPOSES ABOUT 2,000-5,000 BBLS OF WATER/DAY.

NANCE OPERATES A COMMERCIAL DISPOSAL WELL JUST NORTH OF MEDICINE LAKE. THE NANCE DISPOSAL OPERATION HAS A SEPARATION PIT THAT IS NETTED AND IS USED TO SEPARATE THE OIL FROM THE WATER. BOTH NANCE AND LANDTECH UTILIZE THE MOBILE OIL RECOVERY UNITS TO FURTHER SEPARATE WATER FROM OIL AND SELL THE OIL COMMERCIALLY.

THE THIRD SITE VISITED WAS A DISPOSAL WELL THAT SERVICES 6 PRODUCING OIL WELLS. THIS SITE HAD NO SURFACE PITS AS ALL OF THE WATER IS CONTAINED IN TANKS PRIOR TO DISPOSAL. THE WELL HOUSE IS CONNECTED TO THE FINAL TANK TO PREVENT FREEZING OF THE PIPES DURING WINTER MONTHS.

ENVIRONMENTAL IMPACTS/BENEFITS: ALL WATER IS INJECTED FOR DISPOSAL.

APPLICABILITY: THE INJECTION FOR DISPOSAL IS APPLICABLE DUE TO THE QUALITY OF THE WATER.

COST: DISPOSAL COSTS VARY BASED ON THE QUALITY OF THE WATER.

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

ADDITIONAL NOTES: NONE.

DATE: 7/13/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF CONCRETE SEPARATION PITS IN SERIES AT LANDTECH

VIEW OF INSTRUMENTS USED TO DETERMINE WATER QUALITY AT LANDTECH

VIEW OF TANKS AND NETTED PIT AT NANCE

VIEW OF INJECTION WELLHEAD AT NANCE

VIEW OF A OILFIELD AND TANKS AT A "NO PIT" DISPOSAL SITE NEAR MEDICINE LAKE

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF A TANK WITH THE WELL HEAD HOUSED NEXT TO IT

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: SITES VISITED IN CX FIELD AND COAL CREEK EXPLORATORY POD

CITY: NORTHEAST OF DECKER STATE: MT COUNTY: BIG HORN

BASIN: POWDER RIVER FIELD: PRB CBM

CONTACT NAME/TITLE: STEVE SASAKI/ DRILLING INSPECTOR- MBOGC

CONTACT NUMBER: (406)656-0040

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: THE CX FIELD WAS VISITED AND AN EMIT WATER TREATMENT PLANT WAS VISITED NORTH OF THE TONGUE RIVER RESERVOIR JUST NORTH OF COAL CREEK. THE CX FIELD HAS SEVERAL DISCHARGE POINTS INTO THE TONGUE RIVER THAT HAVE BEEN GRANDFATHERED AS MDPES DISCHARGE POINTS. 1600 GPM IS CUMMULATIVELY DISCHARGED INTO THE TONGUE RIVER FROM THE CX FIELD. FIDELITY HAS REQUESTED TO ALTER THE MPDES DISCHARGE PERMITS TO ALLOW FOR HIGHER DISCHARGE RATES DURING HIGH FLOW PERIODS OF THE TONGUE RIVER. THE EMIT PLANT VISITED WAS FROM THE COAL CREEK EXPLORATORY PLAN OF DEVELOPMENT (POD). ALL OF THE WATER PRODUCED FROM THE COAL CREEK EXPLORATORY POD IS PUMPED TO A CENTRAL TANK WHERE ANY GAS IS VENTED OFF. THE WATER IS THEN RUN THROUGH THE EMIT PLANT AS DESCRIBED BELOW. AFTER THE EMIT PLANT, THE WATER IS RUN THROUGH A LIMESTONE REACTOR BED, AND THEN THROUGH A RENTENTION PIT AND THEN AN AERATOR PIT PRIOR TO DISCHARGE. THE WATER IS THEN DISCHARGED TO THE TONGUE RIVER THROUGH A PERFORATED PIPE THAT IS TRENCHED BELOW THE BED OF THE RIVER. THE TRENCHED PIPE HAS A CLEAN OUT PIPE OF BOTH SIDES OF THE RIVER THAT DAYLIGHT SO THE TRENCHED PIPE CAN BE EASILY CLEANED OUT AS NEEDED.

THE FOLLOWING PROCESS DESCRIPTION WAS TAKEN FROM THE EMIT TECHNOLOGIES WEBSITE, WWW.EMITTECHNOLOGIES.COM :

COMMERCIALLY AVAILABLE CATION & ANION RESINS ARE USED TO PURIFY PRODUCED WATER OF SODIUM, CHLORIDE, SULFATE AND OTHER IONS IN BOTH A CONTINUOUS AND COUNTERCURRENT OPERATING MODE. THESE CHEMICAL ENGINEERING PRINCIPLES OF MASS TRANSFER MAXIMIZE THE RESINS' ABILITIES IN PURIFYING WATER WITH A CONSISTENT QUALITY. THEY ALSO OPTIMIZE THE USE OF ACID AND ALKALI REGENERANTS, MINIMIZE THEIR VOLUMES AND GENERATE A DENSE BRINE SOLUTION THAT MAY HAVE VALUE AS A CLEAR BRINE FLUID WITHIN THE OIL AND GAS INDUSTRY. THE KEY TO THE HIGGINS LOOP FEATURES IS ITS ABILITY TO MOVE THE RESIN THROUGH THE LOOP VIA INCREMENTAL "PULSING". THE PULSE VESSEL SERVES AS A RESIN FLOW METER TO ENSURE ITS FLOW IS IN PROPORTION TO THE WATER TREATED AND THE AMOUNT OF REGENERANT CONSUMED.

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PRODUCED WATER CONTAINING HIGH NA LEVELS IS FED TO THE ADSORPTION ZONE WITHIN THE HIGGINS LOOP WHERE IT CONTACTS STRONG ACID CATION RESIN WHICH LOADS NA^+ IONS IN EXCHANGE FOR HYDROGEN (H^-) IONS. TREATED WATER EXITS THE LOOP CONTAINING LESS THAN 10 MG/L NA.

CONCURRENT WITH ADSORPTION AND IN THE LOWER SECTION OF THE HIGGINS LOOP, NA-LOADED RESIN IS REGENERATED WITH EITHER HYDROCHLORIC OR SULFURIC ACID TO PRODUCE A SMALL, CONCENTRATED SPENT BRINE STREAM. REGENERATED RESIN IS RINSED WITH WATER PRIOR TO REENTERING THE ADSORPTION ZONE TO REMOVE ACID FROM ITS PORES.

AS RESIN IN THE UPPER LAYER OF THE ADSORPTION ZONE BECOMES LOADED WITH NA, THE FLOWS TO THE HIGGINS LOOP ARE MOMENTARILY INTERRUPTED TO ALLOW ADVANCEMENT OF THE RESIN BED (PULSING) THROUGH THE LOOP IN THE OPPOSITE DIRECTION OF LIQUID FLOW. LIQUID FLOWS ARE RESTARTED AFTER RESIN PULSING IS COMPLETE.

TREATED WATER IS SLIGHTLY ACIDIC DUE TO ITS INCREASED H^- ION STRENGTH, AND IT IS NEUTRALIZED WITH LIMESTONE, WHICH ALSO INCREASES ITS CALCIUM CONCENTRATION SO THAT THE WATER'S SODIUM ADSORPTION RATIO (SAR) IS LESS THAN 1.0. SPENT BRINE CONTAINING REMOVED NA^+ IONS HAS A DENSITY HIGH ENOUGH FOR USE AS A KILL FLUID.

ENVIRONMENTAL IMPACTS/BENEFITS: TREATING PRODUCED WATER WITH THIS TECHNOLOGY PROVIDES ENVIRONMENTAL BENEFITS BY ALLOWING FOR THE WATER TO BE BENEFICIALLY USED BY IMPROVING THE SAR AND LOWERING THE TDS. ONCE THE WATER IS TREATED, IT CAN BE PUT BACK INTO A SURFACE STREAM FOR USE BY LIVESTOCK, WILDLIFE, AND DOWNSTREAM WATER RIGHTS HOLDERS, OR IT CAN BE IRRIGATED IMMEDIATELY.

APPLICABILITY: THE HIGGINS LOOP HAS BEEN IN USE SINCE WWII, AND THE USE OF THE EMIT TECHNOLOGY IS GROWING IN THE POWDER RIVER BASIN ON BOTH THE WYOMING AND MONTANA SIDE. THIS TECHNOLOGY IS USEFUL IN LOWERING SODIUM, BICARBONATES, SAR VALUES, AND OVERALL TDS TO BELOW NPDES PERMIT REQUIREMENTS.

COST: NO INFORMATION WAS COLLECTED ON COST. THE WEBSITE STATES THAT COST IS A FIXED COST AND IS CHEAPER THAN SEVERAL OF THE CURRENT TREATMENT ALTERNATIVES.

ADDITIONAL NOTES: NONE

DATE: 7/11/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF THE ENTRANCE TO CX RANCH

VIEW OF A MPDES DISCHARGE POINT ON CX RANCH

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF THE DISCHARGE POINT INTO THE TONGUE RIVER

CLOSER VIEW OF THE DISCHARGE POINT

VIEW OF THE COAL CREEK EMIT PLANT

VIEW OF A LIME REACTOR BED WITH AN AERATOR

CLOSER VIEW OF THE AERATOR PRIOR TO DISCHARGE TO RETENTION PIT

VIEW OF THE RETENTION AND AERATION PITS

VIEW OF THE DISCHARGE POINT TRENCHED BELOW THE RIVER

CLOSER VIEW OF THE DISCHARGE POINT TRENCHED BELOW THE RIVER

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: NONE AVAILABLE (SUMMIT RESOURCES WAS THE OPERATOR)

CITY: NORTH OF CHINOOK STATE: MT COUNTY: BLAINE

BASIN: RABBITT HILLS FIELD: RABBITT HILLS

CONTACT NAME/TITLE: GARY KLOTZ/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-4871

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED A SURFACE DISCHARGE POINT AT THE RABBITT HILLS OIL FIELD. SIMILAR OIL/WATER SEPARATION PITS WERE USED, ALONG WITH NETTING ON THE PRIMARY PIT TO PROTECT BIRDS AND WILDLIFE. A FILTER SOCK, WHICH IS FREQUENTLY CHANGED OUT, IS ALSO EMPLOYED JUST AFTER THE SECONDARY SEPARATION PIT TO ENHANCE THE OIL AND SOLIDS REMOVAL FROM THE DISCHARGE PRIOR TO DISCHARGING TO THE STOCK POND. FURTHERMORE, A 20-30 FOOT FLEXIBLE PLASTIC TUBE HAS BEEN CONNECTED TO THE PIPE SPILLWAY OF THE STOCK POND TO MINIMIZE EROSION DURING STORM EVENTS AND PERIODS OF HIGH FLOW. THE STOCK POND WAS NOT DISCHARGING OVER THE SPILLWAY AT THE TIME OF THE VISIT.

ENVIRONMENTAL IMPACTS/BENEFITS: DISCHARGED WATER IS CONSUMED BY CATTLE, DEER, AND OTHER WILDLIFE, AND HABITAT IS CREATED FOR WILDLIFE WHERE NONE WOULD BE PRESENT DUE TO THE SEASONAL CONDITION OF THE DRAINAGE.

APPLICABILITY: THE DISCHARGE TO THE SURFACE IS APPLICABLE DUE TO THE QUALITY OF THE WATER AND THE ABILITY OF THE PROCESS TO REMOVE OIL FROM THE WATER PRIOR TO SURFACE DISCHARGE.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE.

DATE: 7/14/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF PRIMARY SEPARATION PIT THAT IS NETTED

VIEW OF SECONDARY SEPARATION PIT ENCLOSED WITH A FENCE AND A CATTLE GUARD

VIEW OF DISCHARGE POINT WITH SOCK FILTERS TO REMOVE OILY SOLIDS

VIEW OF STOCK POND THAT THE PRODUCED WATER IS DISCHARGED TO

VIEW OF STOCK POND DAM WITH PRIMARY SPILLWAY PIPES

CLOSER VIEW OF ENERGY DISSIPATION DEVICE AT DISCHARGE POINT TO REDUCE EROSION

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: SOUTH OF HAVRE IN/AROUND BEAR PAW MOUNTAINS

CITY: HAVRE STATE: MT COUNTY: HILL

BASIN: TIGER RIDGE FIELD: TIGER RIDGE

CONTACT NAME/TITLE: GARY KLOTZ/ FIELD INSPECTOR – MBOGC

CONTACT NUMBER: (406)698-4871

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED TWO CENTRALIZED EVAPORATION PITS AND SEVERAL WELL SITES THAT HAVE LINED, UNLINED, AND OPEN TUB EVAPORATION PITS ADJACENT TO THE WELL HEADS. ONE LOCATION VISITED HAD AN OPEN RING TANK AND A COMPRESSOR TO INCREASE THE GAS PRESSURE TO PIPELINE QUALITY. ANOTHER LOCATION HAD AN ENCLOSED TANK ADJACENT TO THE WELL HEAD. IT WAS UNCLEAR WHY THE TANK HAD BEEN INSTALLED AS THE SITE WAS VERY REMOTE, AND A VACUUM TRUCK WOULD NOT BE ABLE TO EASILY ACCESS THE SITE FOR HAULING WATER. FOR LINED AND UNLINED PITS, VACUUM TRUCKS ARE EMPLOYED ON AN AS NEEDED BASIS TO HAUL THE WATER TO A CENTRAL EVAPORATION PIT. THE CENTRAL EVAPORATION PITS ARE FENCED AND NETTED TO PREVENT WILDLIFE FROM ENTERING THEM.

ENVIRONMENTAL IMPACTS/BENEFITS: ALL WATER IS EITHER EVAPORATED AT THE WELL HEAD, OR EVAPORATED AT THE CENTRAL EVAPORATION PITS. ALL PITS ARE FENCED AND NETTED TO PREVENT ENTRANCE OF LIVE STOCK AND WILDLIFE FROM CONSUMING THE WATER.

APPLICABILITY: THIS PARTICULAR TECHNOLOGY IS APPLICABLE TO GAS FIELDS, PRODUCING LOW VOLUMES OF WATER, IN AN ARID ENVIRONMENT THAT ENCOURAGES EVAPORATION.

COST: COSTS WERE NOT COLLECTED.

ADDITIONAL NOTES: NONE.

DATE: 7/14/2005 INFORMATION COLLECTED BY: JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF 30' RING TANK THAT IS USED TO STORE PRODUCED WATER ADJACENT TO THE WELL HEAD

VIEW OF MOBILE COMPRESSOR UNIT USED TO INCREASE GAS PRESSURE

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF A CENTRALIZED EVAPORATION PIT OFF-LOADING AREA

CLOSER VIEW OF CENTRALIZED EVAPORATION PIT

VIEW OF A LINED PIT ADJACENT TO A WELL HEAD

VIEW OF AN EVAPORATION TUB ADJACENT TO WELL HEAD

VIEW OF A WELL HEAD WITH A TANK ADJACENT TO IT TO HOLD PRODUCED WATER

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

CLOSER VIEW OF PRODUCED WATER TANK ADJACENT TO WELL HEAD

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: 111 WEST 5TH STREET, SUITE 1000 (MAIN OFFICE)

CITY: TULSA STATE: OK COUNTY: OKLAHOMA

BASIN: OKLAHOMA CITY FIELD: OKLAHOMA CITY

CONTACT NAME/TITLE: JANET MCGEHEE/ PRODUCTION MANAGER – NEW DOMINION

CONTACT NUMBER: (918)465-4167

CONTACT NAME/TITLE: TIM BAKER/ POLLUTION ABATEMENT MANAGER-OCC

CONTACT NUMBER: (405)522-2763

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: A DEEP INJECTION WELL, NAMED "DEEP THROAT" HAS BEEN CONSTRUCTED IN THE MATURE OKLAHOMA CITY FIELD IN ORDER TO DISPOSE OF LARGE VOLUMES OF WATER THAT ARE PRODUCED AS A RESULT OF THE DEWATERING TECHNIQUE THAT IS BEING EMPLOYED BY NEW DOMINION, LLC. DEEP THROAT IS COMPLETED AS A MULTI-LATERAL HORIZONTAL DISPOSAL WELL IN THE LOWER ARBUCKLE FORMATION (OVER 8,000' TOTAL DEPTH), AND IT IS PERMITTED TO DISPOSE OF 60,000 BBLS/DAY. THE OIL AND GAS IS BEING PRODUCED FROM THE UPPER PORTION OF THE ARBUCKLE FORMATION (~6,000' DEPTH). THE WATER PRODUCED IS EXTREMELY HIGH IN TDS, AND THE OKLAHOMA CITY FIELD IS IN THE MIDDLE OF A HIGHLY POPULATED AREA DUE TO THE GROWTH OF OKLAHOMA CITY, THEREFORE THE ONLY FEASIBLE OPTION TO MANAGE THE HIGH VOLUMES OF WATER IS TO INJECT IT.

ENVIRONMENTAL IMPACTS/BENEFITS: THERE ARE NO KNOWN BENEFICIAL USES FOR THE HIGH TDS WATER, AND DUE TO THE PROXIMITY TO RESIDENTIAL AREAS, THE MAJOR ENVIRONMENTAL CONCERN IS FOR HUMAN SAFETY FOR THE SURROUNDING NEAIGHBORHOODS. PIPELINES CARRYING THE OIL, WATER, AND GAS ARE ALL BELOW GRADE, AND CARE HAS BEEN TAKEN TO RESTORE ALL PIPELINE CORRIDORS. DUE TO THE PROXIMITY OF HUMAN INHABITANCE, THE DRILLING SITES HAVE BEEN CONDENSED TO A SMALL AREA (~6 CONTIGUOUS ACRES FOR 8 DRILLING SITES). MULTI-LATERAL HORIZONTAL DRILLING TECHNOLOGY IS UTILIZED TO COMPLETE THE WELLS IN VARIOUS FORMATIONS, OVER A LARGE AREA, WHILE ONLY DISTURBING THIS SMALL SURFACE AREA.

APPLICABILITY: MULTI-LATERAL DEEP WELL INJECTION IS BEST SUITED FOR HIGHLY POPULATED AREAS, WHERE THE VOLUME OF WATER IS CONSIDERABLY LARGE, AND/OR THE QUALITY OF THE WATER IS SUCH THAT NO BENEFICIAL USE CAN BE REALIZED.

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

COST: NO INFORMATION WAS COLLECTED ON THE CAPITAL COST TO DRILL "DEEP THROAT". THE COST TO HAVE IT WORKED ON, AS IT WAS BEING WORKED ON DURING THE SITE VISIT, IS APPROXIMATELY $15,000/DAY.

ADDITIONAL NOTES: NONE

DATE: 7/6/2005____ INFORMATION COLLECTED BY: _JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF THE WELL HEAD FOR "DEEP THROAT" THE DEEP MULTI-LATERAL DISPOSAL WELL

VIEW OF THE DRILL RIG SETTING UP TO WORK ON "DEEP THROAT"

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF THE WELL HEAD OF A PRODUCING WELL

VIEW OF THE 3 PHASE SEPARATOR THAT IS SPECIALLY DESIGNED FOR A HIGH SEPARATION EFFICIENCY OF WATER, OIL, AND GAS

VIEW OF A FOUNDATION THAT HAS BEEN CONSTRUCTED FOR AN ADDITIONAL 3 PHASE SEPARATOR

VIEW OF TRANSMISSION LINES CONSTRUCTED TO ALLOW FOR FUTURE GROWTH

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF **PRODUCED WATER MANAGEMENT PRACTICES** FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: 1110 W. STOVALL ROAD

CITY: WILBURTON STATE: OK COUNTY: LATIMER

BASIN: RED OAK FIELD: RED OAK

CONTACT NAME/TITLE: JAY EUBANKS/ FIELD ENV. COORD. – BP AMERICA

CONTACT NUMBER: (918)465-4167

CONTACT NAME/TITLE: TIM BAKER/ POLLUTION ABATEMENT MANAGER-OCC

CONTACT NUMBER: (405)522-2763

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: CURRENTLY, BP ESTIMATES THAT THEY HAVE 450 ACTIVE PRODUCING WELLS IN THE RED OAK FIELD. IN 2004, A PILOT PROGRAM WAS INITIATED BY BP TO PROMOTE FLOOD IRRIGATION AROUND WELL SITES USING THE PRODUCED WATER TO IRRIGATE THE LAND VERSUS HAVING THE WATER HAULED OFF FOR DISPOSAL. CURRENTLY, 13 WELLS ARE PERMITTED, WITH LANDOWNER APPROVAL, TO UTILIZE THE WATER FOR FLOOD IRRIGATION. BP PLANS TO HAVE AS MANY AS 100 WELLS PERMITTED, WITH LANDOWNER APPROVAL, USING THE SAME TECHNIQUES BY THE END OF 2005.

AN AVERAGE OF ½ BBL OF WATER IS PRODUCED FOR EVERY 100,000 CUBIC FEET (CF) OF GAS PRODUCED. THE WATER IS TYPICALLY LOW IN OIL AND GREASE (<1,000 PPM) AND LOW IN TOTAL SUSPENDED SOLIDS (TSS) (<5,000 PPM). THE WATER HAS AN AVERAGE CHLORIDE VALUE BETWEEN 250 AND 500 PPM.

THE OKLAHOMA CORPORATION COMMISSION HAS A REQUIRED APPLICATION FOR SURFACE DISCHARGE THAT SHOULD BE FILED AND APPROVED FOR EACH WELL SITE PRIOR TO FLOOD IRRIGATION ACTIVITIES. THE PERMIT REQUIRES LANDOWNER NOTIFICATION AND APPROVAL, SOIL AND WATER SAMPLES TO BE COLLECTED AND ANALYZED, AND A CALCULATION OF THE APPLICATION RATE BASED ON THE MAXIMUM TSS AND THE MAXIMUM OIL AND GREASE THAT CAN BE APPLIED TO THE LAND ON A PER ACRE BASIS. THE LIMITING CONCENTRATION IS THEN DETERMINED TO BE EITHER TSS OR OIL AND GREASE, DEPENDING ON WHICH CALCULATION IS MORE CONSERVATIVE. THE MAXIMUM TSS THAT CAN BE APPLIED OVER TIME IS 6000 LBS/ACRE, AND THE MAXIMUM OIL AND GREASE THAT CAN BE APPLIED OVER TIME IS 500 LBS/ACRE.

ONCE THE WELL SITE HAS BEEN PROPERLY PERMITTED AND APPROVED, BP CAN THEN COMMENCE THE FLOOD IRRIGATION OF THAT SITE. THE FLOOD IRRIGATION SYSTEM CONSISTS OF CONNECTING A HOSE TO THE DRAIN OF THE STORAGE TANK AT THE WELL SITE (EACH WELL SITE HAS A TANK WITH TEMPORARY STORAGE OF BETWEEN 100 AND 150 BBLS

OF WATER). WHEN THE TANK NEARS CAPACITY, A HOSE IS CONNECTED TO THE DRAIN OF THE TANK, AND A T-FITTING IS CONNECTED TO THE OPPOSITE END OF THE HOSE. TWO PERFORATED HOSES ARE THEN RUN IN OPPOSITE DIRECTIONS INTO THE AREA THAT WILL BE IRRIGATED. THE VALVE AT THE TANK DRAIN IS THEN OPENED AND THE WATER IN THE TANK IS THEN DRAINED INTO THE FIELD, THUS IRRIGATING THE FIELD. BP KEEPS RECORDS OF HOW MUCH WATER IS DISCHARGED, AND WHERE THE WATER IS DISCHARGED TO, SO THAT ONCE THE PERMIT LIMITS HAVE BEEN MET THEY WILL NO LONGER DISCHARGE TO THAT FIELD. THE TANKS TYPICALLY FILL UP IN ABOUT 6 WEEKS. DEPENDING ON THE SOIL AND WATER ANALYTICAL RESULTS, THE FIELDS CAN ACCEPT A WIDE RANGE OF WATER VOLUMES OVER TIME. FOR EXAMPLE, IF A 1 ACRE FIELD IS CALCULATED TO ACCEPT 30,000 BBLS/ACRE, THEN AT A RATE OF 100 BBLS IRRIGATED EVERY 6 WEEKS, THE FIELD CAN BE FLOOD IRRIGATED FOR THE NEXT 34 YEARS BEFORE THE PERMIT LIMITS ARE REACHED. THIS IS A CONSERVATIVE ESTIMATE AS MOST FIELDS CAN ACCEPT MORE THAN 30,000 BBLSS/ACRE, AND MOST FIELDS HAVE MORE THAN 1 ACRE THAT IS ACCESSIBLE TO IRRIGATE.

SOME SITES ARE NOT ACCEPTABLE FOR THIS FLOOD IRRIGATION PRACTICE DUE TO THE TOPOGRAPHY OF THE WELL SITE. GENERALLY, THE WELL NEEDS TO BE LOCATED IN AN AREA WHERE THERE IS A LARGE FLAT (< 3:1 GRADE) AREA TO PREVENT EROSION, AS THE LOAMY SOILS IN THIS AREA CAN BE EROSIVE AT STEEPER GRADES.

ENVIRONMENTAL IMPACTS/BENEFITS: BY UTILIZING THE WATER FOR FLOOD IRRIGATION, IMPROVEMENTS ARE REALIZED BY INCREASED LIVESTOCK AND WILDLIFE FORARING, AND GREATER YIELDS OF HAY.

APPLICABILITY: THE FLOOD IRRIGATION EMPLOYED IN THIS AREA IS ENABLED BY THE QUALITY OF THE WATER (LOW TSS AND LOW OIL AND GREASE), QUALITY OF THE SOIL (LOW TSS), SITE TOPOGRAPHY (< 3:1 GRADE), AND WILLINGNESS OF THE LANDOWNER TO ALLOW THE FLOOD IRRIGATION. SOME LANDOWNERS ARE RELUCTANT TO ALLOW THE FLOOD IRRIGATION TO TAKE PLACE ON THEIR PROPERTY WITHOUT MONETARY COMPENSATION, AT WHICH POINT BP OPTS TO HAVE THE WATER DISPOSED OF THROUGH INJECTION. FURTHERMORE, WATER IS NOT USED FOR FLOOD IRRIGATION IS WEATHER DOES NOT PERMIT DUE TO INCLEMENT CONDITIONS, AT WHICH POINT, THE WATER IS THEN CONTRACTED TO BE HAULED AND DISPOSED THROUGH INJECTION.

COST: THERE IS LITTLE COST ASSOCIATED WITH DISCHARGING THE WATER THROUGH FLOOD IRRIGATION OTHER THAN THE CAPITAL COST OF FABRICATING THE HOSES AND THE OPERATING COST OF THE LABOR HOURS ASSOCIATED WITH MANAGING THE FLOOD IRRIGATION. THE ALTERNATIVE (DISPOSAL INJECTION) IS MORE COSTLY ON A PER BBL BASIS.

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

ADDITIONAL NOTES: NONE

DATE: 7/7/2005____ INFORMATION COLLECTED BY: _JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF A WELL HEAD IN THE RED OAK FIELD THAT USES FLOOD IRRIGATION

VIEW OF THE 150 BARREL TANK THAT WATER IS STORED IN

VIEW OF PERFORATED HOSE THAT IS USED TO FLOOD IRRIGATE

VIEW OF THE TEMPORARY INSTALLATION OF THE FLOOD IRRIGATION SYSTEM

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF THE DEPLOYMENT OF TEMPORARY FLOOD IRRIGATION SYSTEM

VIEW OF A FLOOD IRRIGATION SYSTEM AS WATER IS DRAINED FROM THE STORAGE TANK

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: 16 MILES NORTH HIGHWAY 295

CITY: POWELL STATE: WY COUNTY: PARK

BASIN: BIG HORN FIELD: ELK BASIN

CONTACT NAME/TITLE: JEFF SCHWEIGHART/SENIOR REGULATORY ANALYST –ANADARKO

CONTACT NUMBER: (307) 754-7314

CONTACT NAME/TITLE: CRAIG EGGERMAN/ SENIOR ENV. ANALYST-WYOGCC

CONTACT NUMBER: (307)234-7147

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE SOUTH WATER FLOOD BATTERY 8 (AVG 2100 BBLS WATER/DAY MANAGED), NORTH WATER FLOOD BATTERY 7 (AVG 4400 BBLS WATER/DAY MANAGED), AND NW ELK BASIN (IN MONTANA, 35 GPM WATER MANAGED). A SCALE INHIBITOR IS APPLIED TO THE WATER PRIOR TO PUTTING THE WATER INTO THE TREATMENT SYSTEMS FOR THE TWO WATER FLOOD BATTERIES. THE TREATMENT SYSTEM TREATS THE WATER PRIOR TO DISCHARGE BY RUNNING THE WATER THROUGH SEVERAL PITS/BASINS WHERE BOOMS ARE EMPLOYED TO SEPARATE THE OIL ON THE SURFACE OF THE WATER AND OIL IS SKIMMED OFF OF THE TOP OF THE WATER (PHYSICAL TREATMENT). THE DISCHARGE WATER FLOWS FROM THROUGH A T-SYPHON AND DISCHARGES TO THE SILVER TIP CREEK, WHICH FLOWS NORTH, INTO MONTANA. THE CONFLUENCES WITH SILVER TIP CREEK WERE ALSO VISITED, ALONG WITH THE "SAFETY PITS" THAT ARE USED TO PREVENT SPILLS FROM MIGRATING FURTHER DOWNSTREAM (ADDITIONAL T-SYPHONS AT CRITICAL POINTS SUCH AS ROAD CROSSINGS). THE NW ELK BASIN DISCHARGE IS ON THE MONTANA SIDE OF ELK BASIN, AND IT DISCHARGES JUST UPSTREAM OF A WASHED OUT DAM ALONG SILVER TIP CREEK. THE WASHED OUT DAM IS CURRENTLY AWAITING APPROVAL FROM MDEQ FOR THE WORKPLAN THAT HAS BEEN DEVELOPED TO REMEDIATE THE SITE AFTER A SPILL THAT OCCURRED EARLIER THIS YEAR. THE DAM WASHED OUT DURING A STORM EVENT AS IT HAD NO PRIMARY/EMERGENCY SPILLWAY TO ELEVIATE THE FLOOD CONDITIONS.

ENVIRONMENTAL IMPACTS/BENEFITS: DISCHARGED WATER IS CONSUMED BY CATTLE, DEER, AND OTHER WILDLIFE, AND HABITAT IS CREATED FOR WILDLIFE WHERE NONE WOULD BE PRESENT DUE TO THE SEASONAL CONDITION OF THE DRAINAGE (ONLY FLOWS DURING STORM EVENTS). THE WATER IS ALSO USED FOR IRRIGATION BY LOCAL FARMERS FOR WATERING CROPS.

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

APPLICABILITY: THE IRRIGATION INFRASTRUCTURE IN THE BIG HORN BASIN ALLOW FOR MUCH OF THE PRODUCED WATER TO BE USED BY LOCAL FARMERS AND RANCHERS FOR IRRIGATING CROPS AND KEEPING STOCK PONDS FULL OF WATER.

COST: NO INFORMATION WAS COLLECTED ON COST, BUT ANADARKO INDICATED THAT IF THE WYPDES REQUIREMENTS BECOME ANY MORE STRINGENT IT WILL BE MORE COST EFFECTIVE TO DISPOSE OF THE WATER THROUGH INJECTION.

ADDITIONAL NOTES: EROSION IS A PROBLEM AT DISCHARGE POINTS, DUE TO THE SOIL CONDITIONS AND THE DIFFICULTY WITH ESTABLISHING VEGETATION THAT IS NOT CONSIDERED NOXIOUS WEEDS.

THE EPA (JANE NACKETT) HAS HAD A DIFFICULT TIME ACCEPTING THE "SAFETY PIT" PRACTICE FRO SPILL PREVENTION AND MANAGEMENT. WYOGCC AND ANADARKO POINTED OUT THAT IT IS UNREALISTIC TO BUILD BERMS IN THIS TERRAIN (LOTS OF HILLS AND STEEP GRADES) THAT WILL HOLD THE AMOUNT OF WATER THAT MAY BE DISCHARGED IN THE EVENT OF A SPILL (UNTREATED OILY WATER IS THE MAIN CONCERN FOR SPILLS AT THIS FIELD).

THE 230 PPM CHLORIDE RULE IS ALSO A CONCERN IF A WAIVER IS NOT EXTENDED TO THE OIL AND GAS INDUSTRY AS IT WILL MAKE IT UNFEASIBLE TO DISCHARGE AND MEET THE WYPDES REQUIREMENTS.

DATE: 6/27/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF ELK BASIN FIELD ENTRANCE

VIEW OF SECONDARY PIT WITH SKIMMING BOOM

VIEW OF SECONDARY PIT T-SIPHON TO PREVENT OIL FROM DISCHARGING

VIEW OF SECONDARY PIT DISCHARGE TO SILVER TIP CREEK

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF T-SIPHONS IN SILVER TIP CREEK DRAINAGE TO PREVENT OIL SPILLS FROM MIGRATING DOWNSTREAM

VIEW OF A PRIMARY PIT WITH NETTING TO PROTECT WILDLIFE

VIEW OF A SURFACE DISCHARGE AFTER OIL HAS BEEN SKIMMED FROM WATER

VIEW OF A LIVESTOCK/WILDLIFE WATER HOLE SUPPLIED BY PRODUCED WATER

VIEW OF A PIT WHERE OIL IS SEPARATED FROM THE DISCHARGE WITH A T-SIPHON

CLOSER VIEW OF A PIT WHERE OIL IS SEPARATED FROM THE DISCHARGE WITH A T-SIPHON

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: 1501 STAMPEDE AVE.

CITY: CODY STATE: WY COUNTY: PARK

BASIN: BIG HORN FIELD: GARLAND

CONTACT NAME/TITLE: MARVIN BLAKESLEY/HES PROFESSIONAL – MARATHON

CONTACT NUMBER: (307) 527-2127

CONTACT NAME/TITLE: RON ???/TECHNICIAN? – MARATHON

CONTACT NAME/TITLE: CRAIG EGGERMAN/ SENIOR ENV. ANALYST-WYOGCC

CONTACT NUMBER: (307)234-7147

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE ARNOLDUS LAKE WHERE AN AVERAGE OF 80,000 BBLS WATER/DAY IS DISCHARGED. PRIOR TO DISCHARE, THE WATER IS PRETREATED TO SKIM OIL IN FOUR GRAVITY FLOW BASINS/PITS. ALL FOURS PITS ARE COVERED WITH NETTING TO PREVENT BIRDS FROM COMING INTO CONTACT WITH THE WATER PRIOR TO DISCHARGE. BETWEEN THE THIRD AND FOURTH BASIN THERE IS A CONCRETE DITCH THAT IS SEVERAL HUNDRED YARDS LONG THAT ACTS TO FURTHER AERATE THE WATER. HYDROGEN SULFIDE IS A CONCERN. IN ADDITION TO THE WATER DISCHARED TO ARNOLDUS LAKE, THERE ARE 8 INJECTION WELLS THAT ALSO DISPOSE OF WATER INTO THE MADISON FORMATION. ONE OF THE WELLS IS CAPABLE OF DISPOSING 50,000 BBLS/DAY.

ENVIRONMENTAL IMPACTS/BENEFITS: THE LAKE IS A LOW SPOT IN THE TOPOGRAPHY, AND WOULD BE A PLAYA LAKE IF NOT FOR THE PRODUCED WATER DISCHARGE. SEVERAL WATER FOWL USE THE LAKE AS HABITAT, AND THE WATER FOWL IS HUNTED FOR RECREATIONAL PURPOSES AS WELL.

APPLICABILITY: THE IRRIGATION INFRASTRUCTURE IN THE BIG HORN BASIN ALLOW FOR MUCH OF THE PRODUCED WATER TO BE USED BY LOCAL FARMERS AND RANCHERS FOR IRRIGATING CROPS AND KEEPING STOCK PONDS FULL OF WATER.

COST: NO INFORMATION WAS COLLECTED ON COST, BUT MARATHON INDICATED THAT IF THE WYPDES REQUIREMENTS BECOME ANY MORE STRINGENT IT WILL BE MORE COST EFFECTIVE TO DISPOSE OF THE WATER THROUGH INJECTION.

ADDITIONAL NOTES: THE EPA (JANE NACKETT) HAS HAD A DIFFICULT TIME ACCEPTING THE "SAFETY PIT" PRACTICE FOR SPILL PREVENTION AND MANAGEMENT. WYOGCC AND MARATHON POINTED OUT THAT IT IS UNREALISTIC TO BUILD BERMS THAT WILL HOLD THE

AMOUNT OF WATER THAT MAY BE DISCHARGED IN THE EVENT OF A SPILL (UNTREATED OILY WATER IS THE MAIN CONCERN FOR SPILLS AT THIS FIELD).

THE 230 PPM CHLORIDE RULE IS ALSO A CONCERN IF A WAIVER IS NOT EXTENDED TO THE OIL AND GAS INDUSTRY AS IT WILL MAKE IT UNFEASIBLE TO DISCHARGE AND MEET THE WYPDES REQUIREMENTS.

DATE: 6/27/2005____ INFORMATION COLLECTED BY: _JON SEEKINS, JAKE CRISSUP

PHOTO LOG

VIEW OF ARNOLDUS LAKE WHERE AND AVERAGE OF 80,000 BBLS/DAY IS DISCHARGED

VIEW OF PRIMARY PIT WITH NETTING WHERE THE WATER IS SKIMMED WITH T-SIPHONS

VIEW OF SECONDARY PIT WITH NETTING WHERE THE WATER IS POLISHED FURTHER WITH T-SIPHONS

VIEW OF SECONDARY PIT DISCHARGE WHERE WATER IS AERATED

VIEW OF WATER CHANNEL AFTER SECONDARY PIT, WHICH FEEDS INTO THE TERTIARY PIT

VIEW OF TERTIARY PIT WHERE FINAL POLISHING IS COMPLETED WITH A T-SIPHON

VIEW OF TERTIARY PIT DISCHARGE WHICH FEEDS INTO ARNOLDUS LAKE

CLOSER VIEW OF TERTIARY PIT DISCHARGE WHICH FEEDS INTO ARNOLDUS LAKE

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: _____

CITY: HAMILTON DOME_____ STATE: WY__ COUNTY: HOT SPRINGS_____

BASIN: BIG HORN_____FIELD: HAMILTON DOME____

CONTACT NAME/TITLE: ROGER HART/FIELD TECHNICIAN – MERIT

CONTACT NUMBER: (307)_____

CONTACT NAME/TITLE: CRAIG EGGERMAN/ SENIOR ENV. ANALYST-WYOGCC

CONTACT NUMBER: (307)234-7147

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE TWO DISCHARGES AT HAMILTON DOME. BOTH DISCHARGES ARE WYPDES DISCHARGE POINTS, AND HAVE PITS THAT ARE UTILIZED TO SKIM OIL FROM THE SURFACE OF THE WATER PRIOR TO DISCHARGE. IN 2004, WYPDES PERMIT # WY0000680, ALSO KNOWN AS THE "PLACER RATHVON", DISCHARGED AN AVERAGE OF 128,000-130,000 BBLS/DAY AND INJECTED ANYWHERE FROM 0-4700 BBLS/DAY. MEANWHILE, WYPDES PERMIT # WY0000175, ALSO KNOWN AS THE "CEMENT PIT", DISCHARGED AN AVERAGE OF 50,000-68,000 BBLS/DAY AND INJECTED ANYWHERE FROM 43,000-69,000 BBLS/DAY. BOTH DISCHARGES ARE BENEFICIALLY USED FOR IRRIGATION PURPOSES BY LOCAL LANDOWNERS. THE PLACER RATHVON SYSTEM IS CHANNELIZED AND PIPED INTO AN EXTENSIVE IRRIGATION SYSTEM THAT IRRIGATES SEVERAL THOUSAND ACRES OF ALFALFA FIELDS, AND THE CEMENT PIT SYSTEM IS CHANNELIZED AND HAS SEVERAL DIVERSION BOXES ALONG THE CHANNEL WHERE THE LOCAL LANDOWNER DIVERTS THE WATER AS NEEDED TO FLOOD IRRIGATE HIS LAND. ALL WATER NOT DIVERTED IS DISCHARGED TO A DOWNSTREAM WATER RIGHTS HOLDER ON THE COTTONWOOD CREEK TO ENHANCE RIPRARIAN HABITAT AND WATER LIVESTOCK. DURING NON-GROWING SEASON WHEN IRRIGATION IS NOT NECESSARY, THE WATER FROM THE PLACER RATHVON DISCHARGE IS DIVERTED TO LAKE CHARLIE, WHICH HAS T-SIPHONS TO PREVENT A SPILL FROM REACHING COTTONWOOD CREEK. MERIT HAS 250 OIL PRODUCING WELLS IN THIS FIELD, AND UTILIZES 80 INJECTION WELLS.

ENVIRONMENTAL IMPACTS/BENEFITS: IF NOT FOR THE PRODUCED WATER DISCHARGES, THERE WOULD NOT BE ENOUGH WATER TO IRRIGATE THE LAND IN THE HAMILTON DOME FIELD, AND THE FARMERS WOULD NOT BE ABLE TO ACHIEVE THE SAME LEVEL OF SUCCESS THEY ARE CURRENTLY EXPERIENCING.

APPLICABILITY: THE IRRIGATION INFRASTRUCTURE IN THE BIG HORN BASIN ALLOW FOR MUCH OF THE PRODUCED WATER TO BE USED BY LOCAL FARMERS AND RANCHERS FOR IRRIGATING CROPS AND KEEPING STOCK PONDS FULL OF WATER.

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

COST: NO INFORMATION WAS COLLECTED ON COST, BUT MERIT INDICATED THAT IF THE WYPDES REQUIREMENTS BECOME ANY MORE STRINGENT (NOTABLY FOR CHLORIDES) IT WILL BE MORE COST EFFECTIVE TO DISPOSE OF THE WATER THROUGH INJECTION. THIS WOULD DENY THE FARMERS FROM UTILIZING THE BENEFICIAL USE OF IRRIGATION WITH THE PRODUCED WATER.

ADDITIONAL NOTES: THE EPA (JANE NACKETT) HAS HAD A DIFFICULT TIME ACCEPTING THE "SAFETY PIT" PRACTICE FOR SPILL PREVENTION AND MANAGEMENT. WYOGCC AND MERIT POINTED OUT THAT IT IS UNREALISTIC TO BUILD BERMS THAT WILL HOLD THE AMOUNT OF WATER THAT MAY BE DISCHARGED IN THE EVENT OF A SPILL (UNTREATED OILY WATER IS THE MAIN CONCERN FOR SPILLS AT THIS FIELD).

THE 230 PPM CHLORIDE RULE IS ALSO A CONCERN IF A WAIVER IS NOT EXTENDED TO THE OIL AND GAS INDUSTRY AS IT WILL MAKE IT UNFEASIBLE TO DISCHARGE AND MEET THE WYPDES REQUIREMENTS. IT IS BELIEVED THAT THE 230 PPM FOR CHLORIDES HAS BEEN ESTABLISHED TO PROTECT CERTAIN AQUATIC LIFE. WY IS THE ONLY STATE THAT HAS A CHLORIDE STANDARD FOR CLASS III WATERS.

DATE: 6/28/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF "PLACER RATHVON" SECONDARY PIT WHERE WATER IS POLISHED WITH A T-SIPHON BEFORE DISCHARGE TO IRRIGATION FIELD

VIEW OF "PLACER RATHVON" SECONDARY PIT DISCHARGE TO IRRIGATION FIELD

VIEW OF WATER IN CHANNEL GRAVITY FLOWING TO IRRIGATION FIELD

VIEW OF ALFALFA FIELDS THAT BENEFIT FROM IRRIGATION IN HAMILTON DOME

VIEW OF LAKE CHARLIE (BYPASS RESERVOIR DURING NON-GROWING SEASON)

CLOSER VIEW OF LAKE CHARLIE T-SIPHONS USED TO PREVENT

SPILLS FROM ENTERING COTTONWOOD CREEK DRAINAGE

VIEW OF "CEMENT PIT" PRIMARY PIT INPUT WITH NETTING TO PROTECT WILDLIFE

VIEW OF "CEMENT PIT" PRIMARY PIT DISCHARGE TO IRRIGATION CHANNEL

VIEW OF "CEMENT PIT" IRRIGATION CHANNEL WYPDES SAMPLING POINT

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF "CEMENT PIT" IRRIGATION CHANNEL DIVERSION BOX USED FOR FLOOD IRRIGATION

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: PO BOX 127

CITY: MEETEETSE STATE: WY COUNTY: PARK

BASIN: BIG HORN FIELD: LITTLE BUFFALO BASIN

CONTACT NAME/TITLE: KEITH LARSON/PRODUCTION FOREMAN – CITATION

CONTACT NUMBER: (307) 868-9300

CONTACT NAME/TITLE: LARRY PUTNEY/FIELD TECHNICIAN – CITATION

CONTACT NAME/TITLE: CRAIG EGGERMAN/ SENIOR ENV. ANALYST-WYOGCC

CONTACT NUMBER: (307)234-7147

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE TWO DISCHARGES INTO BUFFALO CREEK. BOTH DISCHARGES ARE WYPDES DISCHARGE POINTS, AND HAVE SEVERAL PITS THAT ARE UTILIZED TO SKIM OIL FROM THE SURFACE OF THE WATER PRIOR TO DISCHARGE. CITATION HAS 70 OIL PRODUCING WELLS IN THIS FIELD, AND UTILIZES 140 INJECTION WELLS, WHICH ARE MOSTLY CONVERTED OIL WELLS THAT WERE NON-PRODUCING. OF THE 116,500 BBLS OF WATER PRODUCED DAILY, APPROXIMATELY 72,000 BBLS OF WATER IS REINJECTED FOR SECONDARY RECOVERY. 2,800 BBLS WATER/DAY IS THE MOST A WELL WILL ACCEPT IN THEIR FIELD, AND SOME WELLS ACCEPT AS LITTLE AS 50 BBLS/DAY.

ENVIRONMENTAL IMPACTS/BENEFITS: IF NOT FOR THE PRODUCED WATER DISCHARGES, BUFFALO CREEK WOULD BE AN INTERMITTENT STREAM THAT WOULD BE DRY MOST OF THE YEAR. THE PRODUCED WATER HAS CREATED SOME RIPRARIAN HABITAT WHICH PROMOTES ANTELOPE, DEER, WATERFOWL, AMONG OTHER WILDLIFE SPECIES.

APPLICABILITY: THE IRRIGATION INFRASTRUCTURE IN THE BIG HORN BASIN ALLOW FOR MUCH OF THE PRODUCED WATER TO BE USED BY LOCAL FARMERS AND RANCHERS FOR IRRIGATING CROPS AND KEEPING STOCK PONDS FULL OF WATER.

COST: NO INFORMATION WAS COLLECTED ON COST, BUT CITATION INDICATED THAT IF THE WYPDES REQUIREMENTS BECOME ANY MORE STRINGENT (NOTABLY FOR CHLORIDES) IT WILL BE MORE COST EFFECTIVE TO DISPOSE OF THE WATER THROUGH INJECTION.

ADDITIONAL NOTES: THE EPA (JANE NACKETT) HAS HAD A DIFFICULT TIME ACCEPTING THE "SAFETY PIT" PRACTICE FOR SPILL PREVENTION AND MANAGEMENT. WYOGCC AND CITATION POINTED OUT THAT IT IS UNREALISTIC TO BUILD BERMS THAT WILL HOLD THE

AMOUNT OF WATER THAT MAY BE DISCHARGED IN THE EVENT OF A SPILL (UNTREATED OILY WATER IS THE MAIN CONCERN FOR SPILLS AT THIS FIELD).

THE 230 PPM CHLORIDE RULE IS ALSO A CONCERN IF A WAIVER IS NOT EXTENDED TO THE OIL AND GAS INDUSTRY AS IT WILL MAKE IT UNFEASIBLE TO DISCHARGE AND MEET THE WYPDES REQUIREMENTS. IT IS BELIEVED THAT THE 230 PPM FOR CHLORIDES HAS BEEN ESTABLISHED TO PROTECT CERTAIN AQUATIC LIFE. WY IS THE ONLY STATE THAT HAS A CHLORIDE STANDARD FOR CLASS III WATERS.

DATE: 6/28/2005____ INFORMATION COLLECTED BY: _JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF LITTLE BUFFALO BASIN FIELD OFFICE ENTRANCE

VIEW OF INJECTION WELL UTILIZED FOR ENHANCED RECOVERY

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF FIRST PIT WITH T-SIPHON TO PREVENT OIL FROM DISCHARGING

VIEW OF FIRST PIT'S DISCHARGE TO BUFFALO CREEK

VIEW OF SECOND PIT WITH TWO T-SIPHONS TO PREVENT OIL FROM DISCHARGING

VIEW OF SECOND PIT'S DISCHARGE TO BUFFALO CREEK

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: 1501 STAMPEDE AVE.

CITY: CODY STATE: WY COUNTY: PARK

BASIN: BIG HORN FIELD: OREGON BASIN

CONTACT NAME/TITLE: MARVIN BLAKESLEY/HES PROFESSIONAL – MARATHON

CONTACT NUMBER: (307) 527-2127

CONTACT NAME/TITLE: CRAIG EGGERMAN/ SENIOR ENV. ANALYST-WYOGCC

CONTACT NUMBER: (307)234-7147

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE CUSTER LAKE WHERE AN AVAERAGE OF 30,000 BBLS OF WATER/DAY IS DISCHARGED TO. THERE WERE NO DISCHARGES TODAY, AND MARATHON INDICATED THAT SOME WORK WAS PROBABLY BEING DONE. THE WATER IS PRE-TREATED PRIOR TO DISCHARGE INTO CUSTER LAKE BY RUNNING THE WATER THROUGH SEVERAL PITS THROUGH GRAVITY FLOW AND SKIMMING OIL OFF OF THE SURFACE OF THE WATER THROUGH A SERIES OF BOOMS. A T-SYPHON IS EMPLOYED AT EACH PIT TO MINIMIZE OIL PROGRESSION TO THE NEXT PIT. APPROXIMATELY 500,000 BBLS OF WATER/DAY IS PRODUCED IN THIS FIELD, AND 400,000 BBLS/DAY OF IT IS REINJECTED INTO THE MADISON FORMATION FOR SECONDARY RECOVERY. LOCH CATRIN IS FURTHER DOWNSTREAM FROM CUSTER LAKE, AND PORTIONS OF LOCH CATRIN HAVE DRIED UP BECAUSE THE WATER HAS NOT MADE IT THAT FAR DOWNSTREAM FOR SOME TIME.

ENVIRONMENTAL IMPACTS/BENEFITS: SEVERAL SPECIES OF WILDLIFE AND WATER FOWL USE THE LAKE AS HABITAT, AND THE WATER FOWL IS HUNTED FOR RECREATIONAL PURPOSES AS WELL.

APPLICABILITY: THE IRRIGATION INFRASTRUCTURE IN THE BIG HORN BASIN ALLOW FOR MUCH OF THE PRODUCED WATER TO BE USED BY LOCAL FARMERS AND RANCHERS FOR IRRIGATING CROPS AND KEEPING STOCK PONDS FULL OF WATER.

COST: NO INFORMATION WAS COLLECTED ON COST, BUT MARATHON INDICATED THAT IF THE WYPDES REQUIREMENTS BECOME ANY MORE STRINGENT (NOTABLY FOR CHLORIDES) IT WILL BE MORE COST EFFECTIVE TO DISPOSE OF THE WATER THROUGH INJECTION. MARATHON HAS ESTIMATED THAT BASIN WIDE IT WOULD COST THEM 12-15 MILLION DOLLARS IN CAPITAL COSTS TO CONVERT TO A 100% DISPOSAL OPTION THROUGH REINJECTION, AND ABOUT 1-2 MILLION IN OPERATING COSTS PER YEAR.

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

ADDITIONAL NOTES: THE EPA (JANE NACKETT) HAS HAD A DIFFICULT TIME ACCEPTING THE "SAFETY PIT" PRACTICE FOR SPILL PREVENTION AND MANAGEMENT. WYOGCC AND MARATHON POINTED OUT THAT IT IS UNREALISTIC TO BUILD BERMS THAT WILL HOLD THE AMOUNT OF WATER THAT MAY BE DISCHARGED IN THE EVENT OF A SPILL (UNTREATED OILY WATER IS THE MAIN CONCERN FOR SPILLS AT THIS FIELD).

THE 230 PPM CHLORIDE RULE IS ALSO A CONCERN IF A WAIVER IS NOT EXTENDED TO THE OIL AND GAS INDUSTRY AS IT WILL MAKE IT UNFEASIBLE TO DISCHARGE AND MEET THE WYPDES REQUIREMENTS. IT IS BELIEVED THAT THE 230 PPM FOR CHLORIDES HAS BEEN ESTABLISHED TO PROTECT CERTAIN AQUATIC LIFE. WY IS THE ONLY STATE THAT HAS A CHLORIDE STANDARD FOR CLASS III WATERS.

DATE: 6/28/2005____ INFORMATION COLLECTED BY: _JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF ENTRANCE TO OREGON BASIN FIELD

VIEW OF CUSTER LAKE WITH OIL RIG IN BACKGROUND

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

VIEW OF CUSTER LAKE WITH PIT SYSTEM IN BACKGROUND

CLOSER VIEW OF PIT SYSTEM THAT DISCHARGES TO CUSTER LAKE

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: SITE VISITED NORTH OF I-90

CITY: BETWEEN GILLETTE AND BUFFALO STATE: WY COUNTY: JOHNSON

BASIN: POWDER RIVER FIELD: PRB CBM

CONTACT NAME/TITLE: RICK WAAS/ DRILLING INSPECTOR-WYOGCC

CONTACT NUMBER: (307)358-4101

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: AN EMIT WATER TREATMENT PLANT WAS VISITED NORTH OF I-90 JUST OFF OF THE POWDER RIVER. THE WATER TREATMENT PLANT WAS NOT DISCHARGING AT THE TIME OF THE VISIT. THE FOLLOWING PROCESS DESCRIPTION WAS TAKEN FROM THE EMIT TECHNOLOGIES WEBSITE, WWW.EMITTECHNOLOGIES.COM :

COMMERCIALLY AVAILABLE CATION & ANION RESINS ARE USED TO PURIFY PRODUCED WATER OF SODIUM, CHLORIDE, SULFATE AND OTHER IONS IN BOTH A CONTINUOUS AND COUNTERCURRENT OPERATING MODE. THESE CHEMICAL ENGINEERING PRINCIPLES OF MASS TRANSFER MAXIMIZE THE RESINS' ABILITIES IN PURIFYING WATER WITH A CONSISTENT QUALITY. THEY ALSO OPTIMIZE THE USE OF ACID AND ALKALI REGENERANTS, MINIMIZE THEIR VOLUMES AND GENERATE A DENSE BRINE SOLUTION THAT MAY HAVE VALUE AS A CLEAR BRINE FLUID WITHIN THE OIL AND GAS INDUSTRY. THE KEY TO THE HIGGINS LOOP FEATURES IS ITS ABILITY TO MOVE THE RESIN THROUGH THE LOOP VIA INCREMENTAL "PULSING". THE PULSE VESSEL SERVES AS A RESIN FLOW METER TO ENSURE ITS FLOW IS IN PROPORTION TO THE WATER TREATED AND THE AMOUNT OF REGENERANT CONSUMED.

PRODUCED WATER CONTAINING HIGH NA LEVELS IS FED TO THE ADSORPTION ZONE WITHIN THE HIGGINS LOOP WHERE IT CONTACTS STRONG ACID CATION RESIN WHICH LOADS NA^+ IONS IN EXCHANGE FOR HYDROGEN (H^-) IONS. TREATED WATER EXITS THE LOOP CONTAINING LESS THAN 10 MG/L NA.

CONCURRENT WITH ADSORPTION AND IN THE LOWER SECTION OF THE HIGGINS LOOP, NA-LOADED RESIN IS REGENERATED WITH EITHER HYDROCHLORIC OR SULFURIC ACID TO PRODUCE A SMALL, CONCENTRATED SPENT BRINE STREAM. REGENERATED RESIN IS RINSED WITH WATER PRIOR TO REENTERING THE ADSORPTION ZONE TO REMOVE ACID FROM ITS PORES.

AS RESIN IN THE UPPER LAYER OF THE ADSORPTION ZONE BECOMES LOADED WITH NA, THE FLOWS TO THE HIGGINS LOOP ARE MOMENTARILY INTERRUPTED TO ALLOW ADVANCEMENT

OF THE RESIN BED (PULSING) THROUGH THE LOOP IN THE OPPOSITE DIRECTION OF LIQUID FLOW. LIQUID FLOWS ARE RESTARTED AFTER RESIN PULSING IS COMPLETE.
TREATED WATER IS SLIGHTLY ACIDIC DUE TO ITS INCREASED H^- ION STRENGTH, AND IT IS NEUTRALIZED WITH LIMESTONE, WHICH ALSO INCREASES ITS CALCIUM CONCENTRATION SO THAT THE WATER'S SODIUM ADSORPTION RATIO (SAR) IS LESS THAN 1.0. SPENT BRINE CONTAINING REMOVED NA^+ IONS HAS A DENSITY HIGH ENOUGH FOR USE AS A KILL FLUID.

ENVIRONMENTAL IMPACTS/BENEFITS: TREATING PRODUCED WATER WITH THIS TECHNOLOGY PROVIDES ENVIRONMENTAL BENEFITS BY ALLOWING FOR THE WATER TO BE BENEFICIALLY USED BY IMPROVING THE SAR AND LOWERING THE TDS. ONCE THE WATER IS TREATED, IT CAN BE PUT BACK INTO A SURFACE STREAM FOR USE BY LIVESTOCK, WILDLIFE, AND DOWNSTREAM WATER RIGHTS HOLDERS, OR IT CAN BE IRRIGATED IMMEDIATELY.

APPLICABILITY: THE HIGGINS LOOP HAS BEEN IN USE SINCE WWII, AND THE USE OF THE EMIT TECHNOLOGY IS GROWING IN THE POWDER RIVER BASIN ON BOTH THE WYOMING AND MONTANA SIDE. THIS TECHNOLOGY IS USEFUL IN LOWERING SODIUM, BICARBONATES, SAR VALUES, AND OVERALL TDS TO BELOW NPDES PERMIT REQUIREMENTS.

COST: NO INFORMATION WAS COLLECTED ON COST. THE WEBSITE STATES THAT COST IS A FIXED COST AND IS CHEAPER THAN SEVERAL OF THE CURRENT TREATMENT ALTERNATIVES.

ADDITIONAL NOTES: NONE

DATE: 6/30/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF A EMIT ION EXCHANGE PLANT

VIEW OF A PULSE AND ADSORPTION TANK

VIEW OF A PULSE WATER TANK

VIEW OF THE BACK WASH LOOP

VIEW OF THE RESIN RECOVERY TANK

VIEW OF THE ACID FEED TANKS

VIEW OF A LIME REACTOR BED TO ADJUST PH PRIOR TO DISCHARGE

VIEW OF A POND THAT THE EMIT PLANT DISCHARGES TO PRIOR TO ENTERING THE POWDER RIVER

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: VARIOUS SITES VISITED SOUTH OF I-90

CITY: BETWEEN GILLETTE AND BUFFALO STATE: WY COUNTY: JOHNSON

BASIN: POWDER RIVER FIELD: PRB CBM

CONTACT NAME/TITLE: RICK WAAS/ DRILLING INSPECTOR-WYOGCC

CONTACT NUMBER: (307)358-4101

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VARIOUS CBM SITES WERE VISISTED, AND VARIOUS TYPES OF PRODUCED WATER MANAGEMENT TECHNIQUES AND TECHNOLOGIES WERE VIEWED. THE FIRST STOP WAS AT THE CONSTRUCTION SITE OF A FUTURE WATER TRUCK LOAD OUT FACILITY AND TRUCK WASH OUT STATION THAT WILL USE PRODUCED WATER AS THE SOURCE OF WATER FOR THE FACILITY. THE SITE WAS CONVENIENTLY LOCATED OFF OF I-90 BETWEEN GILLETTE AND BUFFALO.

ALSO NOTED JUST NORTH OF I-90 WAS A DRILL RIG THAT IS DRILLING A 14,250 FT DEEP INJECTION WELL FOR DEEP INJECTION DISPOSAL OF PRODUCED WATER.

THE NEXT WATER MANAGEMENT TECHNIQUE NOTED WAS A WATER TANK FOR CATTLE THAT WAS MADE FROM A TRACTOR TIRE AND HAS PRODUCED WATER "ON TAP". THE WATER DOES NOT FLOW FREELY INTO THE WATER TANK, BUT RATHER, THE HYDRANT CAN BE TURNED ON AT THE RANCHERS DISCRETION. THE WATER IS PIPED TO THE WATER TANK AND IS UNDER PRESSURE SO THAT IT WILL FLOW. THIS IS A GOOD USE OF THE WATER BY ALLOWING A SOURCE OF WATER TO BE AVAILABLE IN A REMOTE LOCATION TO PROMOTE CATTLE FORAGING IN OTHER AREAS.

THE NEXT SITE VISITED WAS A POND WITH SPRAY EVAPORATION ATOMIZERS. THE TECHNOLOGY WAS NOT BEING OPERATED AT THE TIME WITH THE REASON CITED BY THE OPERATOR THAT THE EVAPORATION WAS NOT ENHANCED AS MUCH AS WAS EXPECTED. WATER FROM THE 12 PRODUCING WELLS IN THIS AREA IS CURRENTLY BEING DISCHARGED INTO A SHALLOW AQUIFER AT A RATE OF 11,000 BBLS/DAY INTO 6 INJECTION WELLS THAT ARE ALL AROUND 100 FEET DEEP. CHLORINE TABLETS ARE ADDED TO THE WATER PRIOR TO INJECTION TO KILL BACTERIA AND PREVENT HYDROGEN SULFIDE ACCUMULATION. NO GAS HAS BEEN PRODUCED FROM THE 12 PRODUCING WELLS YET, AND THE OPERATOR IS WAITING FOR PRODUCTION TO INCREASE IN NEARBY LEASES TO HELP DRAW DOWN THE PRESSURE GRADIENT ON THE COAL SEAM.

ENVIRONMENTAL IMPACTS/BENEFITS: PROVIDING A CONSISTENT SOURCE OF WATER FOR LIVESTOCK AND WILDLIFE AND PROVIDING HABITAT FOR FISH AND WATERFOWL AND THE

PRIMARY ENVIRONMENTAL BENEFITS ACHIVED BY THESE TREATMENT TECHNOLOGIES. FURTHERMORE, BY UTILIZING THE PRODUCED WATER FOR INDUSTRIAL PURPOSES AT THE WATER TRUCK LOADOUT STATION, IT HELPS TO CONSERVE WATER FOR OTHER HUMAN USES SUCH AS CONSUMPTION.

APPLICABILITY: THE CBM WATER FROM THIS PORTION OF THE PRB CAN BE USED FOR INDUSTRIAL APPLICATIONS, STOCK AND WILDLIFE WATERING, AND RECREATION PURPOSES. TREATMENT PROCESSES OBSERVED (ZEOLITE, REVERSE OSMOSIS, AND INO EXCHANGE) ARE DISCUSSED INDIVIDUALLY IN SEPARATE SITE SUMMARIES.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE

DATE: 6/30/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF THE ENTRANCE TO A WATER TRUCK LOADOUT/WASH FACILITY JUST OFF OF I-90 THAT WILL USE CBM PRODUCED WATER

VIEW OF THE WATER TRUCK LOADOUT/WASH FACILITY UNDER CONSTRUCTION

VIEW OF A 14,250' DEEP INJECTION WELL THAT IS BEING DRILLED NEAR I-90

VIEW OF A TIRE STOCK TANK THAT IS SUPPLIED BY CBM PRODUCED WATER ON DEMAND

VIEW OF ATOMIZER OPERATED BY MCCARTNEY ENGINEERING ON JONES PIT 41-18

VIEW OF A SHALLOW INJECTION WELL ON THE JONES RANCH OPERATED BY MCCARTNEY

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF
PRODUCED WATER MANAGEMENT PRACTICES
FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: VARIOUS SITES VISITED

CITY: WRIGHT, SIOUX RANCH STATE: WY COUNTY: CAMPBELL

BASIN: POWDER RIVER FIELD: PRB CBM

CONTACT NAME/TITLE: RICK WAAS/ DRILLING INSPECTOR-WYOGCC

CONTACT NUMBER: (307)358-4101

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED A CBM DISCHARGE INTO HAYS CREEK WHERE THE PRODUCED WATER IS USED TO IRRIGATE A GOLF COURSE NEAR THE TOWN OF WRIGHT, WY. ALSO VISITED THE 13,000 ACRE SIOUX RANCH14 MILES SOUTH OF WRIGHT ON HWY 59 AND VIEWED SEVERAL PONDS THAT HAVE BEEN REJUVENATED WITH CBM PRODUCED WATER. ACCORDING TO THE LAND OWNER, EDDIE RENO, THE PONDS WERE DRYING UP DUE TO THE DROUGHT, AND THEY HAD NO WATER TO IRRIGATE WITH. THEY HAD TO STOP RUNNING CATTLE ON THE LAND IN ORDER TO ALLOW THE GRASS TO RECOVER FROM THE DROUGHT PERIOD. NOW THAT WATER IS READILY AVAILABLE FROM CBM PRODUCTION THE PONDS ARE FULL AGAIN AND WILDLIFE IS FLOURISHING, THE PONDS ARE USED FOR RECREATIONAL PURPOSES, AND THEY PLAN TO PUT CATTLE BACK ON THE LAND AS SOON AS NEXT YEAR.

ENVIRONMENTAL IMPACTS/BENEFITS: ACCORDING TO THE LAND OWNER AT SIOUX RANCH, EDDIE RENO, THE EXISTING STOCK PONDS WERE DRYING UP DUE TO THE DROUGHT, AND THEY HAD NO WATER TO IRRIGATE WITH. THEY HAD TO STOP RUNNING CATTLE ON THE LAND IN ORDER TO ALLOW THE GRASS TO RECOVER FROM THE DROUGHT. NOW THAT WATER IS READILY AVAILABLE FROM CBM PRODUCTION THE PONDS ARE FULL AGAIN AND WILDLIFE IS FLOURISHING, THE PONDS ARE USED FOR RECREATIONAL PURPOSES, AND THEY PLAN TO PUT CATTLE BACK ON THE LAND AS SOON AS NEXT YEAR.

APPLICABILITY: THE CBM WATER FROM THIS PORTION OF THE PRB IS FRESH, SO IT CAN READILY BE USED FOR IRRIGATION, STOCK AND WILDLIFE WATERING, AND RECREATION PURPOSES. NO TREATMENT IS REQUIRED.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE

DATE: 6/29/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF CBM PRODUCED WATER DISCHARGE TO HAYS CREEK, NEAR GOLF COURSE IN WRIGHT, WY

VIEW OF A IRRIGATION POND ON GOLF COURSE WITH A FOUNTAIN TO AERATE THE WATER

VIEW OF A TIRE LIVESTOCK WATER TANK DISCHARGING TO AN EXISTING POND ON THE SIOUX RANCH

VIEW OF A PRODUCED WATER POND USED FOR FLOOD IRRIGATION ON THE SIOUX RANCH

VIEW OF A DEER NEAR A PRODUCED WATER POND ON THE SIOUX RANCH

VIEW OF A COMPRESSOR STATION ON THE SIOUX RANCH

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: SITE VISITED SOUTH OF I-90

CITY: BETWEEN GILLETTE AND BUFFALO STATE: WY COUNTY: JOHNSON

BASIN: POWDER RIVER FIELD: PRB CBM

CONTACT NAME/TITLE: RON LINCZ/ NEWPARK ENVIRONMENTAL WATER SOLUTIONS

CONTACT NUMBER: (403)861-4075

CONTACT NAME/TITLE: RICK WAAS/ DRILLING INSPECTOR-WYOGCC

CONTACT NUMBER: (307)358-4101

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: NEWPARK ENVIRONMENTAL WATER SOLUTIONS (NEWS) IS CONSTRUCING AND HAS PLANS FOR OPERATING A 20,000 BBLS/DAY WATER TREATMENT PLANT TO REDUCE SAR VALUES TO BELOW WYPDES PERMIT LEVELS AND ALLOW DISCHARGE TO THE SURFACE. THE WATER TREATMENT PLANT UTILIZES REVERSE OSMOSIS TECHNOLOGY TO REMOVE THE CHARGED IONS AND LOWER THE SAR AND THE TDS IN THE WATER, HOWEVER, IT ALSO EMPLOYS A PATENTED TECHNOLOGY TO TREAT THE WATER BEFORE THE RO UNIT TO MINIMIZE FOULING OF THE RO MEMBRANES.

THE PATENTED TECHNOLOGY IS BASED ON THE EMERGING SCIENCE OF SONOCHEMISTRY. NEWS IS APPLYING THIS TECHNOLOGY INITIALLY TO WASTEWATER TREATMENT. HIGH-FREQUENCY SOUND WAVES ARE USED TO POWER PHYSICAL-CHEMICAL REACTIONS. THESE ULTRASONIC SOUND WAVES, IN LIQUIDS, CAUSE THE FORMATION OF MICRO BUBBLES THAT COLLAPSE AT EXTREMELY HIGH TEMPERATURES AND PRESSURES AT THE MOLECULAR LEVEL GENERATING NOVEL CHEMICAL REACTIONS WITH MINIMAL EFFECT ON AMBIENT TEMPERATURES.

AT THE CORE OF THE NEWS WASTEWATER TREATMENT PROCESS IS AN INSTRUMENT REFERRED TO AS AN ARMEL ACTIVATOR. IT MANAGES THE FLOW DYNAMICS OF THE WASTEWATER STREAM BY PRESSURE AND SOUND FREQUENCY VARIATIONS. THIS PROVIDES TURBULENT MIXING, ULTRASONIC PRESSURE WAVES AND CAVITATION. INTERMOLECULAR DISTANCES ARE SHORTENED AMONG MOLECULES WITH AN INCREASE IN SPECIFIC CONTACT SURFACES.

THE RESULTS ARE THAT DESIRED REACTIONS DOWNSTREAM OF THE ARMEL ACTIVATOR (SUCH AS COAGULANT ADDITION AND FLOCCULATION) OCCUR WITH VERY SHORT RETENTION TIMES AND WITHOUT EXCESSIVE USE OF CHEMICAL ADDITIVES.

A SMALLER PLANT HAS BEEN CONSTRUCTED AND IS CURRENTLY IN USE TO REMOVE

DISSOLVED SOLIDS FROM THE WASTEWATER GENERATED BY OIL AND GAS PRODUCTION ACTIVITIES IN THE PINEDALE/JONAH FIELDS IN THE GREATER GREEN RIVER BASIN OF WYOMING. CONSTITUENTS WILL BE LOWERED TO LEVELS THAT WILL ALLOW DISCHARGE UNDER AN NPDES PERMIT INTO THE COLORADO RIVER BASIN.

ENVIRONMENTAL IMPACTS/BENEFITS: TREATING PRODUCED WATER WITH THIS TECHNOLOGY PROVIDES ENVIRONMENTAL BENEFITS BY ALLOWING FOR THE WATER TO BE BENEFICIALLY USED BY IMPROVING THE SAR AND LOWERING THE TDS. ONCE THE WATER IS TREATED, IT CAN BE PUT BACK INTO A SURFACE STREAM FOR USE BY LIVESTOCK, WILDLIFE, AND DOWNSTREAM WATER RIGHTS HOLDERS, OR IT CAN BE IRRIGATED IMMEDIATELY.

APPLICABILITY: THIS TREATMENT TECHNOLOGY IS EMERGING. THE SUCCESS OF THIS TECHNOLOGY WILL BE CLOSELY TIED TO THE SUCCESS OF THE TECHNOLOGY TO EFFECTIVELY AND EFFICIENTLY TREAT WATER FROM THE PINEDALE/JONAH FIELD AS WELL AS CBM WATER FROM THE POWDER RIVER BASIN TO BELOW THEIR PERMIT LIMITS.

COST: COST IS EXTREMELY VARIABLE BASED ON THE WATER QUALITY AND THE LEVEL OF THE DESIRED WATER QUALITY.

ADDITIONAL NOTES: NONE

DATE: 6/30/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF A REVERSE OSMOSIS PLANT UNDER CONSTRUCTION

VIEW OF A SKID MOUNTED REVERSE OSMOSIS SYSTEM

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: VARIOUS SITES VISITED OF OFF I-90

CITY: BETWEEN GILLETTE AND BUFFALO STATE: WY COUNTY: JOHNSON

BASIN: POWDER RIVER FIELD: PRB CBM

CONTACT NAME/TITLE: RICK WAAS/ DRILLING INSPECTOR-WYOGCC

CONTACT NUMBER: (307)358-4101

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: TWO EXISTING ZEOLITE FACILITIES WERE VISITED, AND ONE ZEOLITE FACILITY THAT IS UNDER CONSTRUCTION WAS VISITED. OF THE TWO EXISTING ZEOLITE FACILITIES, ONLY ONE WAS CURRENTLY BEING DISCHARGED TO.

ZEOLITE IS A NATURALLY OCCURING MINERAL THAT CAN BE MINED, CRUSHED, AND MODIFIED TO ENHANCE THE CATION EXCHANGE CAPACITY OF THE MINERAL. THE ZEOLITE IS THEN PLACED IN A COLUMN, OR A PIT, AND PRODUCED WATER IS PASSED THROUGH IT TO ALLOW FOR THE CHARGED IONS IN THE WATER (SUCH AS SODIUM) TO BE EXCHANGED FOR THE CHARGED IONS IN THE ZEOLITE (SUCH AS CALCIUM AND MAGNESIUM). THE EXCHANGE OF SODIUM FOR CALCIUM AND MAGNESIUM ALLOWS FOR THE SODIUM ADSORPTION RATIO (SAR) TO BE LOWERED, WHICH IN EFFECT RENDERS THE WATER CAPABLE FOR USE IN IRRIGATION, OR FOR A DIRECT DISCHARGE TO A STREAM/CREEK.

ENVIRONMENTAL IMPACTS/BENEFITS: TREATING PRODUCED WATER WITH ZEOLITE PROVIDES ENVIRONMENTAL BENEFITS BY ALLOWING FOR THE WATER TO BE BENEFICIALLY USED BY IMPROVING THE SAR. ONCE THE WATER IS TREATED, IT CAN BE PUT BACK INTO A SURFACE STREAM FOR USE BY LIVESTOCK, WILDLIFE, AND DOWNSTREAM WATER RIGHTS HOLDERS, OR IT CAN BE IRRIGATED IMMEDIATELY.

APPLICABILITY: ZEOLITE IS AN EFFECTIVE TREATMENT TECHNOLOGY FOR USE ON WATER CONTAINING HIGH LEVELS OF SODIUM, AS IT IMPROVED THE SAR VALUES BY EXCHANGING SODIUM FOR CALCIUM AND MAGNESIUM.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE

DATE: 6/30/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF A ZEOLITE WATER TREATMENT SYSTEM

VIEW OF A ZEOLITE PLANT UNDER CONSTRUCTION

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: SALT CREEK OPERATION CENTER, 1 MILE SOUTH OF MIDWEST

CITY: MIDWEST STATE: WY COUNTY: NATRONA

BASIN: POWDER RIVER FIELD: SALT CREEK

CONTACT NAME/TITLE: JOHN FARRELL/ ANADARKO

CONTACT NUMBER: (307)437-9568

CONTACT NAME/TITLE: RICK WAAS/ DRILLING INSPECTOR-WYOGCC

CONTACT NUMBER: (307)358-4101

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED TWO RECREATION PONDS THAT ARE SUPPLIED BY PRODUCED WATER FROM THE SALT CREEK FIELD. THE FIRST POND HAS AN EARTHEN SPILLWAY THAT REQUIRES SOME ADDITIONAL EARTHWORK DUE TO EROSION PROBLEMS THAT HAVE OCCURRED. THE SECOND POND HAS A PIPE SPILLWAY AND AN EARTHEN EMERGENCY SPILLWAY. THE TWO PONDS ARE SUPPLIED BY PRODUCED WATER AT A RATE OF 5 GPM. WATER DISCHARGES FROM THE RECREATION PONDS TO THE SALT CREEK, WHICH EVENTUALLY FEEDS INTO THE POWDER RIVER. A TOTAL OF APPROXIMATELY 350 BBLS OF WATER/DAY IS DISCHARGED TO THE TWO PONDS, AND THE REMAINDER OF THE WATER PRODUCED (CLOSE TO 600,000 BBLS/DAY) IS RE-INJECTED INTO ENHANCED RECOVERY WELLS AND DISPOSAL WELLS. THE SALT CREEK FIELD IS THE SECOND LARGEST WATER PRODUCING FIELD IN WYOMING.

ENVIRONMENTAL IMPACTS/BENEFITS: THE RECREATION PONDS ARE STOCKED WITH FISH AND ARE WIDELY USED BY SPORT FISHERMAN. WILDLIFE SUCH AS WATERFOWL AND ANTELOPE ALSO USE THE RECREATION PONDS FOR WATER AND HABITAT.

APPLICABILITY: THE INJECTION OF THE WATER FOR ENHANCED RECOVERY IS A BENEFICIAL USE, AS WELL AS THE RECREATION USE OF THE WATER FOR FISHING AND WILDLIFE HABITAT. A PIPELINE TO PIPE CBM PRODUCED WATER FROM THE POWDER RIVER CBM FIELDS IS ALSO UNDER CONSIDERATION FOR USE IN ENHANCED RECOVERY AND INJECTION DISPOSAL INO THE MADISON FORMATION TO COOL THE FORMATION.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE

DATE: 6/29/2005 INFORMATION COLLECTED BY: JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF ENTRANCE TO RECREATION POND SUPPLIED BY SALT CREEK PRODUCED WATER

VIEW OF A PVC PIPE THAT DELIVER PRODUCED WATER TO RECREATION POND

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

SITE INFORMATION

OFFICE ADDRESS: _____

CITY: TEAPOT DOME_____ STATE: WY__ COUNTY: NATRONA_____

BASIN: POWDER RIVER_____FIELD: TEAPOT DOME____

CONTACT NAME/TITLE: RICK WAAS/ DRILLING INSPECTOR-WYOGCC

CONTACT NUMBER: (307)358-4101

WATER MANAGEMENT TECHNOLOGIES/PRACTICES IN PLACE

DESCRIPTION: VISITED THE ROCKY MOUNTAIN OILFIELD TESTING CENTER'S (RMOTC) TESTING LABORATORIES WHERE PRODUCED WATER IS USED TO RAISE SHRIMP AND TILAPIA IN LARGE TANKS. A GREENHOUSE IS ALSO ONSITE TO TEST THE ABILITY OF DIFFERENT SPECIES OF PLANTS TO BE IRRIGATED WITH PRODUCED WATER THAT HAS HIGHER SALINITY. THE TEAPOT NAVAL RESERVE IS ALSO A WORKING OIL AND GAS FIELD THAT PRODUCES ABOUT 700 BBLS OF OIL/DAY AND ABOUT 50,000 BBLS OF WATER/DAY. THE PRODUCED WATER IS MANAGED THROUGH RE-INJECTION FOR ENHANCED RECOVERY AS WELL AS A SURFACE DISCHARGE TO THE TEAPOT CREEK. SEVERAL PITS ARE IN PLACE TO SEPARATE THE OIL FROM THE WATER PRIOR TO THE PERMITTED DISCHARGE POINT.

ENVIRONMENTAL IMPACTS/BENEFITS: THE FIELD COVERS APPROXIMATELY 10,000 ACRES AND WILDLIFE ABOUNDS THROUGHOUT THE FIELD. THE PRODUCED WATER DISCHARGE TO TEAPOT CREEK IMPROVES THE RIPRARIAN HABITAT, WHICH WOULD BE SEASONAL AT BEST WITHOUT THE PRODUCED WATER.

APPLICABILITY: THE RMOTC LABORATORIES IS AN EXCELLENT PLACE TO PROVE NEW TECHNOLOGIES AND EXPERIMENT WITH EMERGING TECHNIQUES FOR PRODUCED WATER MANAGEMENT AND BENEFICIAL USE.

COST: NO INFORMATION WAS COLLECTED ON COST.

ADDITIONAL NOTES: NONE

DATE: 6/29/2005____ INFORMATION COLLECTED BY: _JON SEEKINS, JAKE CRISSUP

SITE VISIT SUMMARY

IDENTIFICATION, VERIFICATION, AND COMPILATION OF

PRODUCED WATER MANAGEMENT PRACTICES

FOR CONVENTIONAL OIL AND GAS PRODUCTION OPERATIONS

PHOTO LOG

VIEW OF TANKS WHERE TILAPIA AND SHRIMP ARE RAISED WITH PRODUCED WATER

VIEW OF A TILAPIA FISH THAT WAS RAISED IN PRODUCED WATER

VIEW OF STEAM GENERATED FROM A NETTED PRIMARY SEPARATOR PIT

VIEW OF SECONDARY AND TERTIARY PITS PRIOR TO DISCHARGE TO TEAPOT CREEK