Final
README
PRODUCED WATER COMPOSITIONAL DATABASE
ADVANCED RESOURCES INTERNATIONAL, INC.
DOE CONTRACT DE-FC26-02NT41437

CONTACT INFORMATION

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the views of the DOE.

DISCLAIMER

The data in this report is intended for general information only. Advanced Resources
International, Inc. makes no warranty with respect to the quality of the data contained
within this database nor its suitability for any specific use or application. Users of the
database assume all risks and liability arising from such use.

INTRODUCTION

This database was constructed by Advanced Resources International, Inc. as part of Project DE-FC-02NT41437, "Identifying and Remediating High Water Production in Basin Centered Formations" under the supervision of the U.S. Department of Energy. Historical records for produced water data were collected from multiple sources, including Amoco, British Petroleum, Anadarko Petroleum Corporation, United States Geological Survey (USGS), Wyoming Oil and Gas Commission (WOGC), Denver Earth Resources Library (DERL), Bill Barrett Corporation, Stone Energy, and other operators.

In addition, 86 new samples were collected during the summers of 2003 and 2004 from the following areas: Waltman/Cave Gulch, Pinedale, Tablerock and Wild Rose. Samples were tested for standard seven component "Stiff analyses", and strontium and oxygen isotopes.

16,035 analyses were winnowed to 8028 unique records for 3276 wells after a data screening process was completed. The review process is described in the following section.

A preliminary version of this database was released in June, 2005. This final version of
the database contains additional data not previously released and corrects miscellaneous
format errors, particularly in date entries, uncovered during final review.

FILE FORMATS

CD contains the database in ACCESS, EXCEL, DBF, and CSV formats.

HISTORICAL DATABASE SCREENING AND STANDARDIZATION

Data was screened first for duplicate records based on well location, well name and interval sampled. Data that passed this screening were subjected to culling based on

chemical criterion presented by Hitchon and Brulotte, 1994. Any samples falling into the
following categories were deleted from the database:
PH less than 5,
PH greater than 10,
Potassium greater than 5 times sodium,
Potassium equal to chloride,
Magnesium greater than or equal calcium,
Charge imbalance greater than 15%.
Charge balance was calculated as the sum of the cations minus the sum of the anions divided by the total ions. Any samples within 15% charge balance were accepted. Incomplete analyses were accepted.

For historical data, screening was based solely on meeting the chemical criteria listed
above. Data that passed was accepted "as is" with no screening for how locations, formation names, collection methods or other information was originally assigned. To
make sorting of the database easier, an attempt was made to standardize formation names
(as provided by operators) and collection methods. Many times only incomplete information was available; in such cases, sample data was still included in the database.

New samples collected for this study were analyzed for quality by the project geochemist,
and samples of questionable quality were deleted from the database.

Values for chemical constituents are listed in their original units - either mgl (milligrams
per liter) or ppm (parts per million). Type of units is listed in the column designated
"UNITS".

FIELD NAMES AND DESCRIPTIONS

ID: Unique database identification code.

WELLNAME: Full or partial well name was assigned as provided from historical data or

Wyoming Oil and Gas Commission records.

WELL_NO: Well number was assigned as provided from historical data or Wyoming Oil and Gas Commission records.

API_ID: Unique well identification code (UWI) assigned to each well. Where API/UWI numbers were not available, an attempt was made to assign one through matching other

available data criterion for the well.

LATITUDE: Latitude was assigned as provided from historical data or Wyoming Oil and Gas Commission records.

LONGITUDE: Longitude was assigned as provided from historical data or Wyoming Oil and Gas Commission records.

TOWNSHIP: Township was assigned as provided from historical data or Wyoming Oil and Gas Commission records.

TWN_DIR: Township direction was assigned as provided from historical data or Wyoming Oil and Gas Commission records.

RANGE: Range was assigned as provided from historical data or from Wyoming Oil and Gas Commission records.

RNG_DIR: Range direction was assigned as provided from historical data or from Wyoming Oil and Gas Commission records.

SECTION: Section was assigned as provided from historical data or from Wyoming Oil and Gas Commission records.

QTRQTR: Quarter/quarter section location designation was assigned as provided from historical data.

DATE_SAMPLED: Date water sample was collected(YYYYMMDD).

DATE_ANALYZED: Date water sample was analyzed (YYYYMMDD).

UPPER_DEPTH_FT: Top depth sample was taken from (feet) in measured depth.

LOWER_DEPTH_FT: Lower depth that sample was taken from (feet) in measured depth.

FORMATION: Formation name provided with data.

REVISED_FORMATION: Formation names standardized for ease of sorting. No attempt was made to check accuracy or consistency of original formation names provided
by data sources.

INTERVAL_SAMPLED_FROM: Information on location and method of sample collection as provided from data sources.

REVISED SAMPLING METHOD: Standardized nomenclature for location and method of sample collection.

SAMPLE_TYPE_DETAIL: Additional notes on sample location and collection methods, including DST, production and swab information.

LAB THAT RAN SAMPLE: Name of laboratory processing samples as provided from original data sources.

UNITS: Units of analyses for most chemical constituents - mgl (milligrams per liter) or
ppm (parts per million). Exceptions are dD_H2O, d18O_H2O, and 87Sr_86Sr.

SODIUM: Concentration of sodium ion in UNITS.

POTASSIUM: Concentration of potassium ion in UNITS.

LITHIUM: Concentration of lithium ions in UNITS.

CALCIUM: Concentration of calcium ions in UNITS.

MAGNESIUM: Concentration of magnesium ions in UNITS.

IRON: Concentration of iron ions in UNITS.

SULFATE: Concentration of sulfate ions in UNITS.

CHLORIDE: Concentration of chloride ions in UNITS.

CARBONATE: Concentration of carbonate ions in UNITS.

BICARBONATE: Concentration of bicarbonate ions in UNITS.

HYDROXIDE: Concentration of hydroxide ions in UNITS.

HYDROGEN SULFIDE: Concentration of hydrogen sulfide ions in UNITS.

TDS MEASURED: Concentration of total dissolved solids in UNITS.

OBSERVED PH: pH of the water sample.

ALKALINITY: Alkalinity of water sample.

OBSERVED RW_68_F: Measured water resistivity at 68 degrees Fahrenheit.

CHARGE BALANCE: Charge balance was calculated as the sum of the cations minus the sum of the anions divided by the total ions. Any samples within 15% charge balance were accepted. Incomplete analyses were accepted.

STRONTIUM: Concentration of strontium ions in UNITS.

RUBIDIUM: Concentration of rubidium ions in UNITS.

SILICA: Concentration of silica ions in UNITS.

ALUMINUM: Concentration of aluminum ions in UNITS.

BARIUM: Concentration of barium ions in UNITS.

IODIDE: Concentration of iodide ions in UNITS.

BROMIDE: Concentration of bromide ions in UNITS.

SPECIFIC GRAVITY: Specific gravity of sample in grams per cubic centimeter.

dD_H20: Deuterium isotope composition of the produced water with respect to standard mean ocean water(SMOW) expressed as dD(%)SMOW.

d18O_H20: Oxygen isotope composition of the produced water with respect to standard mean ocean (SMOW)water expressed as d18O(%)SMOW.

87Sr_86Sr: Strontium isotopic ratio (87SR/86SR).

COMMENTS: Miscellaneous comments provided from original data sources were retained in the event that they may prove to hold useful information.

REFERENCES:

Hitchon, B. and M. Brulotte, 1994, Culling criteria for "standard" formation water analyses: Applied Geochemistry, v. 9, p 637-645.