Pryor Chemical Company
Pryor Facility
Pryor, Oklahoma

Permit Renewal Application
for
Class I Non-Hazardous Underground Injection Control Well

Permit No. IW-NH-49022-RI

Submitted
to
Oklahoma Department of Environmental Quality

VOLUME 1

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Application Form
Reservoir Mechanics

October 2017

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PRYOR FACILITY
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APPLICATION FORM

OMB No. 2040-0042 Approval Expires 11/30/2014

United States Environmental Protection Agency

Underground Injection Control Permit Application

(Collected under the authority of the Safe Drinking Water Act. Sections 1421, 1422, 40 CFR 144)

I. EPA ID Number

		T/A	C
U			

Read Attached Instructions Before Starting

For Official Use Only

Application approved mo day year	Date received mo day year	Permit Number	Well ID	FINDS Number

II. Owner Name and Address

Owner Name: PRYOR CHEMICAL COMPANY

Street Address: 16 PENNSYLVANIA AVE

Phone Number: (405) 235-4546

City: OKLAHOMA CITY

State: OK

ZIP CODE: 73107

III. Operator Name and Address

Owner Name: PRYOR CHEMICAL COMPANY

Street Address: 4463 HUNT STREET

Phone Number: (918) 825-9021

City: PRYOR

State: OK

ZIP CODE: 74361

IV. Commercial Facility

- [ ] Yes
- [x] No

V. Ownership

- [x] Private
- [ ] Federal
- [ ] Other

VI. Legal Contact

- [x] Owner
- [ ] Operator

VII. SIC Codes

EXPLOSIVES - 2892

VIII. Well Status *(Mark "x")*

- [x] A. Operating — Date Started mo day year: 06/10/1969
- [ ] B. Modification/Conversion
- [ ] C. Proposed

IX. Type of Permit Requested *(Mark "x" and specify if required)*

- [x] A. Individual
- [ ] B. Area

Number of Existing Wells	Number of Proposed Wells	Name(s) of field(s) or project(s)
1		

X. Class and Type of Well *(see reverse)*

A. Class(es) (enter code(s))	B. Type(s) (enter code(s))	C. If class is "other" or type is code 'x,' explain	D. Number of wells per type (if area permit)
I	I		

XI. Location of Well(s) or Approximate Center of Field or Project

Latitude Deg	Latitude Min	Latitude Sec	Longitude Deg	Longitude Min	Longitude Sec	Township and Range Sec	Twp	Range	1/4 Sec	Feet From	Line	Feet From	Line
36	14	33.7	95	16	23.9	3	20N	19E	SW				

XII. Indian Lands (Mark 'x')

- [ ] Yes
- [x] No

XIII. Attachments

(Complete the following questions on a separate sheet(s) and number accordingly; see instructions)

For Classes I, II, III, (and other classes) complete and submit on a separate sheet(s) Attachments A--U (pp 2-6) as appropriate. Attach maps where required. List attachments by letter which are applicable and are included with your application.

XIV. Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibliity of fine and imprisonment. (Ref. 40 CFR 144.32)

A. Name and Title *(Type or Print)*	B. Phone No. *(Area Code and No.)*
John M. CARVER, Vice President	(405) 235-4546
C. Signature	D. Date Signed

RESERVOIR
MECAHNICS

PRYOR CHEMICAL COMPANY
PRYOR FACILITY
ODEQ PERMIT RENEWAL APPLICATION
PERMIT NO. IW-NH-49022-R1
RESERVOIR MECHANICS

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Attachment 5 Annual Formation Pressure Tests Reanalysis Years 2001-2016

I. RESERVOIR MECHANICS

After analysis of the local and regional geology near the Pryor Chemical Company (PCC) facility, injection well flow and pressure models (*DuPont Basic Plume and DuPont Multilayer Pressure*) were run to evaluate the effects of effluent disposal under the conditions requested in this permit application. Detailed descriptions of these models are shown in Attachments 1 and 2 of this document.

The DuPont Deepwell models are structured to focus on the key physical mechanisms influencing the system behavior at a site. These models permit evaluation of the contribution of each mechanism to the system under consideration. The DuPont Deepwell models are understandable, and are accepted by the U.S. Environmental Protection Agency (EPA) and many state regulatory agencies, including the Oklahoma Department of Environmental Quality (ODEQ). Model results are obtained from equations, which provide a relationship between the physical mechanisms governing the system response. The ease of understanding these relationships provides the means for technical interaction by a diverse group of interested people.

The PCC facility has one injection interval, the Arbuckle Dolomite Injection Interval. (See Attachment F, for a discussion of the injection interval.) This interval is the focus of the model simulations. Predicted effects of effluent disposal into the injection interval are modeled for injection time periods of actual historical injection (Year-End 2016) and 10 years (Year-End 2028). A post-closure period of 30 years is also modeled to show the pressure decay once injection ceases.

I.A. Reservoir Mechanics of the Injection Reservoir

An understanding of the regional and local geology is essential to constructing the reservoir model. Based on interpretation of borehole geophysical logs, scout ticket information, and published literature, a comprehensive picture of the subsurface geology was developed for the facility (Attachment F). Input parameters required by the flow and containment model are the following:

- Carbonate, Sandstone, and Shale Layers
  - Average Thickness
  - Permeability
  - Porosity
  - Rock Compressibility
- Original formation fluid salinity, viscosity, density
- Original formation pressure
- Layer Dispersion Characteristics

The following sections describe where and how the model input parameters were obtained. Note that the model inputs are dependent on the specific model used. The models use different parameter subsets; differentiation between the model inputs is identified in each parameter description section.

I.A.1 Injection Zone Stratigraphy and Lithology

The PCC facility is located in northeastern Oklahoma in Section 3, Township 20 North, Range 19 East of Indian Meridian, in Mayes County, Oklahoma. The area is located between two regional geologic structures: Cherokee Platform and Ozark Plateau (Christenson, et al. 1994). The Cherokee Platform is a shallow geologic platform consisting of mostly marine or shallow-marine Paleozoic Age rocks. The Ozark Uplift formed from the late Paleozoic through the Mississippian era. Movement associated with the Ozark Uplift was upward, which tilted and exposed the subsurface rocks of the Cherokee Platform. The Seneca Fault, a regional feature that extends from southwestern Missouri to northeastern Oklahoma, is located approximately 2.5-miles northwest of the injection well. This fault, along with its minor associated faults, is self sealing.

The stratigraphy of northeastern Oklahoma, in descending order, ranges from Quaternary Alluvium at the surface or near surface into Paleozoic Age rocks followed finally by Pre-Cambrian Age Basement rock. The Quaternary Alluvium (Tertiary in age) is generally silt that contains some gravel. The Paleozoic deposits above the Woodford Shale (Upper Confining Zone) are limestones with significant chert content. The Woodford Shale is a black shale. The Arbuckle Group (Injection Zone) is group of thick dolomites with sandstone lenses. Pre-Cambrian granite basement rocks (Lower Confining Zone) underlie the Arbuckle dolomites.

I.A.2 Characteristics of the Injection Reservoir

I.A.2.1 Layer Thickness

The *DuPont Basic Plume Model* and *Multilayer Pressure Model* perform two-dimensional computations for horizontal distribution of effluent front boundaries and pressure. They accept one thickness value for each modeled layer. The PCC No. 1 injection well is completed as an open hole. The gross thickness of the Arbuckle Dolomite in the PCC injection well totals at least 461 feet. The portion of the injection interval accepting flow has been historically estimated at 220 feet. Based on analysis of mechanical integrity test data (differential temperature and flow meter logs), a very conservative estimate of the portion of the open interval accepting flow was made for this permit renewal. This thickness will be referred to as the effective injection reservoir thickness and totals 30 feet. PCC notes that it is planning a well workover with an objective to return the injection interval to its original estimated thickness.

The effective injection reservoir thickness is used in the *DuPont Multilayer Pressure Model* for the Arbuckle Dolomite Injection Interval. This value is approximately 7 percent of the gross open hole interval potentially available for flow. The effective injection reservoir thickness is also used in the *DuPont Basic Plume Model*. The thickness is conservative in that temperature logs show injection into a thicker interval.

Small-scale variations in layer thickness can influence the overall movement of the waste plume, but these variations are implicitly included within the framework of the dispersion parameters (i.e., "multiplying factor" in the *DuPont Basic Plume Model*) of the model.

I.A.2.2 Permeability and Transmissivity

Permeability is the capacity of a porous media to transmit fluids. Permeability values for the injection interval were determined from analysis of injection/falloff tests of the injection well.

PCC acquired the injection well in 2000 and annual injection/falloff tests have been performed on the well since. These tests were all performed with high-resolution surface gauges. The most recent test was performed in August 2016. The falloff portion of each of the historic falloff tests was analyzed using Reservoir Description Service, Inc.'s TRANS II transient analysis software package. TRANS II provides both log-log (multi-rate and derivative type curve) and semi-log (superposition) analyses. The injection/falloff tests from 2001 to 2016 were all reanalyzed for this

permit renewal application using an effective injection reservoir thickness of 30 feet in TRANS II. Results are summarized in Table 1 and reanalysis of the tests are included in Attachment 5.

Based on the tests' reanalysis, an effective permeability of 3,150 millidarcies is assigned to the Arbuckle Dolomite Injection Interval in the modeling. This value is reasonable based on the tests reanalysis results and its use results in a conservative prediction of pressure by the model.

I.A.2.3 Porosity

Porosity is the ratio of void space in a given volume of rock to the total bulk volume of rock expressed as a percentage. The more porous a rock, the more fluid can be stored in a given rock volume. Porosity for Arbuckle Dolomite is estimated at 10 percent based on information reported in historical reports for the site, and the value will be used for both the pressure and plume models. Minor variations in porosity are handled in the *DuPont Basic Plume Model* using a "Multiplying Factor" (see Section 1.A.2.5).

I.A.2.4 Temperature

The PCC facility is in Mayes County which has an average surface temperature of 60 °F (Oklahoma Climatological Survey, 2017). Based on geothermal gradient maps and previous work, the original formation temperature for the Arbuckle Dolomite at a depth of 451 feet is estimated at 70 °F. This yields a temperature gradient of 2.0 °F per 100 feet of depth.

I.A.2.5 Layer Dispersion Characteristics

Dispersivity is a measure of the mechanical dispersion property of a porous material and is defined as a length to describe the ability of media to disperse solutes (Walton, 1985). Dispersivity is a function of both the vertical and lateral permeability variations, and increases with formation heterogeneity. In general, increasing travel distance equates to greater dispersion, and, therefore, higher dispersivities.

To be conservative, a multiplying factor, M, of 2.0 is used in the PCC model to more conservatively represent the waste plume areal extent. The multiplying factor was estimated from work performed by Xu and Eckstein (1995) for dispersivity as a function of field-scale movement. The multiplying factor used in the model is equivalent to an upper-end dispersivity value of approximately 76 feet. This is a reasonable value for the scale of the plume within a 30 foot effective injection reservoir thickness.

I.A.2.6 Wellbore Characteristics

The *DuPont Multilayer Pressure Model* uses a default wellbore radius of 0.5 feet and a wellbore skin factor of zero (i.e., no enhancement or pressure drop at the completion). These defaults are used in the PCC model. Therefore, the model is predicting the incremental flowing pressure increase in the formation, which provides a stable point of comparison for future monitoring, since actual wellbore skin conditions vary year to year (Table 1).

I.A.2.7 Reservoir Fluid Dissolved Solids Content, Viscosity, and Specific Gravity

Arbuckle Dolomite formation's sodium chloride content and total dissolved solids levels were determined in the Kaiser Aluminum injection wells when they were drilled. The Kaiser wells are located approximately 1.2 miles north northwest of the PCC No. 1 injection well. The chloride content was 21,620 mg/l, and the total dissolved solids were 35,195 mg/l.

Using the estimated formation temperature of 70 ^{o}F (Section I.A.2.4), the equivalent specific gravity for the formation fluid is 1.014.

A viscosity of the formation fluid as described here is 1.0 centipoise.

I.A.2.8 Static Reservoir Pressure

The *DuPont Multilayer Pressure Model* predicts the incremental pressure increase with time, above the background initial formation pressure. From historical data, the estimated static reservoir pressure is 212.83 psi. (see Table 2). Assuming a reservoir depth of 451 feet below ground surface, this yields a pressure gradient of 0.472 psi/ft.

I.A.2.9 Compressibility

Compressibility is the change in volume per unit increase in pressure. In a zone that is 100 percent saturated with water the total compressibility is defined as the formation compressibility plus the compressibility of water corrected for water saturation:

$$c_t = c_f + c_w S_w$$

Fluid (water) compressibility (c_w) is built into the program code of the *DuPont Multilayer Pressure*

Model as a fixed value of $3.034E^{-06}$ psi^{-1} after Table 2-5 in Freeze and Cherry (1979).

Compressibility of the rock can be estimated from correlations in Hall (1953), which indicate compressibility in the range of $5x10^{-6}$ psi^{-1} for consolidated rocks with porosities near 10 percent. The *DuPont Multilayer Pressure Model* uses the classic "hydrology" definition (Freeze and Cherry, 1979; Lohman, 1979) for compressibility of "alpha", which is related to the rock compressibility as shown below.

$$c_f = \alpha / \phi$$

Since porosity is approximately 10 percent, a value for alpha of $5.0E^{-07}$ psi^{-1} is assigned in the model input file for the value of rock compressibility.

I.A.3 Prediction of Reservoir Pressure Increase

I.A.3.1 The DuPont Multilayer Pressure Model

When effluent is injected into a subsurface geological formation, the pressure within the receiving reservoir will increase. This pressure increase will be greatest at the well, and will decrease with distance away from the injection site. After injection ceases, the pressure will diminish, and approach its value before injection.

The *DuPont Multilayer Pressure Model* is used to determine the pressure distribution within the injection reservoir. Documentation of this model is presented in Attachment 1. The model is an extension of an earlier treatment presented by Miller, et al., (1986) that is based on the Theis (1935) equation. The model discounts the ability of the aquiclude layers to compressively store fluids, which provides a conservative upper bound to the pressures modeled within the injection reservoir. The pressure model is set up as a single-layer simulation of injection into the Arbuckle Dolomite. The *DuPont Multilayer Pressure Model* requires four layers as a minimum, consisting of an alternating sequence of impermeable (odd numbered layers) and permeable (even numbered layers) units. The base of the bottom layer is a "no flow" boundary, which does not allow pressure or fluid leak-off from the system. The Arbuckle Dolomite Sand is set up as the bottom layer (Layer 4) in the four-layer *DuPont Multilayer Pressure Model*; therefore, it is confined from below.

The Arbuckle Dolomite is assigned a thickness of 30 feet, a permeability of 3,150 millidarcies (md), and a fluid viscosity of 1.0 centipoise (cp). Therefore, the model transmissibility (permeability-thickness/ viscosity) is conservative compared to the average calculated transmissibility of 107,245 md-ft/cp, determined from the historical ambient falloff tests (Table 1). An average porosity of 10 percent is also used in the model. An "alpha" value of $5.00E^{-7}$ psi^{-1} is assigned to the Arbuckle Dolomite so that the total system compressibility [formation compressibility plus water compressibility ($3.034E^{-6}$ psi^{-1})] value of $3.53E^{-6}$ psi^{-1} is also matched. The overlying shale layer is assigned a vertical permeability of $1.0E^{-15}$ darcies. Studies of the Woodford Shale throughout Oklahoma report porosities ranging from 4 percent to 20 percent; therefore, a minimum porosity of 13.5 percent is not unreasonable and is used in the models. Since the Woodford Shale is modeled as an impermeable layer, the exact assignment of porosity is not critical. The Arbuckle Dolomite is essentially a "confined" unit in the model, allowing no leak-off or exchange of pressure or fluid above or below the modeled unit. The single-layer model set-up for the Arbuckle Dolomite used in the simulation is shown in Table 3.

I.A.3.2 Modeled Injection Rate

For this Permit Application, modeling of injection at the PCC facility modeled future injection at the Maximum Injection Rate (175 gpm) for 10 years (Year-End 2028) and a post-closure period (no injection) of 30 years. Projected injection is modeled on an annual time step. Historical injection rates have been well below the permitted maximum injection rate, and it is anticipated that future injection rates will also be less than the maximum rate. The use of the maximum requested rate for modeling, therefore, is conservative.

I.A.3.3 Modeled Injection Interval Transmissibilities

Model predicted formation pressure increase due to injection is directly proportional to the assigned transmissibility (kh/μ) value used for that interval. Calculated injection reservoir transmissibility from the model inputs (thickness x permeability/viscosity) is shown in Table 4.

I.A.3.4 Pressure Model Results

Model runs for the Arbuckle Dolomite injection interval are made to predict lateral pressure distributions for the historical injection period and 10 years (2017 through Year-End 2028) at the Maximum Injection Rate of 175 gpm. Using the input parameters discussed above, the model set up is tested to ensure that the resulting pressures match or overmatch the measured flowing bottomhole pressures from the annual injection/falloff tests (Figure 1).

The DuPont Multilayer Pressure Model run files for the Arbuckle Dolomite consist of

Injection Rate (gpm)	Filename	Comment
175	pryor_flow_2028.rcv	Master job input deck and run file
	pryor_flow_2028.prm	Model parameter dimension file

These model input files for the pressure simulations are contained in Attachment 3.

The DuPont Multilayer Pressure Model output files for the Arbuckle consist of:

Injection Rate (gpm)	Filename	Comment
175	pryor_flow_2028.sum	Master job run summary output file
	pryor_flow_2028.pinj	Pressure increase at injection well output file
	pryor_flow_2028.pmon	Pressure increase at artificial penetrations
	pryor_flow_2028.pcnt	Areal pressure distribution plot file – End of Historical, 10 Years

These output files for the pressure simulations are contained in Attachment 3.

Results of the pressure simulation are based on the *DuPont Multilayer Pressure Model* runs. For current case conditions over the modeling term, a summary of the pressure increases at both the injection well and at the 2.0-mile radius Area of Review Boundary are shown in Table 5.

Figure 2 graphically shows the modeled incremental predicted pressure increase with time in the Arbuckle Dolomite at the injection well. Note that the incremental model pressure increase has been translated to a downhole wellbore pressure at the reference depth of 451 feet using the reference zero pressure of 213 psi (right graph axis). The areal extent of the pressure plume from the injection well at Year-End 2016 is shown in Figure 4. The pressure profile away from the injection well at Year-End 2028 (projected injection period) is shown in Figures 3 and 5 at the maximum injection rate of 175 gpm.

I.A.3.5 Pressure Recovery

The *DuPont Multilayer Pressure Model* simulation run also is used to predict the post-injection pressure recovery toward initial formation pressure for a period of 30 years after injection is modeled to cease. The results of the modeling for the maximum injection rate (175 gpm) indicate that pressure recovery in the injection reservoir will begin immediately and continue at a rapid pace through the first-year post-injection. Pressure recovery is projected to continue asymptotically, with formation pressure returning to approximate background pressure after 30 years (see Figure 2). Results indicate that pressure in the injection reservoir will equilibrate rapidly within the Area of Review.

I.A.4 Justification of Plume Geometry

In a purely homogeneous geological formation, the interface between the effluent and formation fluid will advance laterally as a sharp vertical front, and, in the case of a single isolated well, the front will take the shape of a right circular cylinder. The diameter of the circle will be determined strictly by geometric considerations, involving the total volume of the injected effluent, and the height and porosity of the formation. Such a plume is referred to as an ideal circular plume.

Horizontal variations in formation thickness and permeability can affect the lateral extent of effluent transport. Large sudden changes in these parameters can be included explicitly in model calculations, using image well techniques, or using the multiplying factor (see Section 1.A.2.5).

For multiple-well injection sites, methods of analyzing injected effluent transport in purely homogeneous geological formations have been available for many decades, based on work in the petroleum field. The standard approach involves a two-part process. First, determine the lateral velocity distribution within the injection formation at any time using solutions provided by potential flow theory. Second, integrate the time-dependent kinematic equations relating the calculated velocity distribution to the motion of the interfacial front between the injected effluent and formation fluid.

The first step takes advantage of the mathematical analogy between fluid flow in porous media and ideal potential flow of inviscid fluids. This mathematical analogy permits the determination of the velocity distribution in an injection formation directly from the previously established solution to the same problem in potential flow theory.

The second part of the modeling process involves the use of the velocities determined by the mathematical equations to calculate the time-dependent motion of the front between the injected effluent and formation fluid. This is accomplished mathematically by introducing a set of fictitious tracer particles around the circumference of each plume in the *DuPont Basic Plume Model*, and calculating the trajectory of these particles as time progresses. A separate set of tracer particles is employed for each well. Because the model automatically conserves mass, these tracer particles remain situated on the outer perimeter of the individual plumes for all times.

A variety of different forms of horizontal variation can occur, but two of the most common are (a) gradual changes in permeability, and (b) sudden changes, such as a flow barrier. If a sudden change is known to exist, its effects can be modeled directly, using image well methods, as discussed previously. Gradual trends have less of an influence on effluent transport, but are more

difficult to model precisely. However, one can obtain a worst-case estimate of their effects simply by approximating these variations as equivalent sudden changes. Other types of horizontal variations that may be present can be handled by using the multiplying factor to provide a margin of safety in predicting an upper bound to the maximum lateral extent of the injected effluent.

At the PCC facility, plume geometry is only influenced by dispersion. Dispersion is handled in the model through the "multiplying factor" described in Section 1.A.2.5, which results in a modeled plume size greater than that which would be predicted using pure plug flow.

I.A.5 Extent of the Waste Plume

I.A.5.1 The DuPont Basic Plume Model

During injection, the movement of effluent within injection reservoirs is dominated by the volumetric growth of the individual plume and related displacement of the formation fluid away from the well. Effluent plume growth during injection is modeled in this Permit Application using the *DuPont Basic Plume Model*.

This model was introduced in Miller, et al., (1986). Model documentation is presented in Attachment 2. The *DuPont Basic Plume Model* calculates the time-dependent lateral movement of the plume emanating from the well at an injection site. The model can handle the effects of multiple well interactions, but that feature is not required in the case of this site. The model is set up as a single layer calculation, which discounts the vertical exchange of fluids between geologic strata.

For this Permit Application, the plume model is set up as a single-layer simulation of injection into the Arbuckle Dolomite. The model does not allow pressure or fluid leak-off from the system. The Arbuckle Dolomite is assigned a very conservative thickness of 30 feet (the Injection Well has 461 feet of open hole) and an average porosity of 10 percent in the plume model.

The Multiplying Factor is set at a value of 2.0. The Multiplying Factor simulates a dispersivity of approximately 76 feet and results in a conservatively large plume because it essentially doubles the volume injected. The singe-layer model set-up used in the simulation is in Table 6.

I.A.5.2 Modeled Injection Rate

For this Permit Application, modeling of injection at the PCC facility considered two time frames: historical injection (Year-End 2016) and 10 years of projected injection (Year-End 2028). It is conservatively assumed that the rate for the site for the full projected period will be at the Maximum Injection Rate of 175 gpm. The injection rate used in the model simulation runs for the PCC facility are shown in Table 7.

The Multiplying Factor enhances the injection rate as a multiplier; therefore, the effective modeled injection rates in the Arbuckle Dolomite is 350 gpm for the maximum injection. The rate was modeled for the full 10 years of the projected modeling period through Year-End 2028.

I.A.5.3 Plume Model Results

The model simulation for the Arbuckle Dolomite Injection Interval was made to predict the plume perimeter at the end of the historical injection period and projected injection through Year-End 2028. The simulation was run using the Maximum Injection Rate of 175 gpm.

The *DuPont Basic Plume Model* run files (Attachment 4) for the Arbuckle Dolomite consist of:

Injection Rate (gpm)	Filename	Comment
175	pryorplume2028.rcv	Master job input deck and run file
	pryorplume2028.prm	Model parameter dimension file
	pryorplume2028.inj	Layer properties and injection rate file

The *DuPont Basic Plume Model* output file (Attachment 4) for the Arbuckle Dolomite consists of:

Injection Rate (gpm)	Filename	Comment
175	pryorplume2028.plt	Areal plume perimeter plot file – Historical, Year-End 2028

The time dependent horizontal distribution of injected effluent (plume geometry) is presented in the following section. The results are obtained from the prediction of the *DuPont Basic Plume Model*.

I.A.5.3.1 Horizontal Extent

The projected maximum horizontal extent of the injected effluent plume in the Arbuckle Dolomite Injection Interval at Year-End 2028 will not exceed a radius of two miles (10,560 feet), using the Maximum Injection Rate of 175 gpm and a Multiplying Factor of 2.00. The model-predicted time-dependent horizontal extent of the plume at Year-End 2028 is shown in Figure 6. The modeling results of the plume perimeter can be found in Attachment 4 .plt File.

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FIGURES

FIGURES

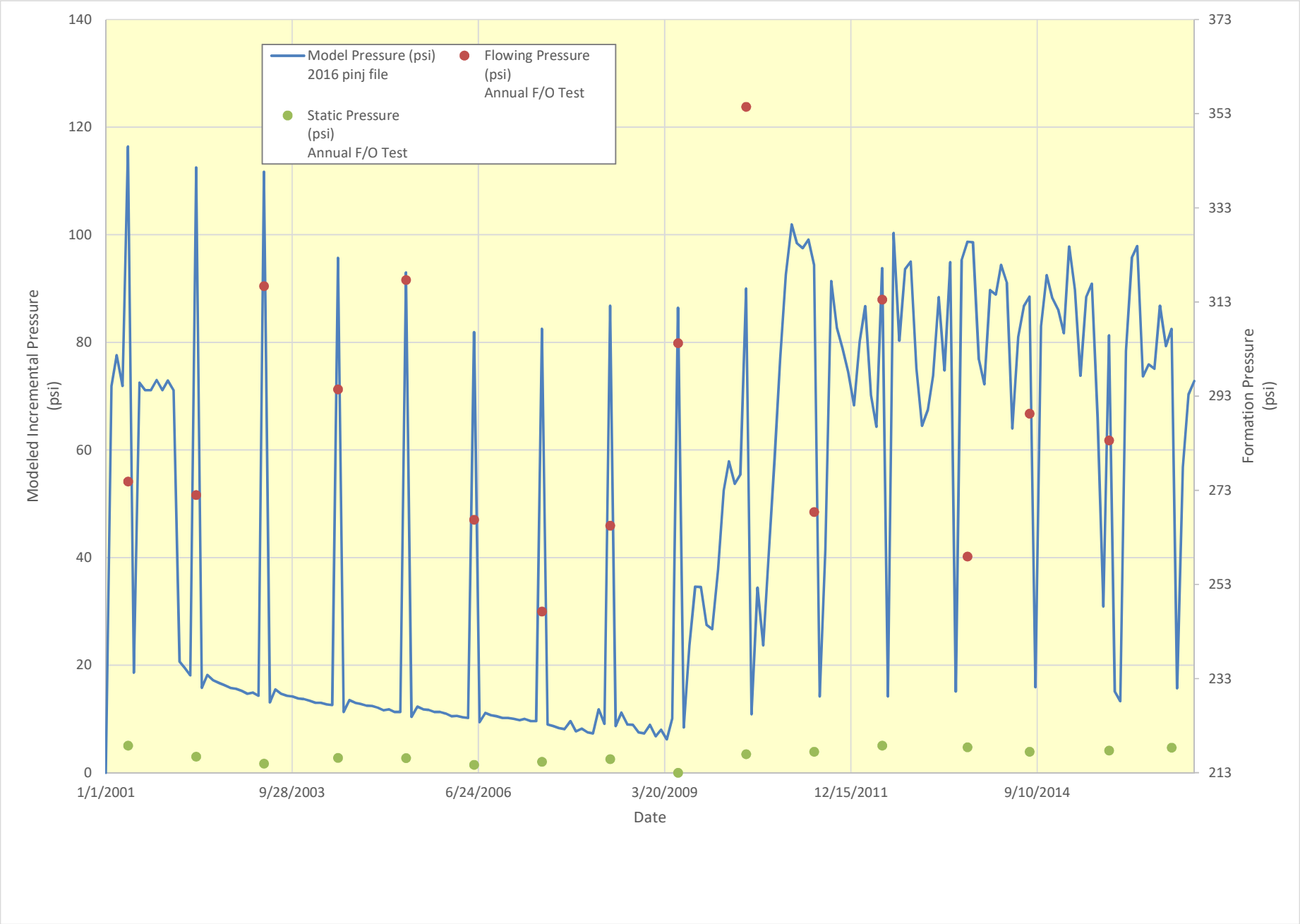

Figure 1 Modeled pressure increase at PCC No. 1 injection well through Year-End 2016 with calculated annual ambient test flowing bottomhole pressure

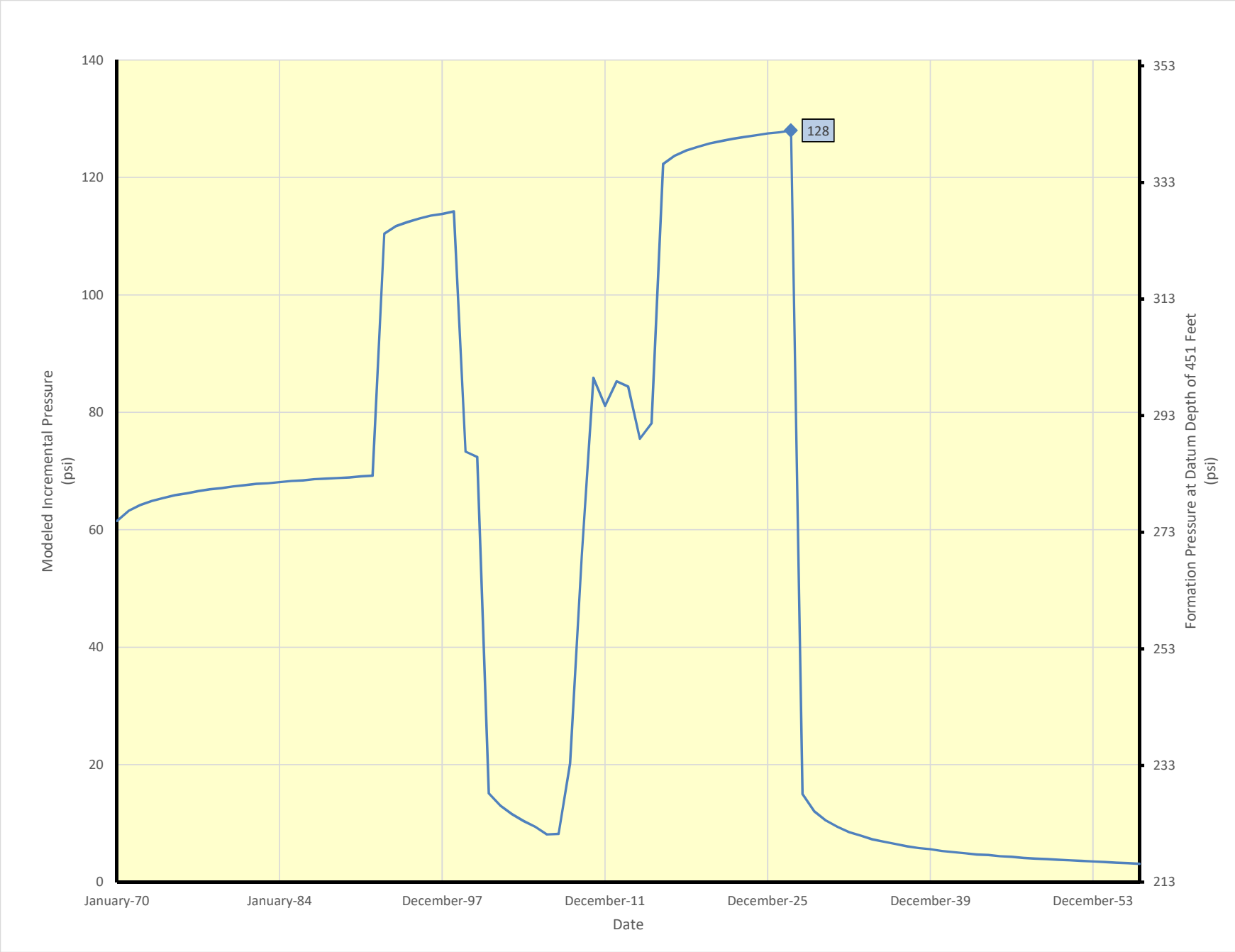

Figure 2 Predicted operational pressure increase at PCC No. 1 injection well through Year-End 2028 at 175 gpm, with a 30-year post-closure period

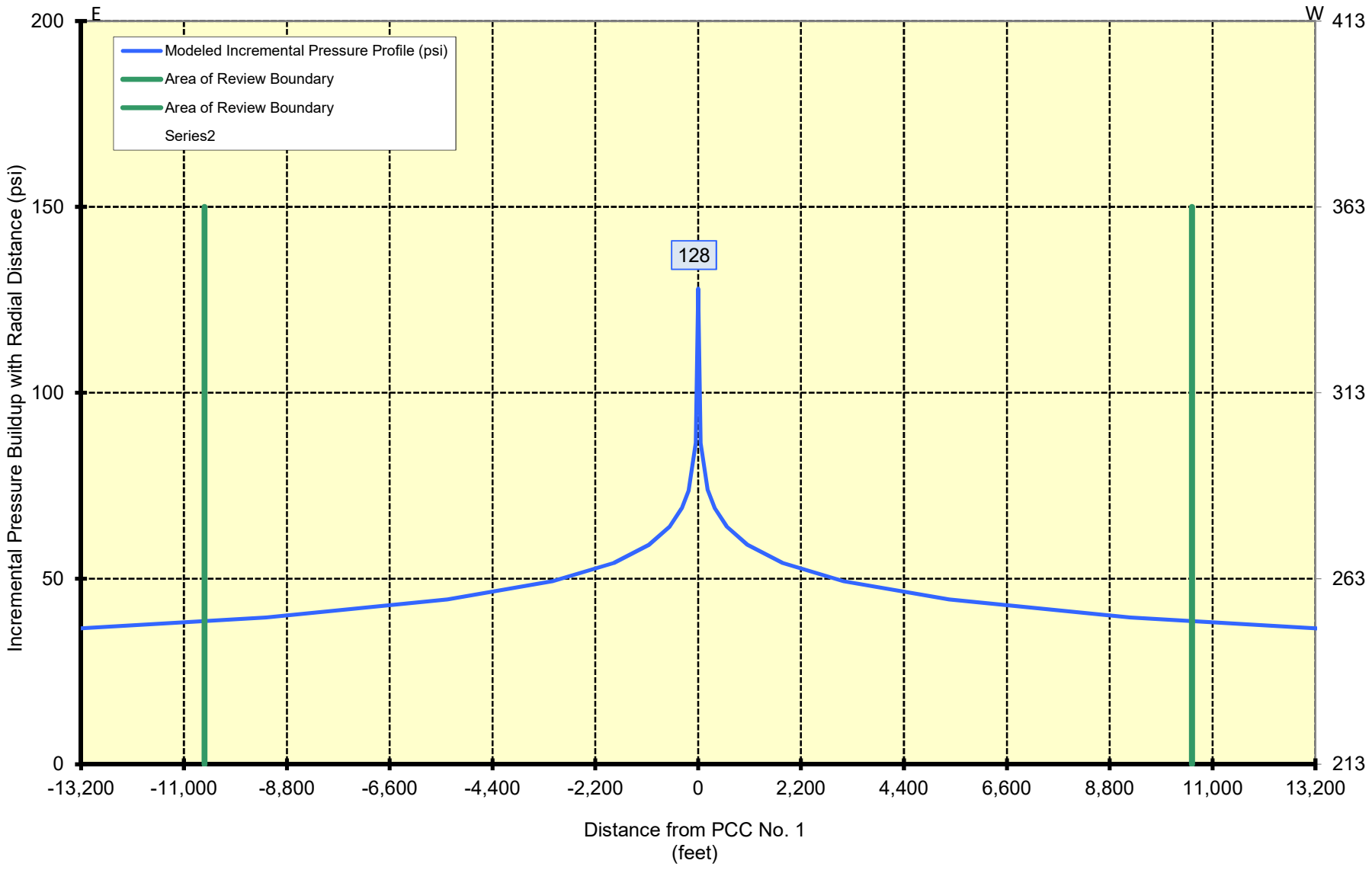

Figure 3 Pressure Profile at end of Projected Injection Period (Year-End 2028) at Maximum Injection Rate (175 gpm)

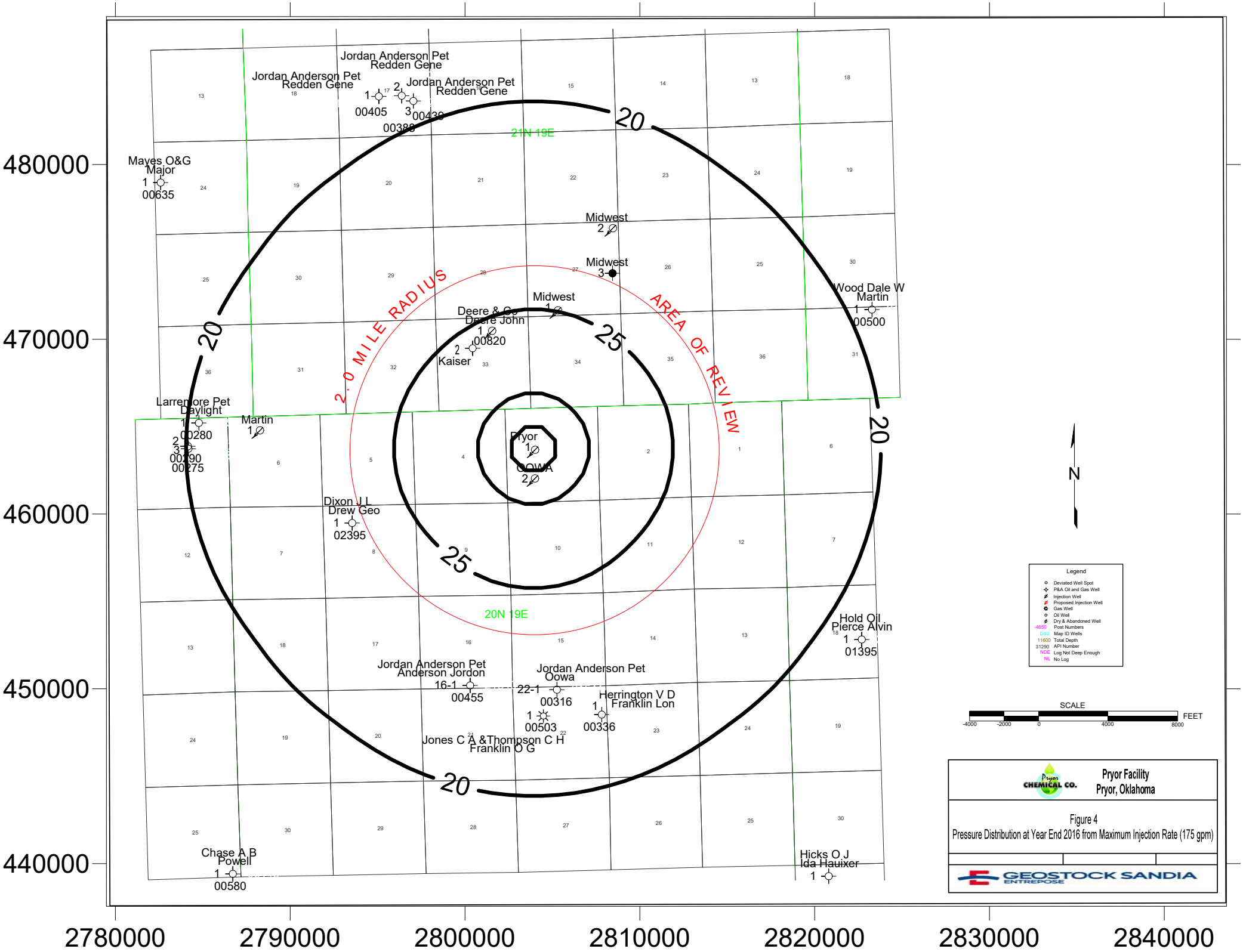
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Figure 4
Pressure Distribution at Year End 2016 from Maximum Injection Rate (175 gpm)
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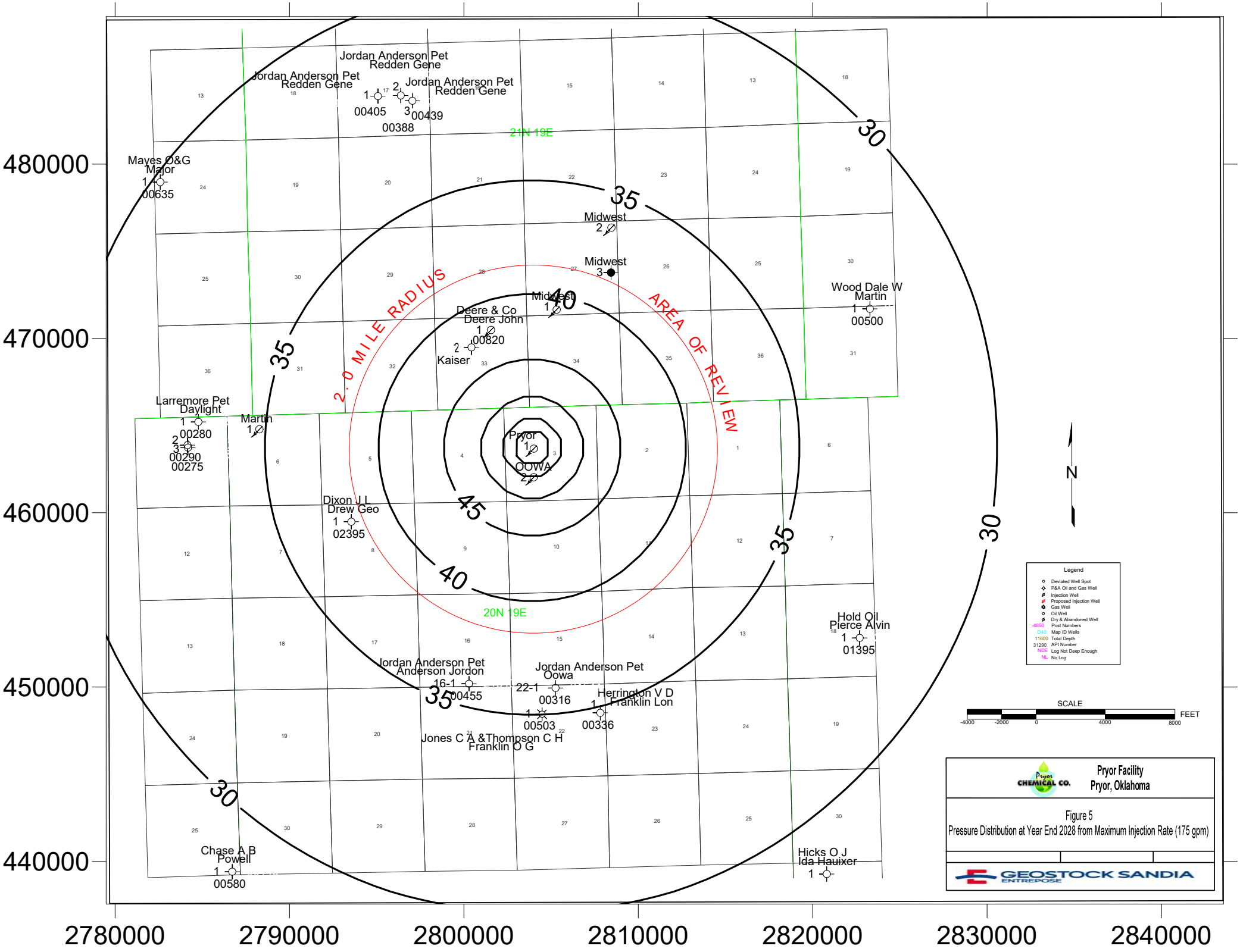
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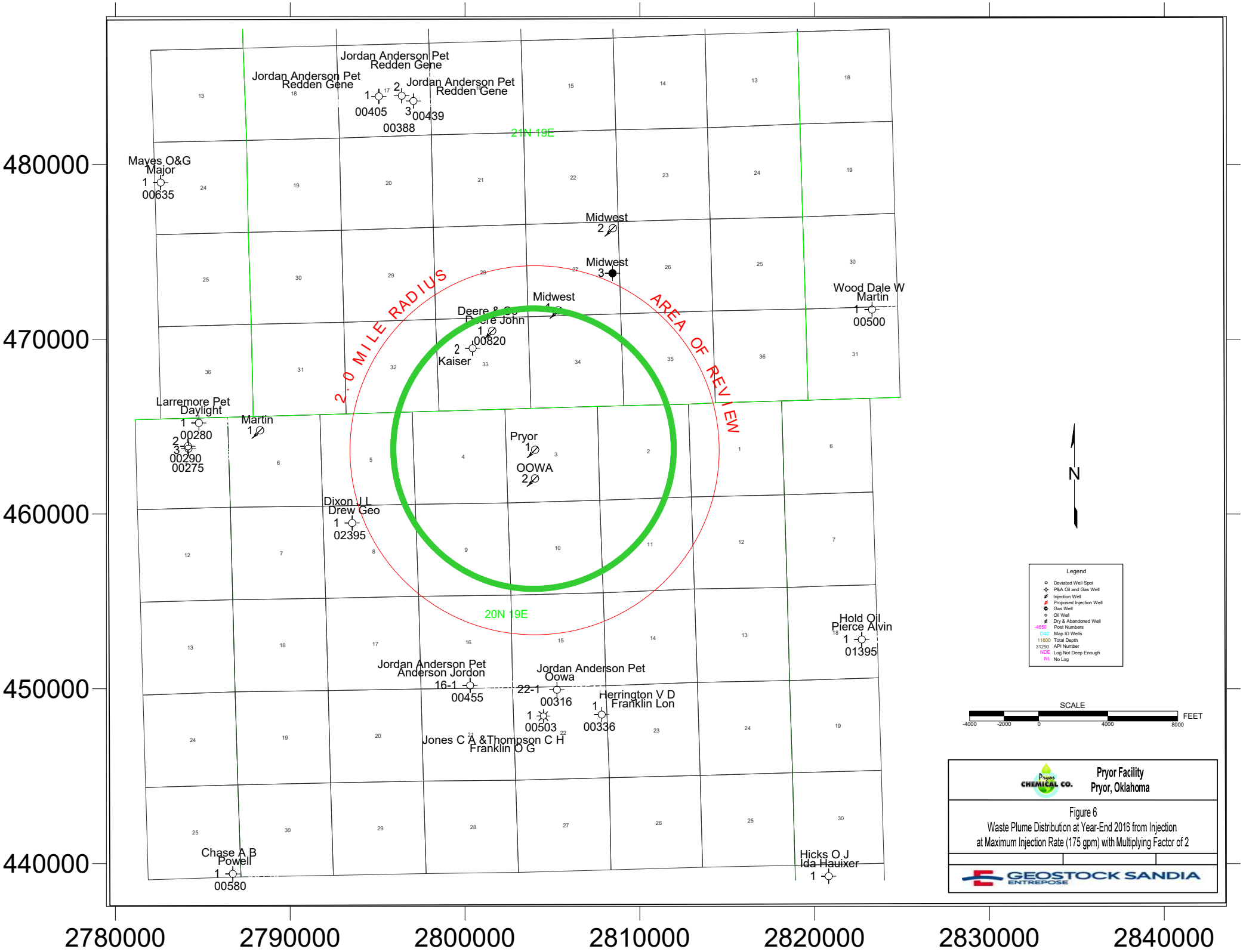
Pryor Facility
Pryor, Oklahoma
Figure 5
Pressure Distribution at Year End 2028 from Maximum Injection Rate (175 gpm)
GEOSTOCK SANDIA
ENTREPOSE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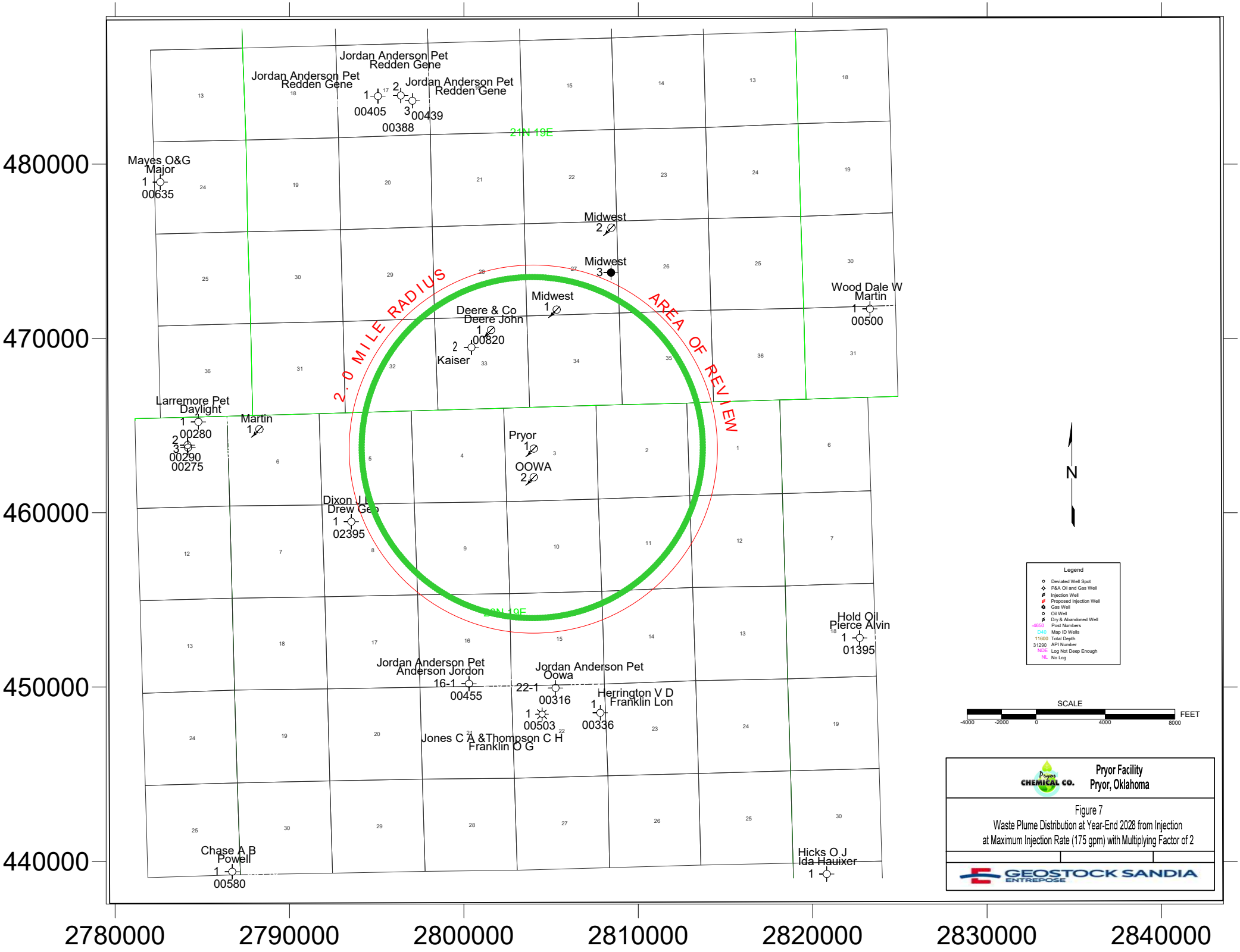
Pryor CHEMICAL CO.
Pryor Facility
Pryor, Oklahoma
Figure 6
Waste Plume Distribution at Year-End 2016 from Injection
at Maximum Injection Rate (175 gpm) with Multiplying Factor of 2
GEOSTOCK SANDIA
ENTREPOSE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Pryor Facility
Pryor, Oklahoma
Figure 7
Waste Plume Distribution at Year-End 2028 from Injection
at Maximum Injection Rate (175 gpm) with Multiplying Factor of 2
GEOSTOCK SANDIA
ENTREPOSE

TABLES

TABLE 1
SUMMARY OF HISTORICAL INJECTION/FALLOFF TESTS

TEST	TRANSMISSIBILITY (MD-FT/CP)	FORMATION THICKNESS (FEET)	VISCOSITY (CENTIPOISE)	CALCULATED PERMEABILITY (MILLIDARCIES)	SKIN
04/2001	146,117.26	30	1	4,870.57	53.8
04/2002	151,680.25	30	1	5,056.00	55.29
04/2003	81,050.46	30	1	2,701.68	23.38
05/2004	90,491.11	30	1	3,016.37	33.83
05/2005	67,427.85	30	1	2,247.59	23.04
05/2006	117,550.27	30	1	3,918.34	55.69
05/2007	197,042.73	30	1	6,568.09	97.28
05/2008	134,839.95	30	1	4,494.66	59.24
05/2009	71,068.58	30	1	2,368.95	27.18
05/2010	40,528.22	30	1	1,350.94	13.10
05/2011	148,101.73	30	1	4,936.72	74.47
05/2012	62,560.61	30	1	2,085.353	29.15
08/2013	158,262.03	30	1	5,275.40	91.45
07/2014	85,476.20	30	1	2,849.21	39.15
09/2015	89,331.23	30	1	2,977.70	47.31
08/2016	74,392.46	30	1	2,479.74	37.62

Note – All tests reanalyzed in April 2017

Table 2
Historical Static Pressures in Pryor Chemical Company No. 1 Injection Well

Test Date	Test Injection Rate (gpm)	Test Type	Gauge Depth (ft KB)	Wellbore Fluid Gradient (psi/ft)	Static Pressure at Gauge Depth (psig)	Static Pressure at Datum Depth (psig)	Incremental Static Pressure (psi)	Flowing Pressure at Gauge Depth (psig)	Flowing BHP at Datum Depth (psig)	Delta Pressure due to Skin (psi)	Skin Adjusted FBHP at Datum Depth (psig)	Incremental Flowing Pressure (psi)	Well Test kh/u (md-ft/cp)	Net Thickness (feet)	Viscosity (cp)	Calculated Permeability (md)
PCC No. 1 Injection Well				***Orig. Static Press=**		**212.83**	**psi***			**Datum= 451' BGL**						
Apr-01	175	Falloff	0	0.432	24	219	5.76	383	578	303.6	275	61.85	146,117	30	1.00	4,871
Apr-02	173	Falloff	0	0.432	21	216	3.42	378	572	300.6	272	59.00	151,680	30	1.00	5,056
Apr-03	173	Falloff	0	0.432	20	215	1.95	365	559	243.2	316	103.36	81,050	30	1.00	2,702
May-04	159	Falloff	0	0.432	21	216	3.15	369	564	269.7	294	81.42	90,491	30	1.00	3,016
May-05	147	Falloff	0	0.432	21	216	3.11	365	560	242.4	318	104.68	67,428	30	1.00	2,248
May-06	128	Falloff	0	0.432	20	215	1.68	365	560	293.0	267	53.73	117,550	30	1.00	3,918
May-07	130	Falloff	0	0.432	20	215	2.33	363	558	310.6	247	34.26	197,043	30	1.00	6,568
May-08	139	Falloff	0	0.432	21	216	2.88	365	559	294.1	265	52.48	134,840	30	1.00	4,495
May-09	137	Falloff	0	0.432	18	213	0.00	364	559	255.1	304	91.23	71,069	30	1.00	2,369
May-10	113	Falloff	0	0.432	22	217	3.94	356	550	196.1	354	141.42	40,528	30	1.00	1,351
May-11	150	Falloff	0	0.432	22	217	4.44	439	634	365.8	268	55.40	148,102	30	1.00	4,937
May-12	140	Falloff	0	0.432	24	219	5.73	390	585	271.2	313	100.50	62,561	30	1.00	2,085
May-13	164	Falloff	0	0.432	23	218	5.43	397	592	332.8	259	45.91	158,262	30	1.00	5,275
Jul-14 **	125	Static Survey	705	0.432	347	223	9.79	--	--	--	--	--	--	--	--	--
July-14	125	Falloff	0	0.432	22	217	4.43	372	567	277.7	289	76.28	85,476	30	1.00	2,849
Sep-15	115	Falloff	6.5	0.432	23	218	4.70	381	576	292.3	283	70.57	89,331	30	1.00	2,978
Aug-16	115	Falloff	6.5	0.432	23	218	5.30	383	578	282.1	296	83.02	74,392	30	1.00	2,480

** Lowest static pressure is from 2009. Used this as original*

*** 2014 ran static gradient survey only*

**** Note: Since surface gauge used, skin includes both completion efficiency and tubing friction loss.*

***** Static pressure measured at end of falloff period, pressure still decreasing.*

TABLE 3
DUPONT MULTILAYER PRESSURE MODEL INPUT PARAMETERS

Model Layer	Model Interval	Thickness (feet)	Porosity (percent)	Permeability (darcy)	Viscosity (cp)	Compressibility (psi-1)
1	Containment Shale Layer	300	13.5	1.0E-15	1.0	6.89E-05
2	Permeable Sand	10	10.0	0.10	1.0	5.00E-07
3	Containment Shale Layer	50	13.5	1.0E-15	1.0	6.89E-05
4	Arbuckle Dolomite	30	10.0	3.150	1.0	5.00E-07

TABLE 4
DUPONT MULTILAYER PRESSURE MODEL TRANSMISSIBILITY

SAND	MODEL TRANSMISSIBILITY (md-ft/cp)
Arbuckle Dolomite	94,500

*For transmissibility value by year, see Table 1.

TABLE 5
DUPONT MULTILAYER PRESSURE MODEL
PRESSURE DISTRIBUTION RESULTS

MODELED INJECTION RATE (gpm)	LOCATION	END OF HISTORICAL INJECTION PERIOD (YE2016) (PSI)	END OF PROJECTED INJECTION PERIOD (YE2028) (PSI)
175	No. 1 Injection Well	73	128
	2-Mile AOR Boundary	24	39

The modeling results of the pressure build-up for each year modeled can be found in Attachment 3 The files are designated with the suffix ".sum".

TABLE 6
DUPONT BASIC PLUME MODEL INPUT PARAMETERS

MODEL LAYER	MODEL INTERVAL	THICKNESS (FEET)	POROSITY (PERCENT)	DISPERSIVITY (FEET)	MULTIPLYING FACTOR
1	Arbuckle Dolomite	30	10	76	2.0

TABLE 7
DUPONT BASIC PLUME MODEL INJECTION RATE

INJECTION INTERVAL	RATE MODELED (GPM)	EFFECTIVE RATE MODELED (GPM)*
Arbuckle Dolomite	175	350

* with Multiplying Factor

ATTACHMENT 1

ATTACHMENT 1
DUPONT MULTILAYER PRESSURE MODEL

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1.0 MULTILAYER PRESSURE MODEL - GENERAL DESCRIPTION

This model has been developed to calculate the pressure increase produced within various permeable layers of an underground geological system as a result of waste injection. It is an extension of an earlier pressure model described in detail by Miller et al. (1986).

The earlier development considered only a single permeable injection layer bounded above and below by totally impermeable strata. The model was based on the well-known Theis equation (1935), originally formulated for a single well injecting at a constant rate. By making appropriate use of time and spatial superposition principles, the model was extended to account for multiple injection wells operating at variable injection rates (Thornhill et al., 1982).

The new development further improves the earlier model (Miller et al., 1986) by providing a more detailed and refined picture of system behavior. It recognizes the multiple layer nature of many geological environments, and the potential ability of the various permeable strata of such systems to communicate with one another in terms of both pressure and fluid flow.

At a well that is completed into more than one reservoir at a given time, the various perforated reservoirs can communicate with one another via the wellbore itself (Figure 1). Such an arrangement is referred to in the petroleum industry as a commingled or stratified reservoir (Raghaven, 1986; Shah et al., 1986). Considerable work has been done in quantifying the parameters that influence system response for simplified arrangements of commingled reservoirs (Raghaven, 1986).

Communication also may occur by slow vertical permeation of fluids through the low-permeability aquitards which separate the injection interval and other high-permeability layers from one another (Figure 2). The permeation rate through each aquitard is assumed to be proportional to the pressure differential across it. This discounts the compressive storage capacity of the aquitard, and is a conservative assumption, as discussed in further detail below. Models that are capable of analyzing slow vertical permeation through low-permeability aquitards are referred to in the petroleum industry as crossflow models (Raghaven, 1986).

2.0 MODEL UTILIZATION

There are two primary applications for the Multilayer Pressure Model. The first is in predicting the pressure distribution within the injection interval as a function of time and position, for use in Area of Review evaluations. The second is in predicting the time-dependent variations of pressure buildup at the injection wells. This pressure buildup is subsequently employed as an input to the Multilayer Vertical Permeation Model to predict the extent of waste permeation into the overlying aquitard both during and following the injection period. The Multilayer Pressure Model also provides certain input information to the Basic Plume Model which calculates the growth of the waste plume emerging from the wells at an injection site. For sites with at least one well perforated into more than one injection interval at a given time, the Multilayer Pressure Model calculates partitioning of the injection flow between the available intervals. It also determines interformational flow taking place at wells that are not injecting waste, but which are completed into more than one horizon.

Another application of the Multilayer Pressure Model is the iterative process of calibration between model-generated and observed pressure variations. This process includes determining transmissivities of the high permeability layers, as well as placing loose bounds on the aquitard layer permeabilities. The calibration process involves pressure history matching against observed bottom-hole pressure over the past operating life of the site. The calibrated parameter values thus obtained provide an increased degree of confidence for use in analysis of Area of Review and vertical fluid permeation calculations.

3.0 MODEL STRUCTURE

The model is structured as a general purpose generic tool, capable of being applied to a wide variety of site-specific geological arrangements. It consists of a series of alternating high- and low-permeability layers, numbered in sequence from the top of the layer stack to the bottom (Figure 3). The high-permeability units are assigned even numbers in the sequence, while the low permeability aquitard layers are assigned odd numbers. Each layer corresponds to an identifiable stratigraphic unit at the site.

4.0 MODEL INPUTS

Model inputs refer to data that must be supplied to the computer program to perform a site-specific calculation, together with the potential sources of these data. Inputs to the model are given in the form of fundamental physical properties for the geological strata and fluids. These differ from the reservoir properties used as input to some models, which are specially defined combinations of the fundamental properties.

4.1 Well Locations

The geographical coordinates of the well are specified in terms of an X-Y coordinate system inscribed onto a map of the site locale. Data on the location of the well are readily available from historical records and maps of the plant vicinity. For a deviated wellbore, the borehole is projected downward to its intersection with the injection horizon.

4.2 Geological Data

4.2.1 Average Thickness of Layers

The average thicknesses of the geological units in the model are determined by analyzing resistivity and spontaneous potential logs. Special geological surveys by experienced consulting organizations are often used as additional data sources.

Predicted pressure buildup within an injection interval typically will vary in inverse proportion to the thickness of the injection interval. Thicknesses of the aquitard layers have only a very slight influence on the pressure response of an underground injection system, as evidenced by the ability of single-layer models which do not even include the aquitard layers to predict the pressure response.

4.2.2 High-permeability Layer Properties

4.2.2.1 Average Horizontal Permeability

The average horizontal permeability of these layers can be determined from conventional and sidewall core samples, injectivity/falloff tests, interwell interference tests, or may be estimated from regional geological studies if no site data exist. A large number of core sample data is

desirable to obtain a representative average. The core-derived permeability values can be improved by calibrating the model to historic data at shut-in wells and injecting wells.

Horizontal permeabilities of the strata used for injection constitute first-order parameters in determining the pressure response of the system. Predicted pressure buildup within each injection interval will vary in nearly inverse proportion to the permeability of that layer. For relatively permeable layers not used for injection, model results are quite insensitive to the choice of permeability, since a significant amount of fluid must first pass through the aquitards before the effects of these layers are felt.

4.2.2.2 Average Layer Porosity

Average layer porosities are determined from core samples, geophysical porosity logs, or regional geological studies of the injection interval. Porosity enters into the model only through the contribution of fluid compressibility to the overall layer storativities. Storativity is a reservoir parameter which expresses the combined effects of layer porosity and compressibility. Model results are quite insensitive to the layer storativities, and therefore, also to the porosity values used. Typically, a 10 percent change in porosity will result in less than a 0.5 percent change in predicted pressure buildup.

4.2.2.3 Rock Compressibility

Compressibilities of strata are rarely measured for the geological layers at an underground injection site. Input values for these parameters can be estimated using information from the literature (Freeze and Cherry, 1979) for similar strata. In the model, compressibilities enter into the calculation only by combining with a fluid compressibility term in determining the layer storativities. Since, as mentioned above, model results are very insensitive to layer storativities, they also will be quite insensitive to the values chosen for the compressibilities. The predicted pressure buildup will typically change by less than 10 percent for a factor of 10 change in compressibility.

4.2.3 Low-permeability Layer Properties

Properties required by the model for aquitard (low permeability) layers are vertical permeability and porosity. Actually, porosity is not used in the Multilayer Pressure Model calculation, but it is employed in the Vertical Permeation Model which adopts the same input format. Therefore,

in supplying the Multilayer Pressure Model with these input data, these data are actually stored for later use by the Vertical Permeation Model.

Values of aquitard permeability and porosity rarely have been measured at underground injection sites. It would be unlikely to find data on these parameters, however, their measurement is becoming more frequent under new well installation requirements. Without site-specific measurements, it is necessary to make reasonably conservative estimates based on general information in the literature on similar aquitard materials (Freeze and Cherry, 1979; Neuzil, 1986) or from information for the same geological region.

Predicted pressure buildups are found to be very insensitive to the values selected for aquitard permeabilities, since these permeabilities are generally very low and do not allow for much fluid bleed-off from the injection interval into the aquitards. The ability to calibrate the results of the Multilayer Pressure Model against historic site-specific operating data suggests that the actual aquitard permeability values do not grossly exceed estimates from regional data.

4.3 Well Radius

The model requires data specifying the radius of each active well at an underground injection site. The well radius can be determined from caliper logs for the well. The model results are virtually independent of these parameters at all locations other than very near the wells. Even directly at the wells, the results are very insensitive to the values specified for the radii. Typically, a 10 percent change in well radius will result in less than a one percent change in the predicted pressure buildup.

4.4 Fluid Viscosity

A separate fluid viscosity value is specified for each layer in the model. If fluid samples were taken during drilling, the viscosity can be measured directly with appropriate corrections made for the temperature at depth. When no fluid samples are available, viscosity can be estimated accurately from property data in the literature (Lobo, 1984; Suryanarayana and Venkatesan, 1958; Perry and Chilton, 1973), which give saline brine viscosity as a function of temperature and salinity.

After the model has been calibrated against site-specific operating data, the value of the transmissivity for each of the injection layers in the model will be known more accurately. Since transmissivity is proportional to the ratio of permeability to viscosity, this ratio will be better

characterized. It is actually the ratio, and not individual parameters, that determines the pressure response in the model. Therefore, even if the individual parameters are not known very accurately, their ratio can be calibrated and used to accurately predict pressure buildup.

4.5 Site Operating History

The history of the injection rates into each well and the history of well completions into each injection interval must be specified. This information is available from site operating records. The information can be supplied to the model on an average annual basis, or, preferably, on an average monthly basis.

5.0 MODEL OUTPUTS

5.1 Reservoir Properties

Reservoir parameters are special mathematical combinations of the fundamental physical properties of geological strata and fluids. They include the permeable layer transmissivities and storativities and the aquitard leakances. It is these parameters alone which appear as the coefficients in the hydrological flow equations and govern the pressure response in the model. Therefore, in calibrating the model to site-specific operating data, it is appropriate to calibrate with respect to the reservoir properties rather than the fundamental physical input parameters.

5.2 Injection Rate at Each Well into Each Interval Over Time

If wells are operated such that only one horizon is perforated at any one time, flow into the injection interval will be identical to the injection rate at the wellhead. For a well perforated into more than one horizon at a time, the total injection flow rate at the wellhead is known but typically not the partitioning of the flow between the receiving horizons (unless flow meter logs have been frequently run). This partitioning is calculated in the Multilayer Pressure Model, together with the interformational flow taking place at wells not injecting waste but which are completed into more than one horizon. These calculated injection rates into the individual layers are subsequently employed as inputs to the Multilayer Vertical Permeation Model and the Basic Plume Model.

5.3 Pressure Buildup as a Function of Location and Time

The spatial distribution of pressure buildup with time is the primary output from the Multilayer Pressure Model. It can be displayed graphically by plotting pressure buildup as a function of time at a given location, or on a contour plot, showing lines of constant pressure (isopleths) at any given time. Contour plots are very useful in evaluating Area of Review, since they can include the locations of all boreholes in the region of the injection site.

6.0 ASSUMPTIONS, VALIDATION, AND MARGINS OF SAFETY

This section describes the key assumptions in the model, and evaluates particular site-specific conditions under which the assumptions are valid. Also summarized are various margins of safety built into the Multilayer Pressure Model to guarantee a conservative, upper-bound prediction of the pressure buildup within an underground injection system.

6.1 Flow is Horizontal in the High-permeability Layers, and Vertical in the Low-permeability Layers

According to Neuman and Witherspoon (1969a, b), this assumption is valid whenever the permeability of the high permeability layer is at least 100 times greater than that of the adjacent aquitards (low permeability layers). This condition is virtually always satisfied at underground injection sites.

6.2 Properties and Thicknesses of the Layers do not Vary with Position

Miller et al, (1986) and Collins (1986) have discussed the insensitivity of the pressure distribution developed as a result of injection to vertical variations in hydrogeologic properties (primarily permeability) through the thickness of the injection interval. They have indicated that pressure response is determined mainly by the thickness weighted average of layer properties. The ability of classical "Reservoir Analysis" to predict pressure buildup and drawdown in geological formations known to be highly nonuniform in the vertical direction is direct evidence of this insensitivity.

Properties of the layers, as well as their thicknesses, also can vary in the horizontal direction. The pressure response of an injection interval is determined by the product of the permeability and layer thickness, expressed as the transmissivity. The model includes the capability of handling large, sudden lateral variations in transmissivity, such as a fault blockage, using the method of image wells (Freeze and Cherry, 1979). Effects of gradual changes, such as pinch-outs, can be simulated by modeling these changes as sudden variations imposed at an appropriate location.

6.3 Density of the Waste is the Same as that of the Formation Fluid

The effect on pressure distribution of a density difference between the waste and formation fluid has been analyzed by Miller et al. (1986). They have shown that for a single injection interval,

the inaccuracy in discounting this effect approaches zero in the center of the injection interval and is extremely small elsewhere within the waste plume, amounting to no more than half the product of the density difference (gm/cm^3) and injection interval height (feet), where the inaccuracy is expressed in feet of head. Outside the waste plume, the effect decreases very rapidly with distance away from the well. Density therefore has virtually no bearing on the Area of Review evaluation.

6.4 Viscosities of the Waste and Formation Fluid are Equal

In the high-permeability injection interval, the fluid viscosity varies from that of the waste in the region near the well to that of the formation fluid viscosity at distances further out. Since the injected waste temperature is normally lower than the temperature of the formation fluid, its viscosity may be expected to be slightly higher. This viscosity variation typically will amount to no more than a factor of two. The effect of assuming that the waste viscosity is equal to the formation fluid viscosity will be relevant only within the borders of the waste plume. Outside the plume, the predicted pressure distribution will be virtually unaffected.

If the value of the injection interval permeability is calibrated to pressure data at shut-in wells contained within the plume, the permeability value so determined will be underestimated. Use of this underestimated permeability value in predicting the pressure distribution throughout the injection interval will lead to an overestimate of the pressures at locations within the Area of Review, such as at abandoned boreholes. Thus, the assumption that the waste viscosity is the same as the formation fluid viscosity provides an added margin of safety in the Area of Review calculations.

In predicting vertical waste permeation into the overlying aquitard, use of the formation brine viscosity in the calculation will result in a slight underestimate of the permeation distance. However, the extent of this underestimate typically will be quite minimal compared to the uncertainty associated with the choice of the aquitard permeability value input to the Multilayer Vertical Permeation Model. This choice is normally very conservative by several orders of magnitude. Therefore, the inaccuracy associated with the viscosity assumption can be absorbed into the margin of safety factor for aquitard permeability.

6.5 Compressive Storage in the Low-Permeability Layers is Negligible

The ability of aquitard layers to compressively store fluids is assumed to be negligible in the Multilayer Pressure Model. Under this assumption, the pressure profile within the aquitards will

reach an instantaneous steady state, varying linearly with vertical position and determined by pressure values at the boundaries with the two permeable layers immediately underlying and overlying the aquitard. Moreover, fluid permeation rates across the top and bottom boundaries of the aquitard will be equal and proportional to the pressure difference between the underlying and overlying permeable layers.

Use of this assumption consistently will lead to an overestimate of the pressure within the injection interval during injection. This is because compressive storage of fluids in the aquitards would provide an added sink for bleed-off of fluids and pressure from the injection interval. Therefore, discounting storage provides an added margin of safety in terms of using the Multilayer Pressure Model to calculate both Area of Review and vertical waste permeation into the overlying aquitard.

6.6 The Injection Interval is Fully Perforated

Not all injection wells are perforated over the full height of the injection interval. Effects of partial perforation are important only in the region relatively near the injection well, up to radial distances on the order of a few thicknesses of the injection interval, at most. The actual radial region of influence depends on the fraction of the height perforated and, to a minor extent, on the ratio of vertical to horizontal permeability. Within this region, the pressure buildup will vary both with vertical position through the formation as well as radial position away from the well.

The nature of this variation was studied extensively by Hantush (1964), who provided analytical relationships for quantifying the behavior. Hantush (1964) found that for constant injection rate after a short initial transient period, the contribution of partial perforation effects to the pressure distribution will approach steady state.

Hantush's steady-state equations (Hantush, 1964) have been employed to assess the influence of partial perforation on the pressures at an injection well and at the base of the overlying aquitard. In general, at the well, the effects will be analogous to those associated with well inefficiency or "skin effect." They will increase the pressure in the wellbore during injection in proportion to the injection rate and will have essentially no influence on shut-in pressures (after the initial transients have died out). Since the Multilayer Pressure Model is normally calibrated to shut-in pressures, the calibration results will not be affected by partial perforation. In cases where the model is calibrated to flowing bottomhole pressures, these calculated flowing pressures are corrected for skin and partial penetration (spherical flow) effects. Furthermore, since the effects

of partial perforation are important only in the region near the wells, the Area of Review results also will be unaffected.

The influence of partial well perforation on the pressure at the base of the overlying aquitard is important in estimating vertical permeation. In general, Hantush's results (Hantush, 1964) have shown that, if the perforations are located in the lower portion of the injection interval, as is often the case, the pressure at the base of the overlying aquitard actually will be lower than if the full interval were perforated. Therefore, discounting the partial perforation effect will result in an overestimate of the pressure at the base of the overlying aquitard, and will thus provide an added margin of safety in calculating vertical permeation.

7.0 FORMULATION AND SOLUTION

Based on fundamental freshwater the assumptions discussed in the previous section, the partial differential equation describing the buildup of head (h_i)(which is proportional to the pressure buildup) within each permeable layer i of an underground hydrological system as a function of time and radial distance from an isolated injection well(s) given by Hunt, 1985:

$$S_i \frac{\partial h_i}{\partial t} = T_i \frac{1}{r} \frac{\partial}{\partial r}\left(r \frac{\partial h_i}{\partial r} \right) + R_{i+1}\left(h_{i+2} - h_i\right) + R_{i-1}\left(h_{i-2} - h_i\right) \quad (1)$$

where T_i and S_i are the transmissivity and storativity of permeable layer i, and R_{i+1} and R_{i-1} are the leakances for the overlying and underlying aquitards. These parameters are defined as follows:

$$T_i = \frac{\rho g k_i \, b_i}{\mu_i}$$

$$S_i = \rho g b_i \left(\alpha_i + \phi_i \beta_i\right)$$

$$R_i = \left(\frac{\rho g k_i}{\mu_i \, b_i} \right)$$

Where:

ρ	=	Density of fresh water,
g	=	Gravitational acceleration constant,
k_i	=	Permeability of Layer i,
μ_i	=	Fluid viscosity in Layer i,
b_i	=	Thickness of Layer i.
α_i	=	Compressibility of Layer i,
ϕ_i	=	Porosity of Layer i,
β_i	=	Compressibility of water.

The horizontal boundary conditions on the flow are given by

$$h_i = 0 \, at \; r \to \infty \quad (2)$$

And

$$2\,\pi r\,T_i\,\frac{\partial h_i}{\partial r} = -\,Q_i \;\; at\; r = r_o \tag{3}$$

Where r_o is the well radius and Q_i is the volumetric injection rate into Layer i. Equation 2 implies that the layers are infinite in lateral extent. However, bounded reservoir conditions, and other lateral blockages, can be included by superposition techniques using the method of image wells.

In the vertical direction, no flow is permitted across the lower boundary of the model (downward out of the lowest layer in the stack), while the upper boundary is treated as a zero-head-buildup layer. The location of this boundary typically is taken as the depth of the lowest underground source of drinking water (USDW). This is very conservative from the standpoint of estimating vertical permeation effects, since the actual location of the zero-head-buildup boundary is at the ground surface (water table); thus, the model takes no credit for the vertical flow resistance provided by the aquitard layers overlying the lowermost USDW. In the Multilayer Pressure Model, the choice of the USDW as the zero-head-buildup boundary does not significantly influence the accuracy of the calculations, since this location typically is separated from the injection zone by several intervening aquitard layers, which effectively prevent the pressure variations from propagating to the USDW depth during the operating lifetime of a site.

For a multiple-well site injecting waste at variable rates into wells that are perforated into more than one interval simultaneously, the model makes use of well-established spatial- and time-superposition principles (Freeze and Cherry, 1979) to determine the head buildup. These superposition principles take advantage of the linearity of the basic partial differential equations and boundary conditions with respect to head buildup, together with the assumed spatial independence of layer properties, to calculate the solution for more complex situations by adding together the results for simpler spatial and time arrangements.

The first step in the solution procedure is to generate a set of time-dependent solutions to the response of a single isolated well injecting at a constant unit injection rate, into a specified injection interval. A separate solution is generated for each permeable interval used for injection. This involves solving the basic partial differential equation and boundary conditions given above numerically, and storing the results of the calculations in a set of tables of head buildup as a function of time, radial position, permeable layer index, and injection interval index.

The equations are solved by discretizing the partial differential equations with respect to the radial coordinate using a finite difference approach and solving the resulting set of ordinary differential equations (ODEs) in time by means of a commercially available stiff ODE package. The discretization scheme is carried out in the logarithm of the radius, rather than the radius itself, to achieve an added degree of accuracy, since the head buildup is approximately linear in log(r). The boundary condition at large radial distances from the well (zero-head-buildup) is applied at the final grid point, which is typically placed at a radius of about 200 miles.

Tables of solutions generated for the case of a single isolated well injecting at a constant unit injection rate into a specified injection interval are used to construct the solutions for the actual injection conditions of variable pumping rates and multiple-wells, by applying the principles of spatial- and time-superposition. The only complicated step in this process is accounting for wells that are perforated into several intervals simultaneously. The total injection rates into these wells are known in advance, but typically not the apportionment of the total flow among the available injection intervals. In the Multilayer Pressure Model, this apportionment is calculated by applying an additional boundary condition at all wells completed into more than one horizon. This boundary condition is that the head buildups for all perforated intervals at a given well location are the same.

The physical justification for this requirement is that the vertical flow resistance within the injection tubing is typically very low, so that head loss resulting from downward flow through the section of tubing connecting perforated intervals will be negligible. The well essentially acts as a high conductivity vertical pathway. Implementation of this boundary condition in the model requires the solution of a set of simultaneous linear equations for the flow rates into the individual injection intervals at each increment of time.

8.0 VERIFICATION

The computer model has been verified against a variety of solutions in the literature and with numerical tests to guarantee that it delivers reliable solutions to the model description as stated. In tests involving an isolated well injecting at constant rate into a single interval with impermeable aquitards, the model duplicated the results of the Theis (1935) equation to within 0.2 percent. Similar accuracy was obtained in comparisons against the Hantush and Jacob (1955) steady-state equation, which assumes the existence of a low permeability aquitard between the injection interval and the zero-head-buildup boundary.

A more comprehensive test of the single-well capabilities of the model was provided by a comparison with the results of Hunt (1985). Hunt solved for the head distribution in a multilayer stratigraphic system for the same set of equations as in the present model, but used an analytic solution technique. The geological arrangement in Hunt's example is shown in Figure 4, and the specific parameter values chosen are given in Table 1. Figure 5 compares the steady-state results from the present model with those of Hunt, while Figure 6 presents the corresponding comparison of the time-dependent behavior at a selected location. The two sets of results are identical, to within plotting accuracy. It is interesting to observe that El Didy and Contractor (1987) have performed this same intercomparison with Hunt's calculations to validate their two-dimensional finite element model of a multilayer system (El Didy, 1986).

The above tests fully verify the ability of the model to generate the response of a single isolated well injecting at constant rate into an individual interval, including the numerical discretization scheme employed for the radial coordinate.

The variable injection rate (time-superposition) aspect of the present model was verified by the following procedure. The radially discretized ordinary differential equations describing the time-dependent response of an isolated well injecting into a specified interval can be integrated numerically, not merely for the usual case of a constant injection rate (which is used to generate the tabulated well influence functions used in the model), but also for the case of fully variable injection rate history. On this basis, an integration was performed for a series of step changes in injection rate, and the results of the calculation were compared with output obtained directly from the model using the time-superposition software. Results from the two calculations were identical.

The multiple-well superposition feature of the model was checked using hand calculations for the case of two injection wells located at various coordinate positions injecting at constant rate

into a formation bounded above and below by impermeable aquitards. The single-well response for this situation is governed by the Theis equation.

Results from the model also were compared to the analytic solution for the steady-state head buildup distribution produced by a combination of an injection well and an adjacent withdrawal well, both operating at the same constant flow rate. This solution is given in Bear (1972). The model output agreed with the analytic results to considerably better than 0.1 percent.

It also has been verified that at a well perforated into multiple horizons, the calculated apportionment of injection flow to the individual receiving horizons is consistently determined correctly. This was accomplished by confirming, in all instances, that the head-buildups within the various perforated intervals were identical in agreement with the required boundary condition, and that the sum of the flow rates to the perforated intervals precisely matched the total injection rate at the wellhead.

Table 1
Parameters Used In Hunt's Multiaquifer Example

Aquifer	Injection Rate (m^3/s)	Transmissivity (m^2/s)	Storativity	Overlying Aquifer Leakance (s^{-1})
1	0	0.0004	0.00005	0
2	0	0.0009	0.0004	0.000003
3	0	0.0007	0.00008	0.000008
4	0.04	0.003	0.0002	0.00001
5	0	0.001	0.0001	0.00003

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FIGURES

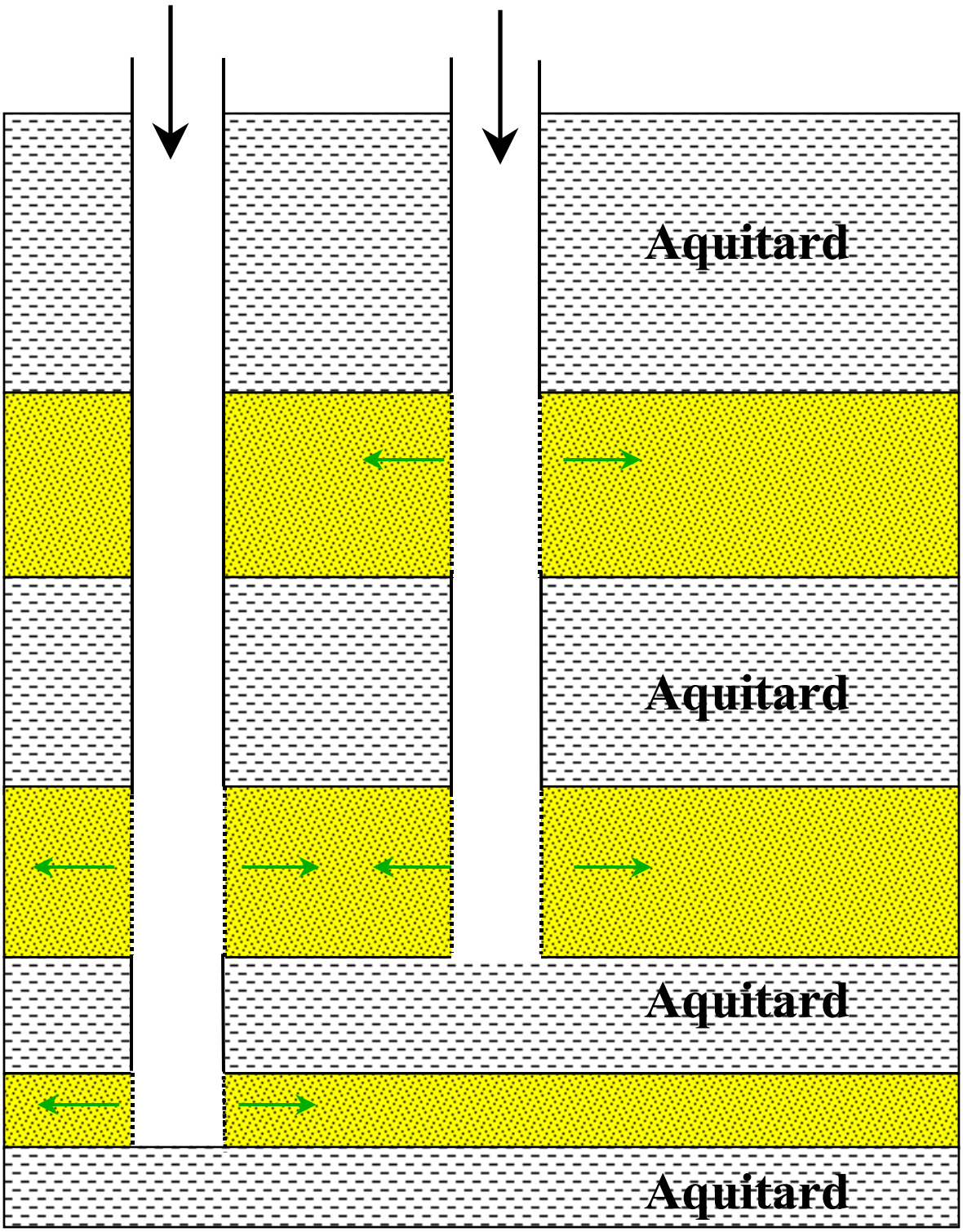

Figure 1
Injection Wells Perforated into More than One Horizon (Commingled)

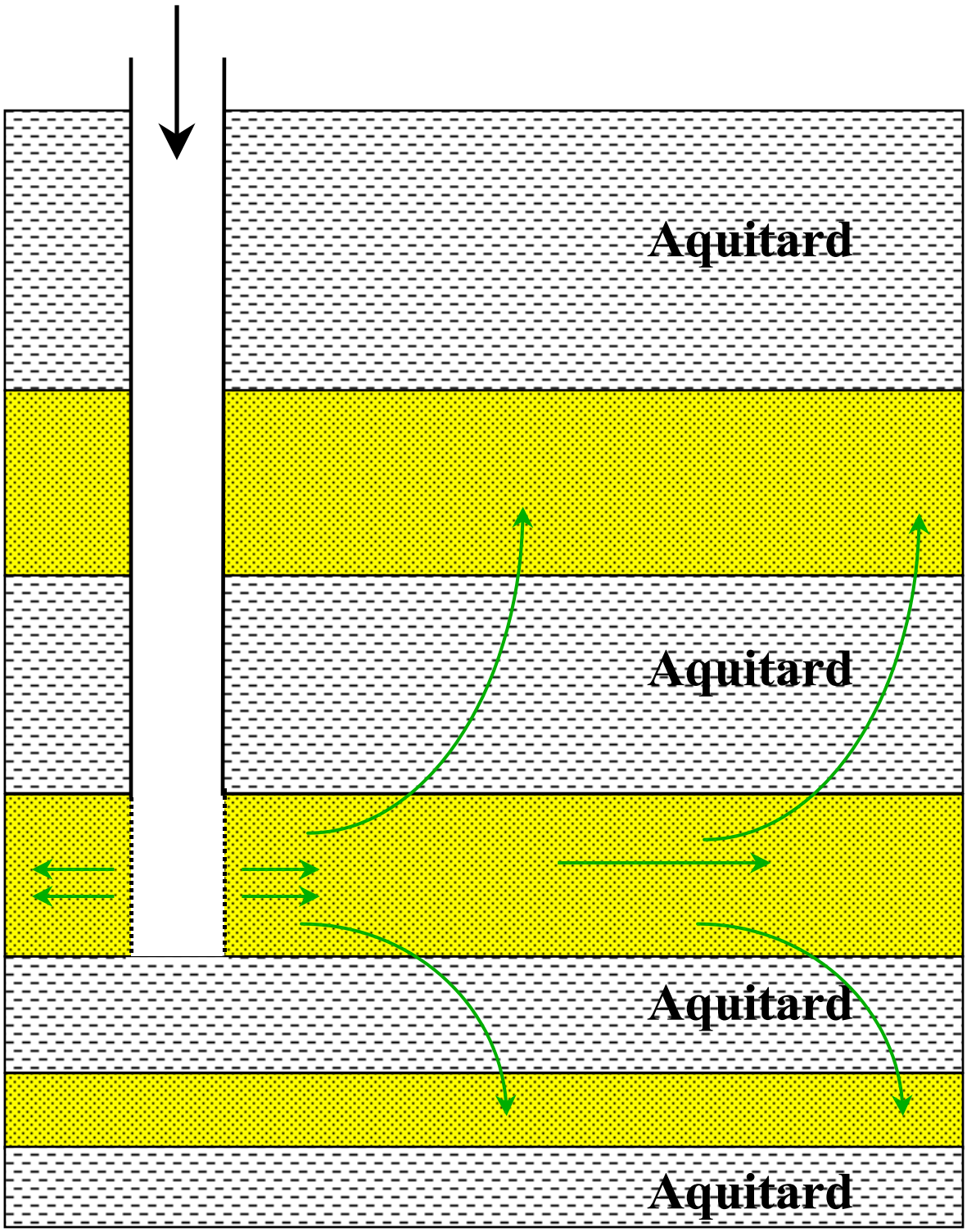

Figure 2
Fluid Seepage through Aquitards (Crossflow)

Geologic Column of Layers

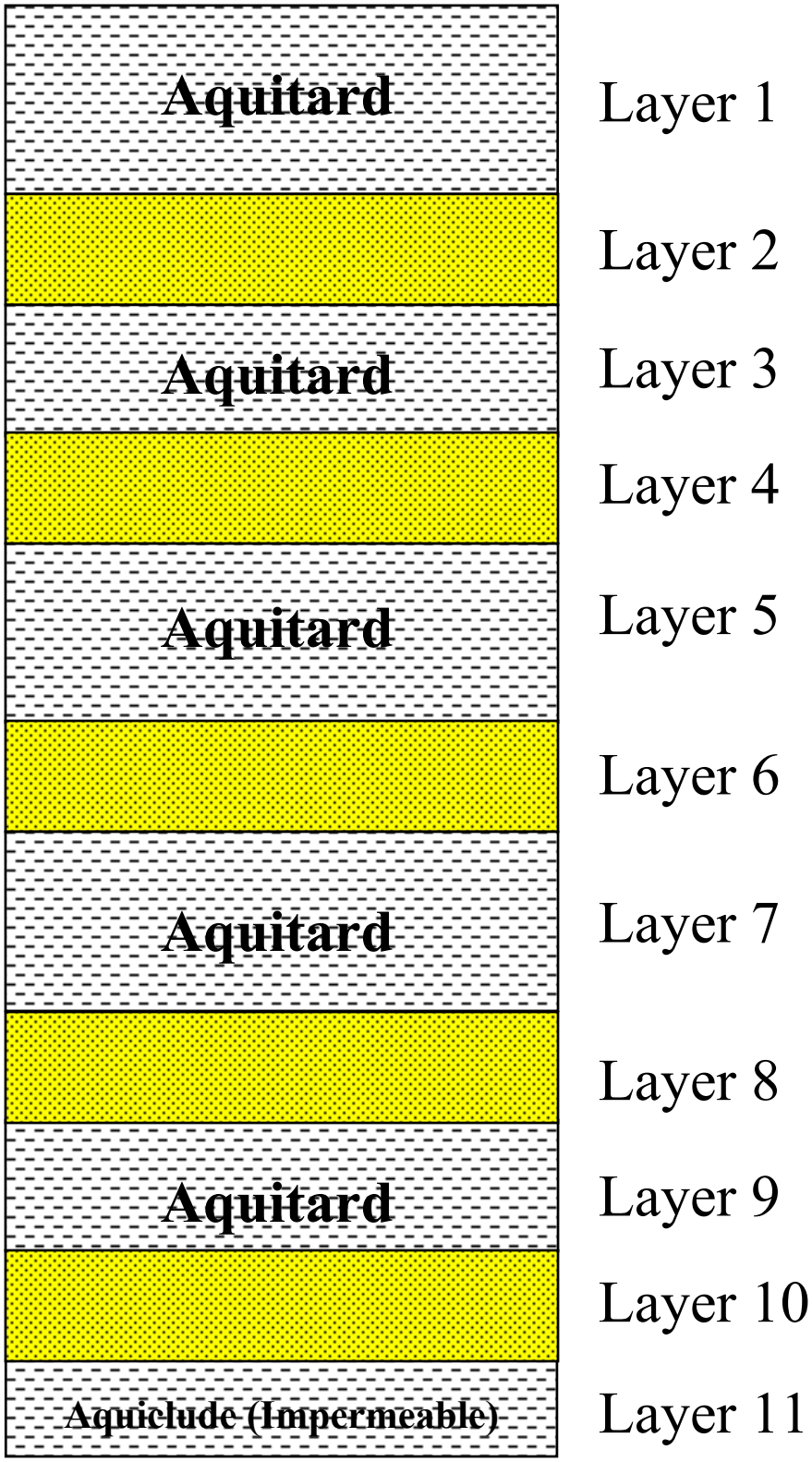

Figure 3
Model Structure for Typical Geological Arrangement

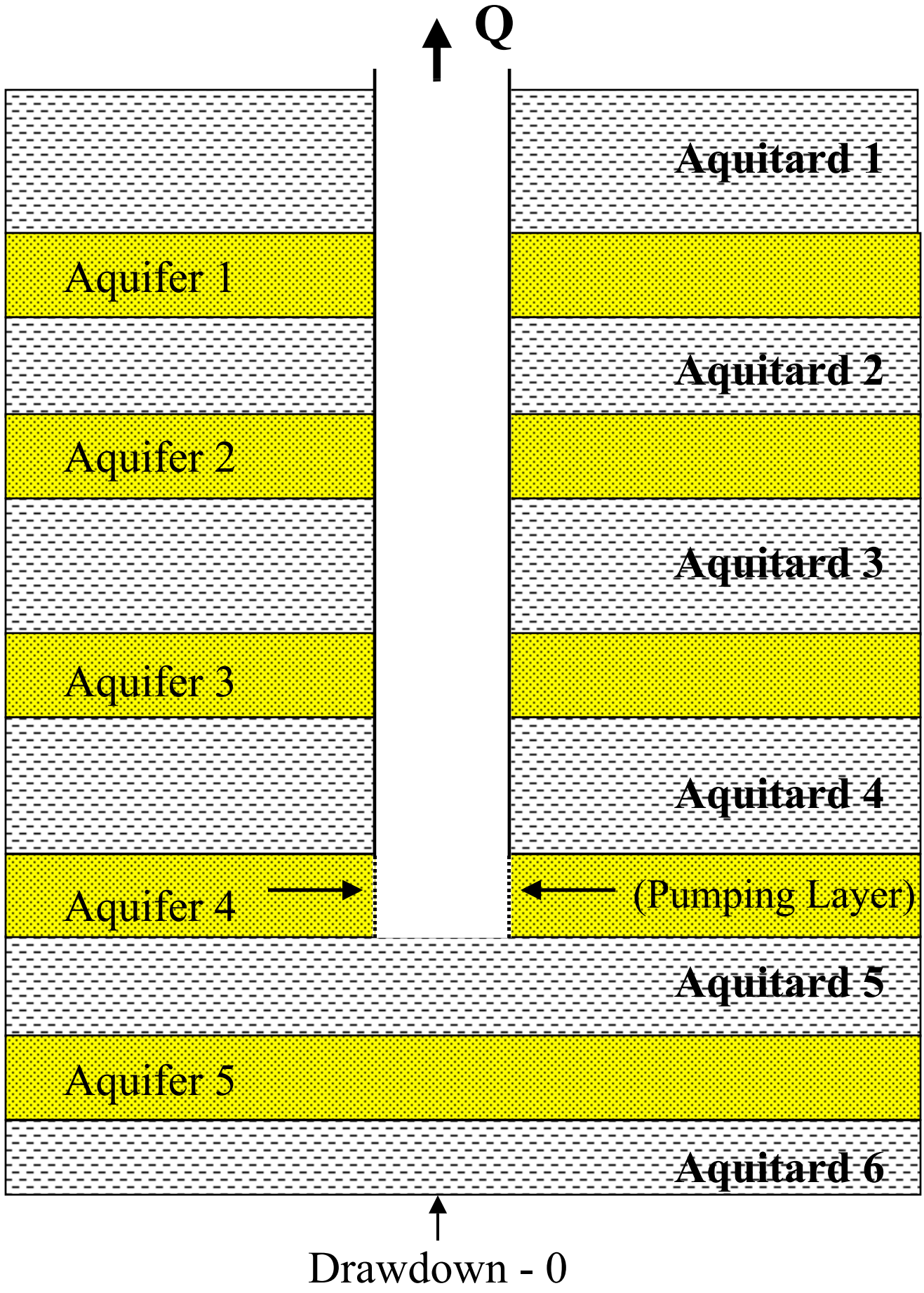

Figure 4
Geological Arrangement in Hunt's Example (1985)

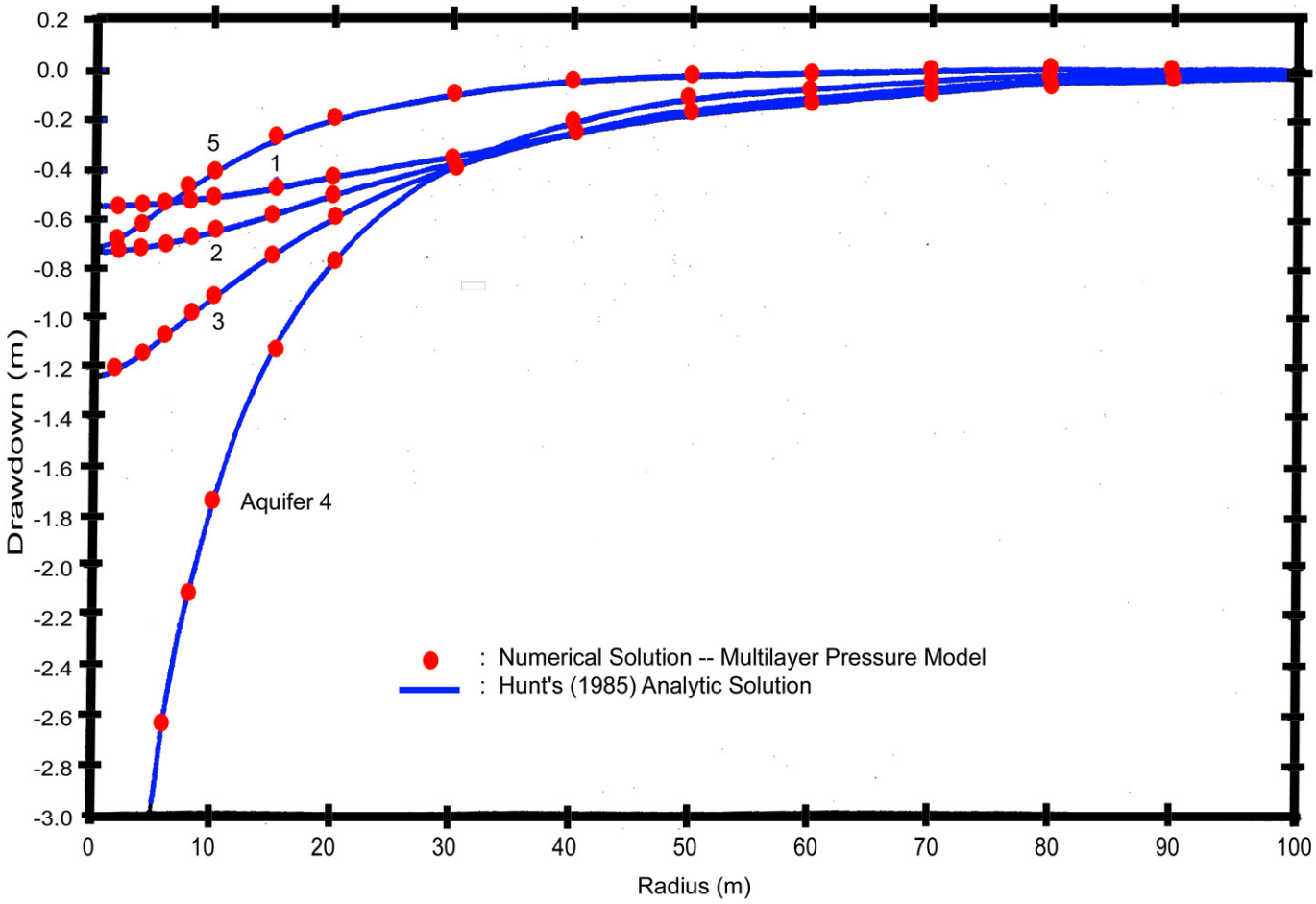

Figure 5: Steady State Drawdown Distribution in Each Aquifer.

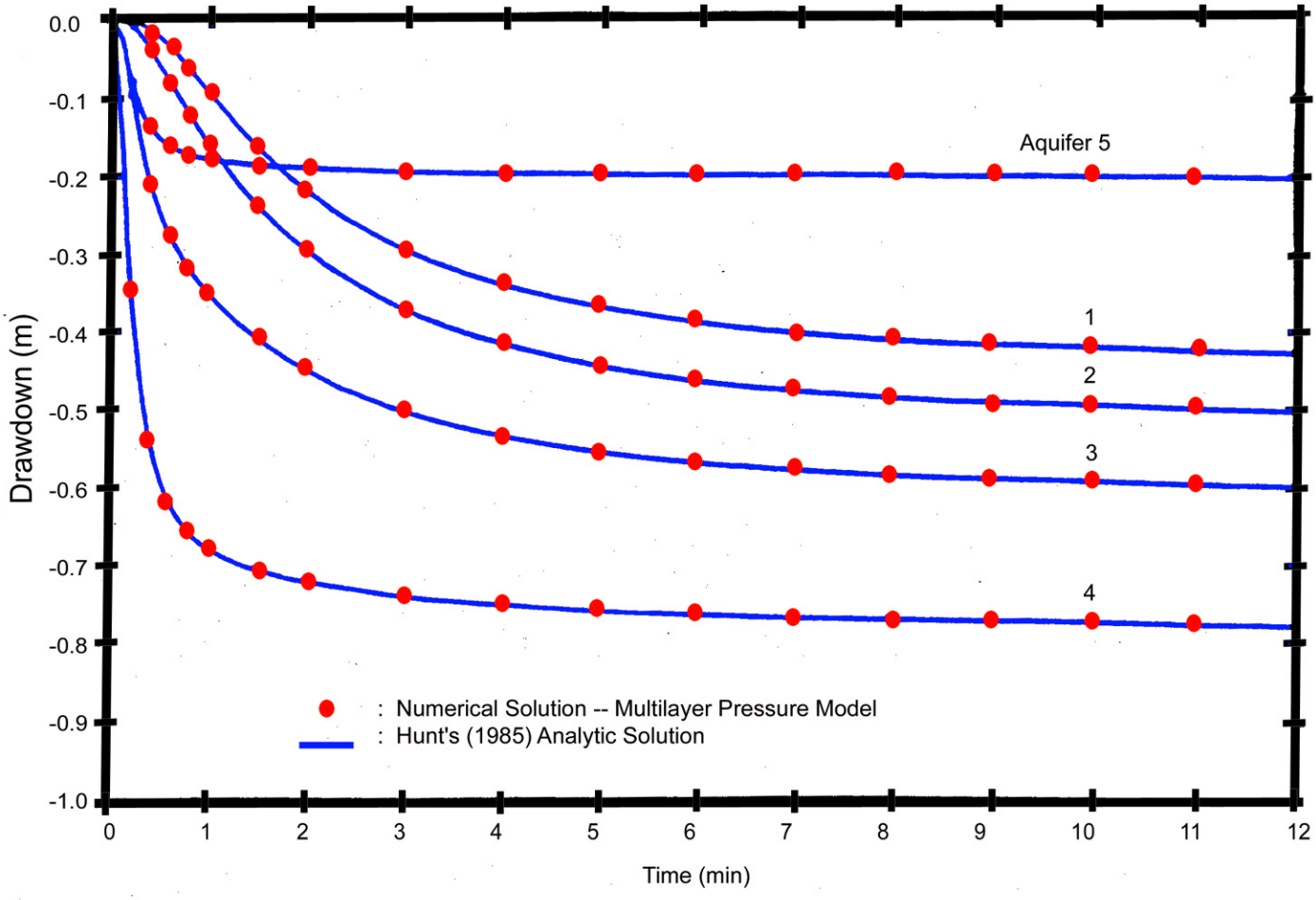

Figure 6: Time Dependent Drawdown Variations at r = 20m in Each Aquifer.

ATTACHMENT 2

ATTACHMENT 2
DUPONT BASIC PLUME MODEL

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1.0 GENERAL DESCRIPTION

The DuPont Basic Plume Model calculates the time-dependent lateral movement of waste plumes emanating from various wells at an injection site. Key features of the model were discussed by Miller et al. (1986).

2.0 MODEL STRUCTURE

The model is set up as a single layer calculation and neglects vertical exchange of fluids between geological strata. A separate calculation is therefore required for each layer into which waste is injected.

Many particle-tracking models of this type neglect the effects of non-uniformities within the injection formation on the distribution of the waste. Such non-uniformities are found to give rise to the phenomenon of macro-dispersion, which causes the leading edge of the waste plume to be jagged or diffuse (rather than vertical and sharp) and results in a greater effective lateral extent for the plume. The Basic Plume Model accounts for the effects of non-uniformities by means of a special technique, known as the "multiplying factor concept," introduced by Miller et al. (1986). This concept provides the basis for establishing an extreme outer perimeter beyond which none of the waste could have passed.

3.0 MODEL INPUTS

The model inputs are the set of parameters that must be supplied to the computer program to perform a site-specific calculation of waste transport within the injection stratum. In addition to identifying the required parameters, the present discussion considers the potential sources of this data and the sensitivity of the model results to variations in the inputs.

3.1 Well Locations

The geographical coordinates of all wells are specified using an X-Y coordinate system inscribed onto a map of the site locale. Data on the locations of the wells is readily available from historical records and maps of the plant vicinity. For a non-vertical wellbore, the borehole is projected downward to its intersection with the injection horizon.

The uncertainties associated with specifying the well locations are typically quite minimal and will have virtually no influence on the predicted advance of the waste plumes.

3.2 Geological Data

3.2.1 Average Injection Stratum Thickness

Average thickness of the injection stratum is determined by analyzing resistivity and spontaneous potential logs. Special geological surveys by experienced consultation organizations are often used as additional data sources.

The model predicts that the distance the waste front advances laterally is inversely proportional to the square root of the injection stratum thickness for the case of an isolated well in an unbounded isotropic medium.

3.2.2 Average Injection Stratum Porosity

The average porosity of the injection stratum is determined from core samples or regional geological studies of the area near the injection site. A large number of core samples is desirable to obtain a representative average.

The lateral advance of the waste front predicted by the model is inversely proportional to the square root of the porosity for the case of an isolated well in an unbounded isotropic medium. This is identical to the variation noted above with respect to the injection stratum thickness.

3.2.3 Location of Flow Barriers

The effects of barriers to fluid flow are accounted for explicitly in the model using the method of image wells (Freeze and Cherry, 1979). The model represents these features as vertical planar boundaries of infinite extent. Their location and orientation are supplied to the model by providing the lateral coordinates of any two points along the flow barrier. The model then calculates the appropriate locations of all image wells by applying a simple geometric formula. Information on the presence of flow barriers can be obtained from geological surveys of the site.

3.2.4 Multiplying Factor

The multiplying factor is used in the Basic Plume Model to compensate for the effects of dispersion associated with non-uniformities in the injection stratum and other geological uncertainties that may be present. It provides a basis for establishing a conservative outer boundary to the possible lateral extent of the waste, rather than predicting the exact waste location.

In practice, the multiplying factor functions as a scaling parameter that increases (mathematically) the injection rates input to the model at the various wells by a constant factor equal to or greater than 1. This results in a corresponding increase in the predicted lateral extent of the waste plumes, relative to the case of a perfectly homogeneous formation. The increased lateral movement simulates, on firm theoretical grounds, the enhanced transport that results from non-homogeneities. Thus, the multiplying factor concept enables a transport model that has been structured primarily as a tool for homogeneous porous media to be used to predict waste movement in a non-homogeneous geological system.

To account for the effects of vertically stratified permeability variations through the thickness of the injection formation, the multiplying factor is set equal to the ratio of the maximum horizontal permeability to the horizontal permeability averaged over the formation thickness. Values for these parameters can be obtained from core samples taken from the injection stratum during well

drilling or from samples at neighboring wells. A large number of samples is desirable to obtain statistically significant estimates.

Use of the multiplying factor guarantees a margin of safety in the calculations, since the approach neglects the mitigating influence of both small-scale transverse dispersion and slow vertical flow, each of which acts to retard the lateral transport.

In calibrating the Basic Plume Model to actual field data, the multiplying factor is employed as the primary calibration parameter. Its value is adjusted to match the observed history of waste movement in the subsurface, as determined from encounters or nonencounters of waste at newly drilled wells at a site.

The predicted lateral advance of the waste front in the Basic Plume Model is proportional to the square root of the multiplying factor for the case of an isolated well in an unbounded medium.

3.3 Site Injection History

The waste injection history at each well must be specified as a function of time. If wells are operated such that only one horizon is perforated at any time, the flow into the injection stratum will be identical to the injection rate at the wellhead. For a well perforated into more than one horizon at a time, the total injection flow rate at the wellhead is known in advance, but not the partitioning of the flow between the perforated horizons. This partitioning can be calculated using the Multi-layer Pressure Model described in Appendix 4-2.

The well injection histories and the sequence of well completions are specified as functions of time for input to the Multi-layer Pressure Model. Injection history information is available from the site operating records. It can be provided on an average annual basis, or preferably, on an average monthly basis.

4.0 MODEL OUTPUTS

The model calculates the time-dependent motion of the front between the waste and formation fluid by predicting the movement of a set of fictitious tracer particles situated at the leading interface of each plume. The plume shapes can then be displayed graphically by joining the points along the plume boundaries.

5.0 ASSUMPTIONS, VALIDATIONS, AND MARGINS OF SAFETY

This section describes the key assumptions in the model and evaluates the particular site-specific conditions under which the assumptions are valid.

5.1 The Flow Is Incompressible

The effects of compressibility of the fluids and the porous medium are important in determining the pressure distribution in a broad geographic area surrounding an injection site, but not in determining the location of the waste. This is because the actual compression of materials that takes place locally is very small but is distributed over a large lateral area. The compression effect will amount to only a few tenths of a percent within the region occupied by the waste. Therefore, neglecting this compression must result in only a slight inaccuracy in the prediction of the waste location. Since the waste is compressed and the pores of the rock are expanded, the assumption will always lead to an underestimate in the lateral extent of the waste plume.

5.2 Seepage from the Injection Stratum into the Overlying and Underlying Aquitards Is Negligible

The adjacent aquitards are typically very low in permeability and will thus permit only a small amount of seepage to occur from the injection stratum. Moreover, this loss will result in a reduction in the lateral flow velocity and in the horizontal extent of the waste plume. Therefore, this assumption is conservative from the standpoint of bounding the waste movement.

5.3 Properties of the Injection Stratum do not Vary with Position

The model assumes that the thickness of the injection stratum does not vary horizontally, and that the permeability and porosity are constant with both horizontal and vertical position.

Horizontal variations in formation thickness and permeability can affect the lateral extent of waste transport. Large, sudden changes in these parameters can be included explicitly in the model calculations, using image well techniques, or through the use of the multiplying factor.

In geological formations such as those in the Gulf Coast region, permeability can vary greatly with vertical location through the thickness of the stratigraphic units. This permeability

variation can result in an inter-fingering phenomenon at the leading edge of the waste plume and the enhancement of lateral transport, sometimes referred to as macro-dispersion. Using the multiplying factor concept allows compensation for these effects and leads to an upper-bound estimate to the lateral movement of the waste.

5.4 Densities of the Waste and Formation Fluids Are Equal

Whenever the density of the injected waste differs from that of the native brine, there will be a tendency for natural convection effects to play a role in influencing the fluid flow velocities within the injection stratum. The injected fluid will be prone to either rise to the top of the formation or sink to the bottom, depending on whether it is more or less dense than the formation fluid. In addition, its leading edge will tend to move further horizontally than if the two fluids were of equal density, irrespective of which fluid is more dense.

Miller et al. (1986) assessed the magnitude of these effects. They showed that by applying an appropriately selected multiplying factor, the influence of density variations between the waste and formation fluids can be included within the context of the Basic Plume Model.

For those injection sites where the multiplying factor has been calibrated to the observed history of waste encounters and nonencounters at newly drilled wells, the value obtained will inherently include the effects of density differences between the waste and formation fluids.

5.5 The Fluid Viscosity Is Uniform within the Injection Stratum

Fluid viscosity within the injection stratum will typically vary by less than a factor of two between the waste viscosity in the region near the wells to the formation fluid viscosity at distances beyond the waste plumes. For a single-well injection site, these variations will have virtually no influence on the radial transport of waste (although the pressure distribution will be affected). For a multiple-well site, the effects can normally be neglected. However, if viscosity variations are much larger than a factor of two at a multiple-well site, appropriate compensation should be included in transport calculations. This can be accomplished by judicious choice of the multiplying factor in the Basic Plume Model.

5.6 The Injection Stratum Is Fully Perforated

Most injection wells are not perforated over the full height of the injection interval. The effects of partial perforation will typically be manifested as a localized phenomenon, confined to the horizontal region within a few formation heights of each individual well. The presence of partial perforation at one well will normally not significantly influence the transport at adjacent wells.

The distance waste travels laterally can be expected to be slightly enhanced as a result of partial perforation, but the effect can be neglected. For a homogeneous isotropic injection stratum, one can show that the lateral advance of the waste plume will never exceed that obtained with a fully perforated interval by more than one-fourth the formation height. This maximum enhancement will occur at a lateral distance of about half a formation height away from the injection well. At larger distances from the well, the waste front will tend to become "self-sharpening," and revert to a more nearly vertical configuration. Thus, the enhancement resulting from partial perforation will decrease with increasing distance from the well.

If the injection formation is anisotropic, so that the permeability in the vertical direction is considerably smaller than the permeability in the horizontal [for example, in a formation exhibiting "layered anisotropy" (Freeze and Cherry, 1979)], the enhanced lateral transport produced by partial perforation will be greater than that described above in the case of an isotropic system. For this situation, one can show that the increased lateral transport will never exceed one-fourth the formation height multiplied by the square root of the ratio of the horizontal to the vertical permeability. Even for a permeability ratio of 10, this will amount to an increased lateral advance of only about three-fourths of a formation height.

6.0 FORMULATION AND SOLUTION

This section presents the formulation and solution of the Basic Plume Model. Attention is focused first on the case of a purely homogeneous geological formation, which produces an ideal vertical waste front. Second, the effects of non-uniformities and hydrodynamic dispersion are considered. Finally, some novel numerical techniques are presented which overcome certain computational problems frequently arising in calculations of this type.

6.1 Ideal Sharp Vertical Waste Front

In a purely homogeneous geological formation, the interface between the waste and formation fluid will advance laterally as a sharp vertical front. This front will take the shape of a right circular cylinder for the case of a single isolated well. The diameter of the circle will be determined strictly by geometric considerations, involving the total volume of the injected waste, and the height and porosity of the formation. Such a plume is referred to as an ideal circular waste plume.

For multiple-well injection sites, methods of analyzing waste transport in purely homogeneous geological formations have been available for many decades, based on work in the petroleum field (Collins, 1961). The Basic Plume Model is therefore not a new development, but closely parallels the standard approach recommended by others (Collins, 1961; Javandel et al., 1984).

The standard approach involves a two-part process. First, determine lateral velocity distribution within the injection formation at any time using solutions provided by potential flow theory. Second, integrate the time-dependent kinematic equations relating the calculated velocity distribution to the motion of the interfacial front between the waste and formation fluid.

The first step takes advantage of the well-known mathematical analogy between fluid flow in porous media and ideal potential flow of inviscid fluids. This mathematical analogy permits the determination of the velocity distribution in an injection formation directly from the previously established solution to the same problem in potential flow theory.

For waste injection at a multiple-well site, Javandel et al. (1984) gave the following potential flow expressions for the lateral components of fluid velocity in an injection formation.

$$V_x = \frac{1}{2\pi\phi b} \sum_{i=1}^{N} \frac{Q_i (x - x_i)}{(x - x_i)^2 + (y - y_i)^2} \tag{1}$$

$$Vy = \frac{1}{2\pi\phi b} \sum_{i=1}^{N} \frac{Q_i (y - y_i)}{(x - x_i)^2 + (y - y_i)^2} \tag{2}$$

Where:

v_x and v_y	=	Lateral pore velocities in the x and y horizontal coordinate directions
Qi	=	Instantaneous injection rate at time t at well i
x_i and y_i	=	Coordinates of well i
b	=	Height of the injection formation
ϕ	=	Porosity
N	=	Total number of injection wells

Equations 1 and 2 implicitly include the use of linear spatial superposition principles to generate the velocity distribution for multiple injection wells from the simpler pure radial velocity distribution for a single isolated well.

The second part of the modeling process involves the use of the velocities determined by Equations 1 and 2 to calculate the time-dependent motion of the front between the waste and formation fluid. This is accomplished mathematically by introducing a set of fictitious tracer particles around the circumference of each plume, and calculating the trajectory of these particles as time progresses (see Figure 1). A separate set of tracer particles is employed for each plume. Because the model automatically conserves mass, these tracer particles remain situated on the outer perimeter of the plume for all times.

The kinematic equations for calculating the time-dependent motions of the tracer particles are given by

$$\frac{dX_k}{dt} = v_x \left(x_k, y_k\right) \tag{3}$$

$$\frac{dY_k}{dt} = v_y\left(x_k, y_k\right) \tag{4}$$

Where:

X_k and Y_k = The horizontal spatial coordinates of a fictitious tracer particle k (k = 1....M, where M is the total number of particles around the circumference of the plume) at time t.

Substitution of Equations 1 and 2 into Equations 3 and 4 leads to a pair of coupled first order ordinary differential equations for the horizontal spatial coordinates X_k and Y_k of each tracer particle as parametric functions of time. The model integrates these equations numerically for all of the particles along the boundaries of all the plumes using a commercially available non-stiff ordinary differential equation routine. This determines the location of the particles around the circumference of each plume at any time t. The shape of the plume can then be displayed graphically by connecting the points.

6.2 Effects of Non-uniformities and Hydrodynamic Dispersion

The degree of hydrodynamic dispersion occurring in field-scale transport experiments has frequently been observed to be much greater than that measured in homogeneous porous media under laboratory conditions.[1] The cause of this phenomenon has been associated with the existence of significant heterogeneous variations in material properties within the underground geological formations, particularly of permeability.

Another important phenomenon that has been noted in the field is the dependence of the effective longitudinal dispersivity parameter (dispersivity in the direction of fluid movement) on the scale of measurement.[2] The observed dispersivity has been found to increase monotonically with distance between the injection source and the measurement receptor. This observation is inconsistent with the usual theoretical assumption employed in many transport models (Intercomp, 1976), namely, that the dispersivity is a constant.

A number of recent publications have provided greater insight into these dispersion phenomena and have reconciled many of the apparent inconsistencies.[3] By focusing attention on purely

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1 Guven et al., 1984; Fried and Combarnous, 1971; Pickens and Grisak, 1981a and 1981b.

2 Guven et al., 1984 and 1985; Anderson, 1979 and 1984; Molz et al., 1983; Domenico and Robbins, 1984; and Gillham et al., 1985; Mercado, 1984.

3 Guven et al., 1984 and 1985; Molz et al., 1983; Matheron and De Marsily, 1980; Lake and Hirasaki, 1981.

stratified geological formations in which the permeability varies strongly with vertical position but not with location laterally, these studies were able to show that at relatively small distances from the injection source, the transport behavior is dominated by advection rather than dispersion. The advection referred to here includes the effects of the vertical permeability variations which give rise to corresponding variations in the lateral velocity profile (Figure 2). These velocity variations cause a highly interfingered boundary to develop between the injected fluid and the native liquid.

When samples are then taken at a collection receptor, the time-dependent concentration variations observed are incorrectly interpreted as being caused by dispersion. In reality, they are caused by the effects of the *advective interfingering*, combined with the vertical mixing that takes place during the sampling process. The effective field-scale *pseudo-dispersivity* (sometimes called *macro-dispersivity*) deduced from this type of test is typically much larger than the dispersivity measured for homogeneous core samples in the laboratory. In the region dominated by advective interfingering, the pseudo-dispersivity determined in the field will be scale-dependent and will increase with increasing distance between the tracer source and the collection receptor.

At larger lateral distances between the source and receptor, a second transport mechanism begins to take effect (Figure 3). This mechanism is *small-scale transverse dispersion*, perpendicular to the advective concentration fingers (in the vertical direction normal to the motion). Note that until the concentration fingers have formed, this second mechanism cannot occur since the driving force for transverse dispersion is a concentration gradient in the vertical direction. The transverse dispersion mechanism acts in opposition to the advective interfingering effect by allowing solutes to transfer from the faster moving layers to the slower moving layers (fingers) and vice versa. The net effect is to reduce the rate at which the pseudo-dispersivity increases with the increasing scale of measurement, and thus the value of the pseudo-dispersivity attained at any location.

At very large lateral distances between an injection source and a measurement receptor, the interaction between the two opposing transport mechanisms approaches an equilibrium. This causes the longitudinal macro-dispersivity to no longer increase with increasing scale of measurement, and to attain a final constant field scale value. On this scale, the concentration variations at the front between the injected fluid and the native liquid will resemble the

variations caused by ordinary dispersion, rather than advection. The concentration fingers will have largely vanished.

The combination of an advective velocity variation normal to the direction of motion and small-scale transverse dispersion typically manifests itself as an apparent longitudinal dispersion phenomenon. This is analogous to the effective longitudinal dispersion behavior investigated by G. I. Taylor (1953, 1954) for flow in a tube. The effect is often referred to as "Taylor dispersion."

The implications of these findings on the lateral transport of waste in underground injection systems can be very significant. Large non-uniformities in properties within the injection stratum (mainly non-uniform permeability) can lead to a high degree of macro-dispersion at the front between the waste and the native brine. Such non-uniformities can be broken down into two broad categories - horizontal and vertical.

A variety of different forms of horizontal variation can occur, but two of the most common are:

1. Gradual changes in permeability, and
2. Sudden changes, such as a flow barrier.

If a sudden change is known to exist, its effects can be modeled directly using image well methods as previously discussed. Gradual trends have less of an influence on waste transport but are more difficult to model precisely. However, one can obtain a worst-case estimate of their effects simply by approximating these variations as equivalent sudden changes. Other types of horizontal variations that may be present can be handled through the use of the multiplying factor to provide a margin of safety in predicting an upper bound to the maximum lateral extent of the waste.

In the Gulf Coast region, the permeability may vary strongly with vertical position through the thickness of the geological formations (Figure 4). Moreover, these vertical variations appear to persist over large lateral distances. In such a system, the interface between the waste and the native brine will no longer be perfectly flat and vertical as in the ideal case of a homogeneous porous medium. Instead, it will assume a highly interfingered shape in which the advective transport mechanisms discussed previously are at work. Neglecting the mitigating influence of the small-scale transverse dispersion mechanism in limiting the horizontal extent of waste provides a conservative worst-case estimate of the lateral waste transport.

The quantitative implications of this permeability distribution are illustrated schematically in Figure 5 for the simple case of rectilinear flow. In the system shown, horizontal flow takes place within a slab of porous matrix of finite extent consisting of a series of discrete layers, each with a different permeability. The flow is driven by an applied pressure difference between the two ends of the slab. This system is analogous to an electric circuit consisting of a set of unequal resistors connected in parallel across a constant potential. The fluid flow will distribute itself among the different layers such that highest flow rates will be obtained in the layers of least resistance (highest permeability). This results in a velocity distribution across the slab that directly reflects the permeability variation:

$$\frac{v(z)}{\bar{v}} = \frac{k(z)}{\bar{k}} \tag{5}$$

Where $\bar{v}$ and $\bar{k}$ are the horizontal velocity and permeability averaged over the thickness of the slab, and v(z) and k(z) are the local values at vertical position z.

According to Equation 5, velocity variations are determined not by the magnitude of the permeability, but by the variations in permeability relative to the average. This represents an important difference between a model used for calculating transport in a stratified geological system (such as the present Basic Plume Model) and a model used for calculating the pressure distribution (such as the Multi-layer Pressure Model), in which the response is determined primarily by the vertically-averaged permeability.

The results expressed in Equation 5 are valid, not just for the simple case of rectilinear flow, but for all geological arrangements in which permeability varies solely with vertical position through the formation. Therefore, these results can be applied directly to predict waste transport within any vertically-stratified multiple-well injection system. For example, to calculate the location of the interface between the waste and native brine in the fastest moving layer of waste, the average velocities determined in the Basic Plume Model are simply multiplied by the ratio of the maximum layer permeability to the vertically-averaged permeability. This is done most conveniently by scaling the injection rates input to all the wells in the model by this same ratio. Since the equations for the velocities are linear in the injection rates (see Equations 1 and 2), the procedure will automatically deliver the required velocity distribution for the fastest moving layer. When the model is run with this modification to the input data, it will output the time-

dependent advance of the fastest moving layer of waste. Of course, only a small fraction of the total waste will actually travel this far.

6.3 Improved Numerical Procedures

A numerical difficulty sometimes experienced with "particle tracking" models like the Basic Plume Model is related to the tangential motion of the fictitious tracer particles along the boundary between the waste and formation brine. Although the particles are initially placed uniformly around the plume perimeter, they will tend to slide along the interface and accumulate in a limited portion of the front as the solution evolves. This leaves the coverage in some parts of the perimeter very sparse and causes a loss of resolution in displaying the plume boundary graphically. There is no loss of accuracy in the solution, only in the graphical display. This difficulty arises when two injection wells are situated relatively close to one another, so that the tracer particles in the "stagnation zone" between the wells are driven out of the region and forced toward the opposite sides of the plumes.

A novel approach has been developed in the Basic Plume Model to overcome these difficulties. This approach automatically requires that the tracer particles remain uniformly spaced around the perimeter of the plume for all times.

The new technique recognizes that the velocity of any tracer particle on the plume boundary can be resolved into two components, one perpendicular to the boundary and one tangential. Only the component perpendicular to the boundary is actually responsible for the observed advance of the plume. The tangential component merely causes the particles to slide along the perimeter like rings on a shower rod. Therefore, the tangential velocity components of the particles can be modified in any arbitrary manner without affecting the predicted shape and movement of the plume boundary. This forms the basis for the new computational approach to achieving high display resolution on the perimeter shape.

The objective of this derivation is to identify a modified velocity distribution (along the boundary of the plumes) capable of correctly predicting the time-dependent evolution of the boundary shapes, while continually maintaining the tracer particles at a uniform spacing around the perimeter. This is accomplished by defining a modified velocity variation $\underline{V}$ (underbars are used here to denote vectors) in the following form:

$$\underline{V} = \underline{v} + v * \underline{\tau} \tag{6}$$

Where:

$\underline{v}$	=	Actual velocity of fluid movement determined from Equations 1 and 2
$\underline{\tau}$	=	Unit tangent vector to the plume boundary at each location
v*	=	Magnitude of an as yet undetermined alteration mathematically imposed on the tangential velocity

From the previous discussion it follows that if all the fictitious tracer particles move with this modified velocity variation, they will automatically remain situated on the plume boundary for all times and properly trace out the time-dependent motion of the perimeter. The problem then reduces to one of determining the variation in altered tangential velocity parameter v* such that the spacing between the particles always remains uniform.

Assume that at time zero, when a well first begins injecting waste, particles are placed uniformly around the circumference of the injection well. Let θ denote the initial angular location of each particle with respect to the x coordinate direction. In the present development the parameter θ shall be used as a particle label or material coordinate to help keep track of the trajectories of the individual particles as they pass through space. The spatial coordinates of any particle X and Y can be expressed parametrically as a function of the initial angle θ and time t as follows:

$$X = X(\theta, t)$$

$$Y = Y(\theta, t)$$

Next, denote dl as the differential arc length between two neighboring tracer particles along the plume boundary at time t. The material coordinates of the two tracer particles are q and q + dθ, and the length of the differential arc is given by:

$$dl = \sqrt{(X')^2 + (Y')^2}\ d\theta \tag{7}$$

Where:

$$X' = \frac{\partial X(\theta, t)}{\partial \theta} \tag{8}$$

And:

$$Y' = \frac{\partial Y(\theta, t)}{\partial \theta} \tag{9}$$

The rate at which this arc is growing in length (stretching) with respect to time is obtained by taking the time derivative of Equation 7. This yields:

$$\frac{dl}{dt} = \frac{X'V'_x + Y'V'_y}{\sqrt{\left((X')^2 + (Y')^2\right)}} d\theta \tag{10}$$

Where V_x and V_y are the components of the modified velocity vector $\underline{V}$ defined in Equation 6, and where use has been made here of the fundamental kinematic conditions that:

$$V_x = \frac{\partial X(\theta, t)}{\partial t}$$

And:

$$V_y = \frac{\partial Y(\theta, t)}{\partial t}$$

The rate of stretching of the entire circumference of the plume, denoted C, is obtained by adding together the contributions of the individual differential elements of arc to yield:

$$\frac{dC}{dt} = \int_0^{2\pi} \frac{X'V'_x + Y'V'_y}{\sqrt{(X')^2 + (Y')^2}} d\theta \tag{11}$$

In order for the tracer particles to remain uniformly distributed around the circumference, the local rate of stretching of the differential arc length at any arbitrary location along the plume perimeter (per unit initial angle dθ) must match the average stretch rate existing over the entire circumference.

This requires that:

$$\frac{X'V'_x + Y'V'_y}{\sqrt{(X')^2 + (Y')^2}} = \frac{1}{2\pi}\int_0^{2\pi} \frac{X'V'_x + Y'V'_y}{\sqrt{(X')^2 + (Y')^2}}\, d\theta \tag{12}$$

If Equation 6 for the modified velocity variation $\underline{V}$ is next expressed in component form, one obtains:

$$V_x = v_x \frac{v^* X'}{\sqrt{(X')^2 + (Y')^2}} \tag{13}$$

$$V_y = v_y \frac{v^* Y'}{\sqrt{(X')^2 + (Y')^2}} \tag{14}$$

Where use has been made here of the fact that the components of the unit tangent vector $\underline{\tau}$ are given by:

$$\tau_x = \frac{X'}{\sqrt{(X')^2 + (Y')^2}}$$

$$\tau_y = \frac{Y'}{\sqrt{(X')^2 + (Y')^2}}$$

Substituting Equations 13 and 14 into Equation 12, and performing some straightforward mathematical manipulations yields:

$$\frac{dv^*}{d\theta} = \frac{1}{2\pi}\int_0^{2\pi} \frac{X'v'_x + Y'v'_y}{\sqrt{\left((X')^2 + (Y')^2\right)}}\, d\theta - \frac{X'v'_x + Y'v'_y}{\sqrt{\left((X')^2 + (Y')^2\right)}} \tag{15}$$

Equation 15 provides the desired relationship for determining alterations to the tangential velocity along the plume v* required for the tracer particles to remain uniformly spaced at all times. It expresses this velocity alteration in terms of the actual fluid velocity components v_x and v_y, and the local spatial derivatives of the plume shape. This velocity variation is not unique,

since Equation 15 gives only the derivative of v*, rather than v* itself. As a result, the tangential velocity change is determined only up to an arbitrary constant of integration (v* at θ = 0).

The required condition of equal spacing for the tracer particles will always be satisfied using Equation 15, irrespective of the choice for the integration constant. However, the average speed at which the equally spaced tracer particles move around the plume boundary will depend on the value selected. To establish uniqueness, it is reasonable to require that this average tangential speed be set equal to zero. This will prevent the particles from moving around the circumference of the plume like cars on a race track.

The average tangential speed will equal zero whenever the following condition is satisfied:

$$\int_0^{2\pi} \left(V_x\, X' + V_y\, Y'\right) d\theta = 0 \tag{16}$$

If Equations 13 and 14 for the components of the modified velocity vector $\underline{V}$ are substituted into Equation 16, one obtains:

$$\int_0^{2\pi} v^* \sqrt{\left(X'\right)^2 + \left(Y'\right)^2}\; d\theta = 0 \tag{17}$$

Where use has been made here of the condition that for potential flow, the integral in Equation 16 is identically zero (the flow is irrotational).

Equations 15 and 17 provide the required relationships in the Basic Plume Model for uniquely determining the tangential velocity parameter v*. Equation 17 is equivalent to specification of the constant of integration in Equation 15, or equivalently, the initial v* value at θ = 0.

Both Equation 15 and Equation 17 can be simplified somewhat by recognizing that, since the tracer particles remain equally spaced around the plume boundaries at all times, the quantity

$$\sqrt{\left(X'\right)^2 + \left(Y'\right)^2}$$

will be a constant, independent of location on the perimeter (independent of θ). Therefore, this radical can be factored out of the integrals in Equations 15 and 17, to yield:

$$C\frac{dv*}{d\theta}=\int_0^{2\pi}\left(X'v'_x+Y'v'_y\right)d\theta-2\pi\left(X'v'_x+Y'v'_y\right) \tag{18}$$

$$\int_0^{2\pi} v*d\theta=0 \tag{19}$$

Where C is the circumference of the plume, defined as:

$$C=\int_0^{2\pi}\sqrt{(X')^2+(Y')^2}\,d\theta \tag{20}$$

Similarly, Equations 13 and 14 become:

$$V_x=v_x+\frac{2\pi\, v*X'}{C} \tag{21}$$

$$V_y=v_y+\frac{2\pi v*Y'}{C} \tag{22}$$

Equations 18 through 22 are the relationships employed in the Basic Plume Model to obtain a uniform distribution of tracer particles and correspondingly high plotting resolution on the plume shapes.

7.0 VERIFICATION

The computer program used to solve model equations has been verified against a variety of analytic and numerical solutions in the literature and by independent numerical tests to guarantee that it delivers correct and accurate results.

The single-well capabilities of the model were first compared with the analytic solution to the case of a homogeneous isotropic injection stratum. This analytical solution is given by the well-known equation:

$$r = \sqrt{\frac{V}{\pi \phi b}} \tag{23}$$

Where r is the radial distance from the well to the leading edge of the waste plume at any time, and V is the total volume of waste injected. The numerical model accurately duplicated this result to within 0.01 percent in all cases tested, irrespective of the injection rate history imposed.

To evaluate the ability of the computer program to accurately describe the behavior of multiple-well injection sites, calculations were performed on a system featuring two wells - an injection well and a nearby withdrawal well. The objective of the calculation was to predict the time-dependent movement of a waste front away from the injection well, and the time for the waste plume to exhibit "break-through" at the withdrawal well. This system was solved analytically by Muskat (1946), and numerically by Collins (1961) and Javandel et al. (1984). Collins considered the general case, in which the variables are expressed in dimensionless form, while Javandel et al. performed calculations for a specific field example. Muskat derived the following analytical expression for calculating the time at break-through:

$$t = \frac{\pi \phi d^2 b}{3Q} \tag{24}$$

Where d is the distance between the wells and Q is the injection rate.

The specific field arrangement analyzed by Javandel et al. (1984) is shown in Figure 6. They assumed an injection rate of 50 m^3/h at Well A, and an equal withdrawal rate at Well B. The height of the formation was 10 m, and the porosity was 25 percent ($\theta = 0.25$). Figure 7 shows a comparison between the results obtained by Javandel et al. (1984) and those from the Basic

Plume Model. The agreement is excellent. The calculated break-through time using the Basic Plume Model was 4.30 years, which is identical to the value obtained by Javandel et al. (1984) and virtually indistinguishable from the analytic result.

The novel numerical technique developed for obtaining high plotting resolution on the shape of the waste plumes was tested by comparing results obtained with this procedure for complex multiple-well injection sites against corresponding calculations carried out using the standard approach. In all cases, the plots were superimposable. The new approach, however, provided much higher resolution in the critical regions near stagnation points.

Another test of the new high resolution version of the Basic Plume Model was to compare the calculated shapes of waste plumes for wells located adjacent to one another. The new numerical technique calculates each waste plume separately and uses the spatial derivatives of the individual boundary shapes over all positions on the plume perimeters to determine the motions of the tracer particles. In those specific cases where virtually all the formation fluid is squeezed out from between the plumes, the shapes of the plume boundaries should closely match one another. This condition has been found to prevail in all situations tested, to such an extent that the plumes fit together like pieces of a jigsaw puzzle.

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FIGURES

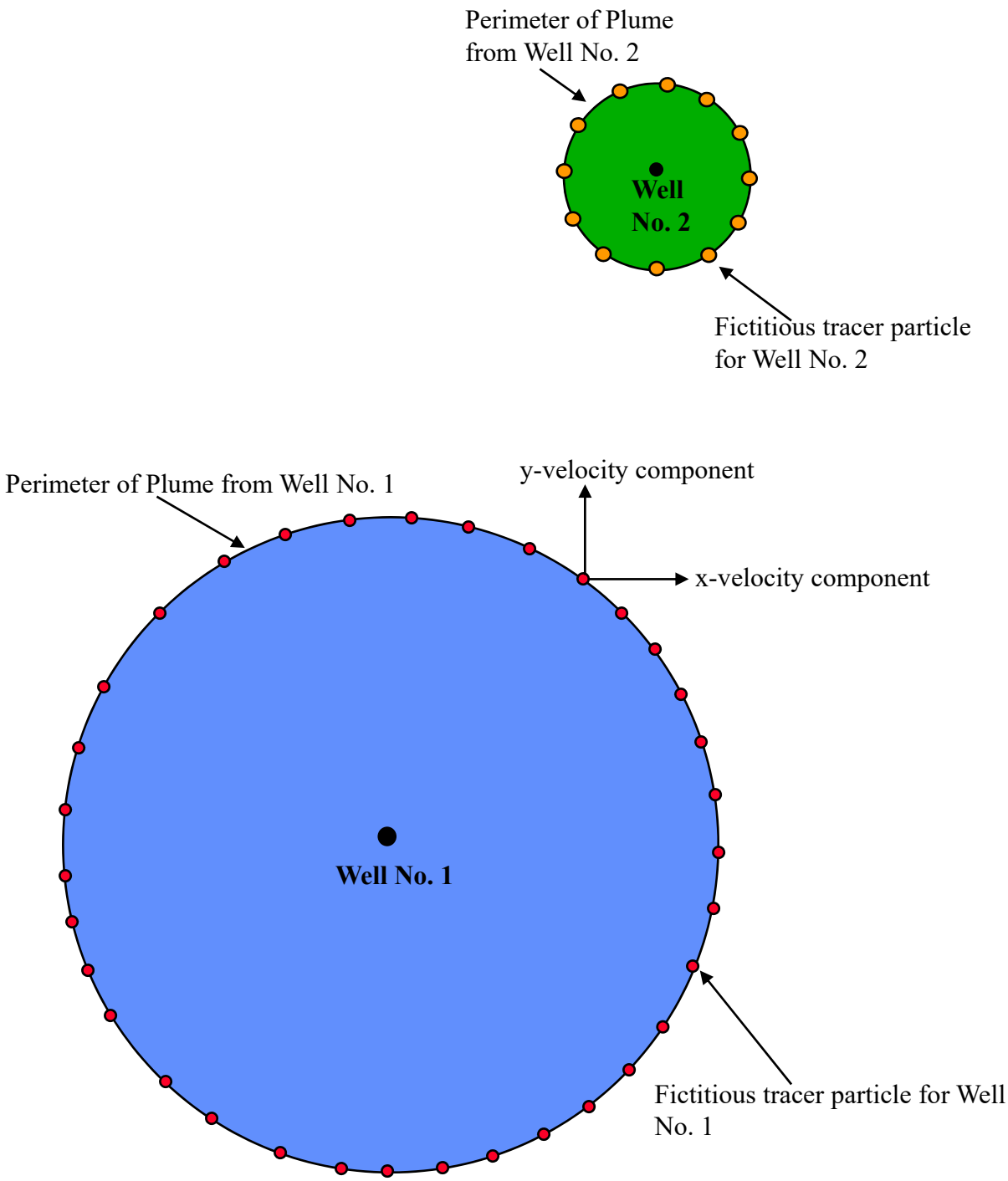

Figure 1
Model Calculation of Fictitious Tracer Particles Around the Perimeters of the Waste Plumes

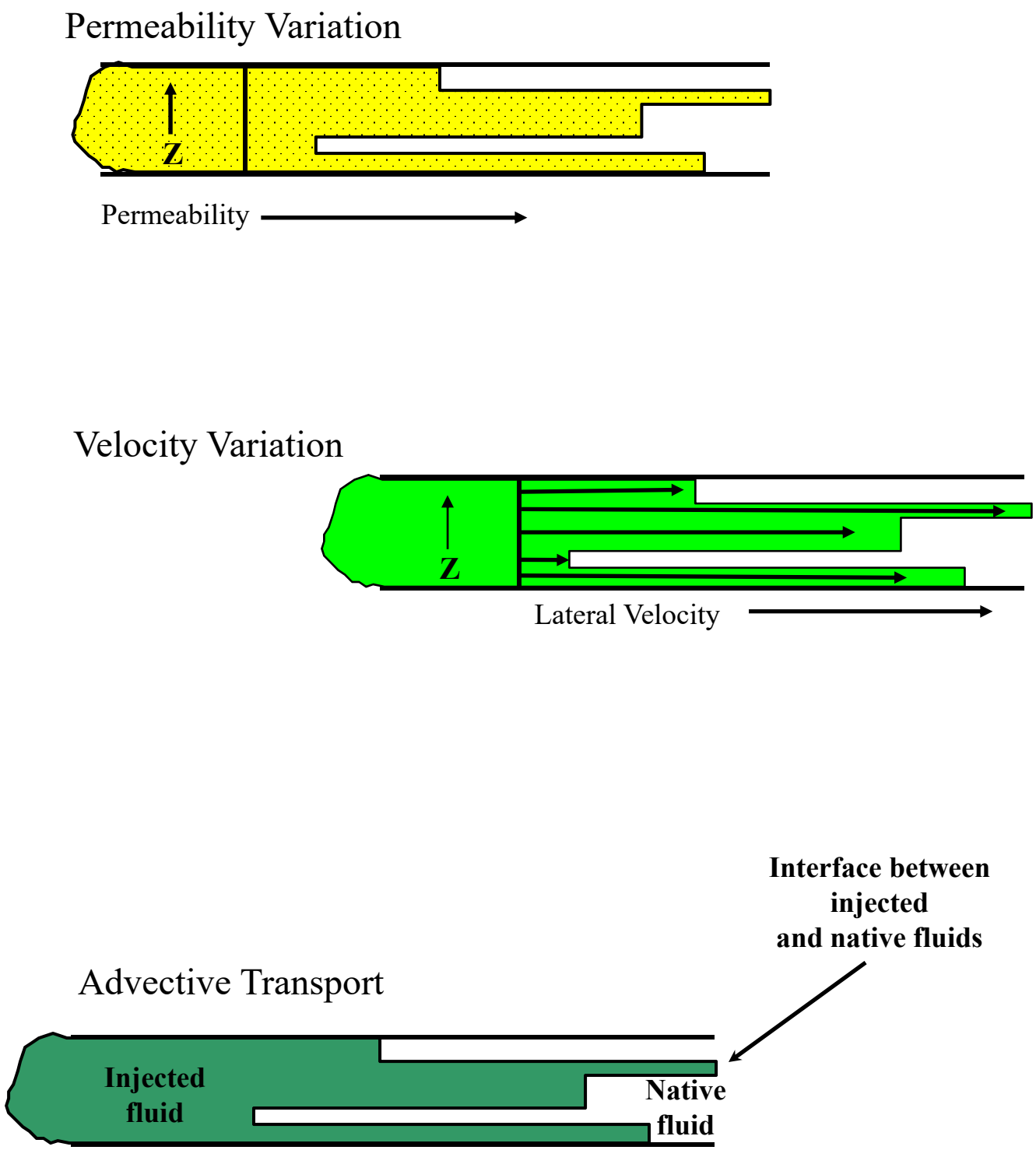

Figure 2
Effect of Stratified Permeability Variations on Lateral Transport

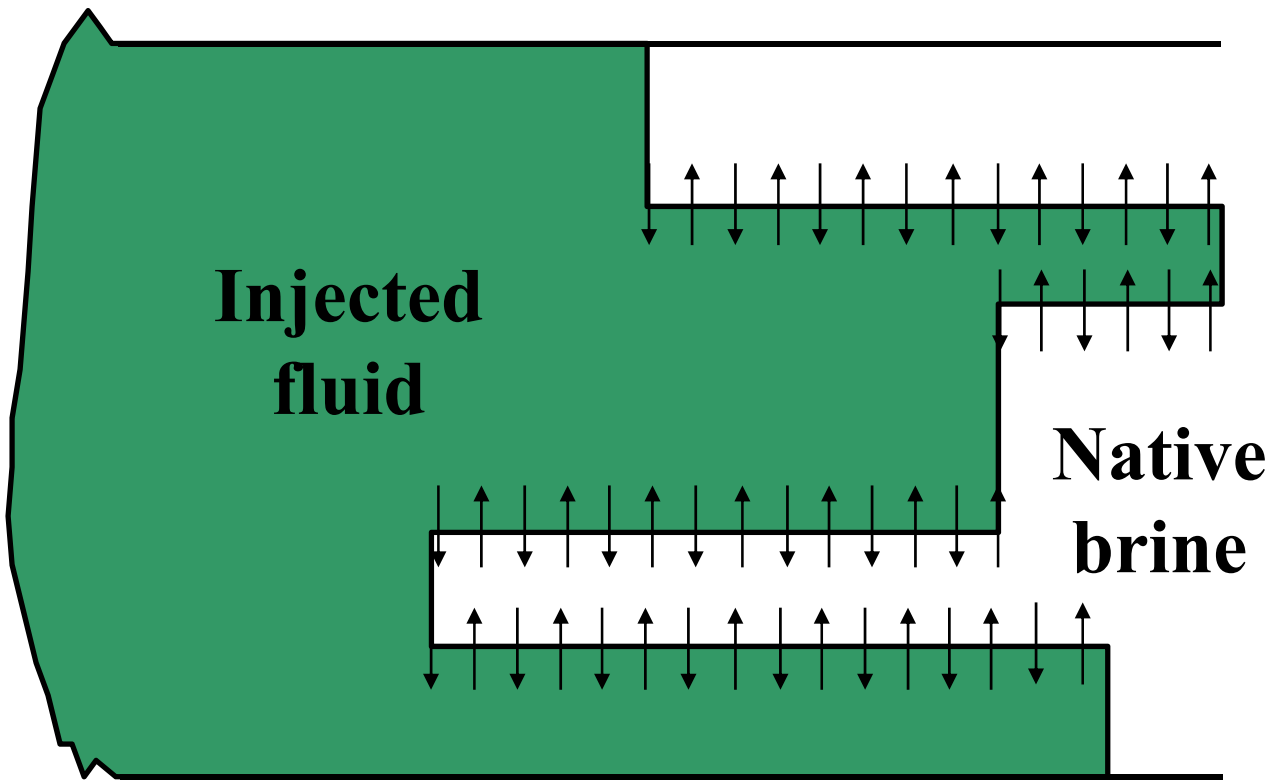

Figure 3
Small-scale Transverse Dispersion Perpendicular to Concentration Fingers

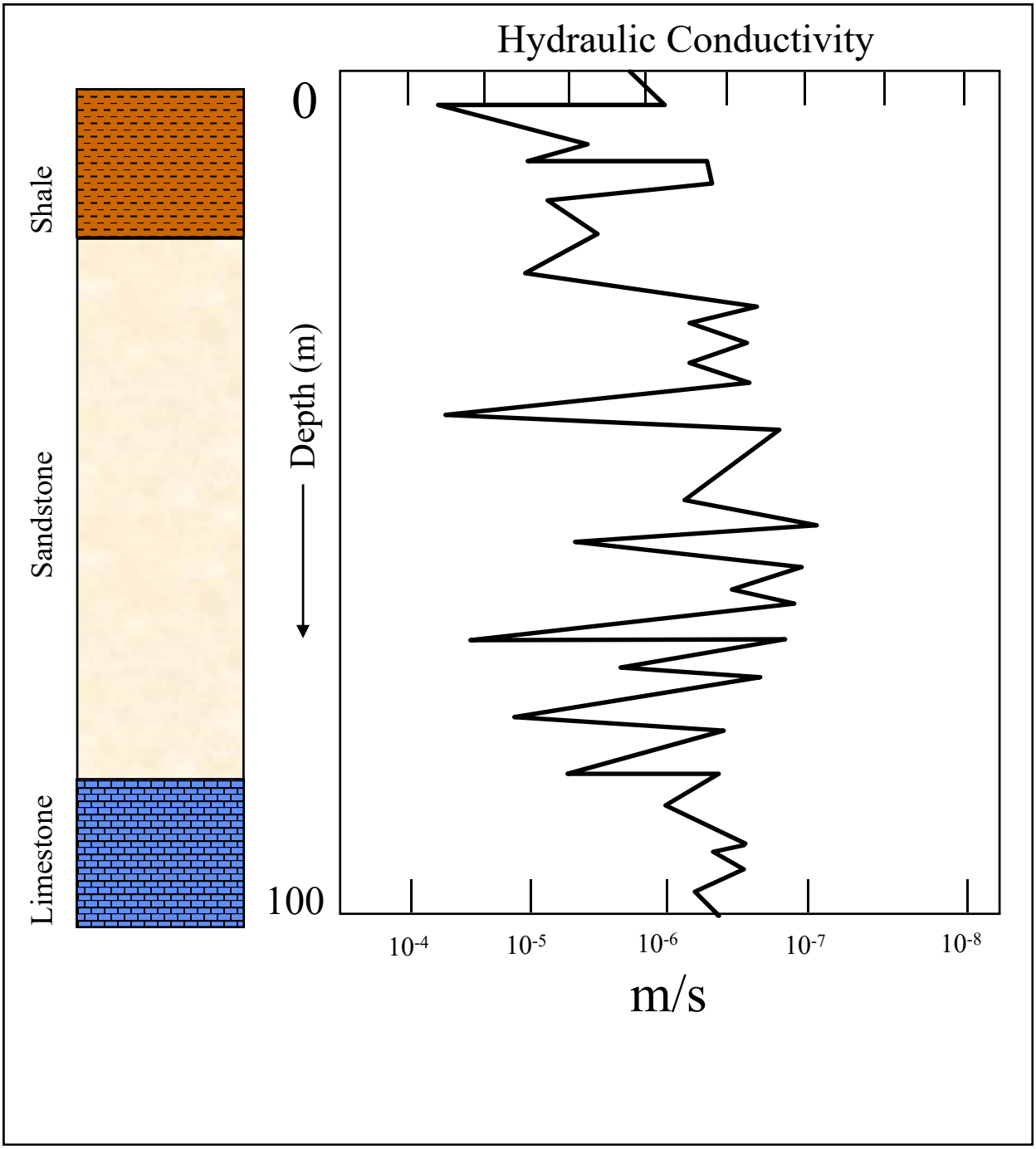

Figure 4
Typical Permeability Variation through the Thickness of a Geological Formation (Freeze and Cherry, 1979). Permeability is Expressed in Terms of Hydraulic Conductivity

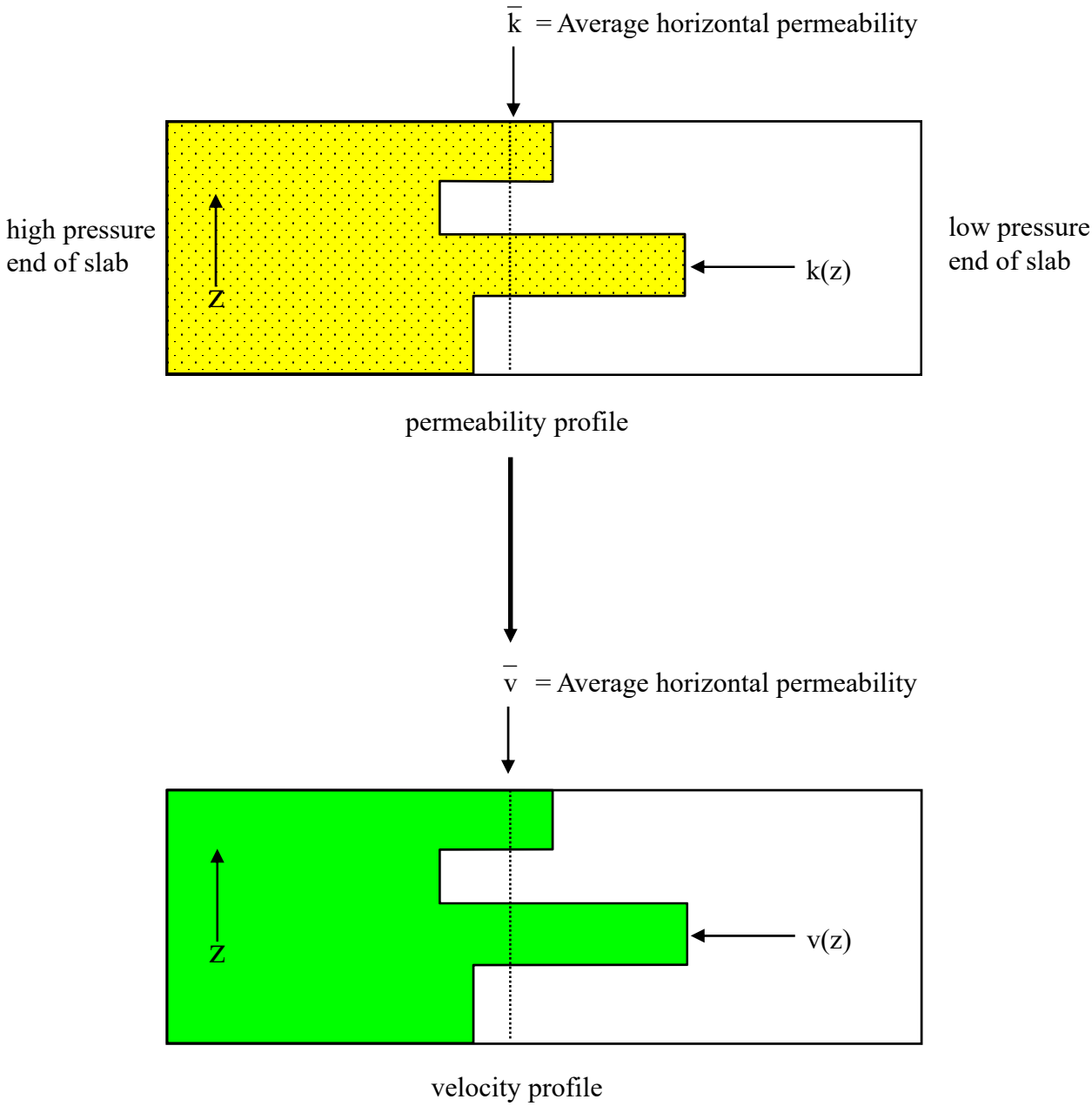

Figure 5
Effect of Stratified Permeability Distribution of Velocity Profile for Rectilinear Flow through a Porous Slab

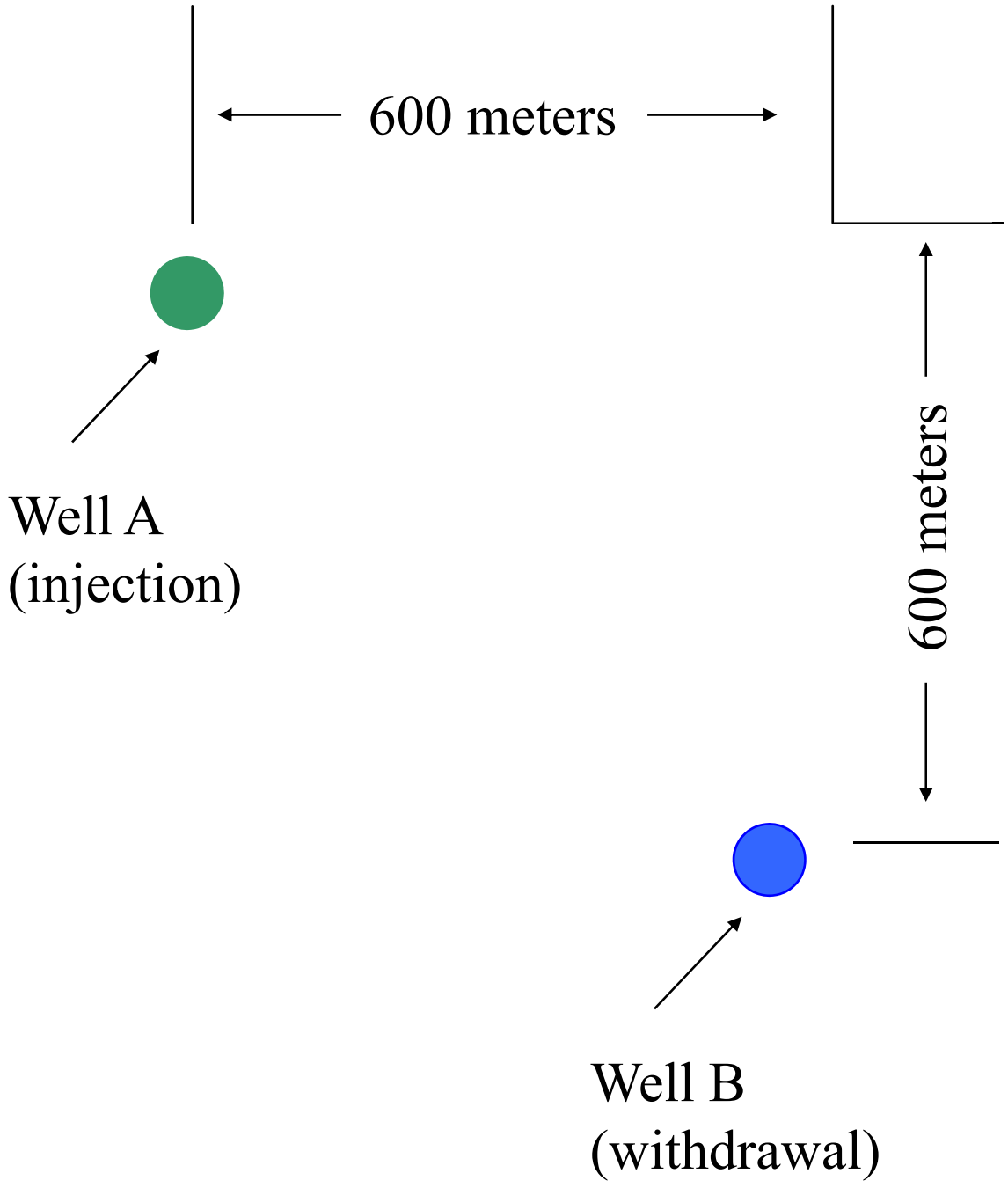

Figure 6
Field Arrangement Analyzed by Javandel et. al., 1984

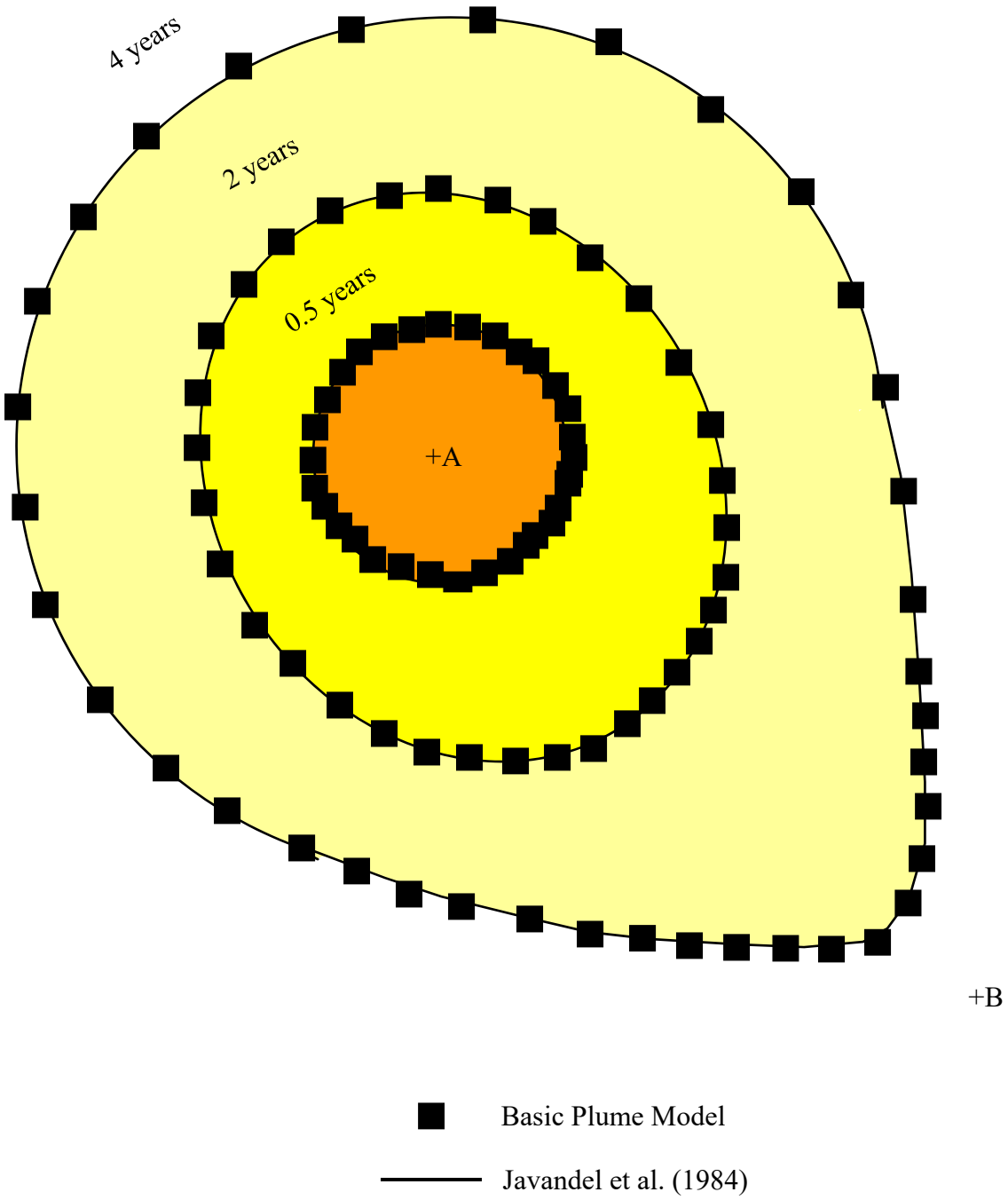

Figure 7
Comparison of Predicted Plume Shapes at Various Times for the Basic Plume Model and Results of Javandel et. al., 1984

ATTACHMENT 3

ATTACHMENT 3
DUPONT MULTILAYER PRESSURE MODEL
COMPUTER RUN AND OUTPUT FILES

ATTACHMENT 3
DUPONT MULTILAYER PRESSURE MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
INPUT FILE - PRYOR_FLOW_2028.RCV

```
TITLE    PRYOR CHEMICALS FLOWING MODEL 2028
YEAR   59.      30.              TINJ, TPC
 4     -1    04 04               NLEV, NINJ, & INJECTION LEVELS
 0                               NSKIP & SKIPPED LEVELS
NOFAULT                          FAULT CALCULATED
PCNT                             CALCULATE DATA FOR PRESSURE CONTOUR PLOTS
8.                               RANGE FOR GRID (MI)
2     47      59                 NCNTTP, & CONTOUR TIME PERIODS
    300.    .135  1.E-15    1.00  6.89E-05  SHALE LAYER 1
     10.     .10    .100    1.00  5.00E-07  SAND LAYER 2
     50.    .135  1.E-15    1.00  6.89E-05  WOODFORD SHALE LAYER 3
     30.     .10   3.150    1.00  5.00E-07  ARBUCKLE LAYER 4
1   INJECTION WELL
    1        0.        0.
5   MONITOR LOCATIONS
    1        0.      100.
    2        0.      500.
    3        0.     1117.
    4        0.     5000.
    5        0.    10000.
1970  95.1
     04-04
1971  95.1
     04-04
1972  95.1
     04-04
1973  95.1
     04-04
1974  95.1
     04-04
1975  95.1
     04-04
1976  95.1
     04-04
1977  95.1
     04-04
1978  95.1
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1979  95.1
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1980  95.1
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1981  95.1
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     04-04
1984  95.1
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1985  95.1
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1986  95.1
     04-04
1987  95.1
     04-04
1988  95.1
     04-04
1989  95.1
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1990  95.1
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     04-04
1993 158.8
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1994 158.8
     04-04
1995 158.8
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1996 158.8
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1998 158.8
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1999 158.8
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2000  95.1
     04-04
2001  95.1
     04-04
2002   7.0
     04-04
2003   6.7
     04-04
2004   6.2
     04-04
2005   5.5
     04-04
2006   4.8
     04-04
2007   3.6
     04-04
2008   4.4
     04-04
2009  23.4
     04-04
2010  77.9
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2011 123.5
     04-04
2012 114.1
     04-04
2013 119.6
     04-04
2014 117.3
     04-04
2015 102.9
```

```
     04-04
2016  106.8
     04-04
2017  175.0
     04-04
```

ATTACHMENT 3
DUPONT MULTILAYER PRESSURE MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM (175 GPM)
INPUT FILE – PRYOR_FLOW_2028.PRM

```
      PARAMETER (NLEV=4)
C     NLEV IS THE TOTAL NUMBER OF LAYERS (AQUIFER+CONFINING)
C     NLEV MUST = NLEVEL READ FROM INPUT FILE
C
      PARAMETER (MXWELL=1)
C     MXWELL IS THE NUMBER OF INJECTION WELLS TO BE CALCULATED
C     MXWELL MUST = NWELL READ FROM INPUT FILE
C
      PARAMETER (MXINJ=1)
C     MXINJ IS THE NUMBER OF INJECTION LEVELS TO BE INCLUDED
C     MXINJ MUST = NINJ READ FROM INPUT FILE
C
      PARAMETER (MXTM=100)
C     MXTM IS THE MAXIMUM ALLOWABLE NUMBER OF TIME PERIODS FOR CALC
C     MXTM MUST BE >= NUMBER OF TIME PERIODS FROM INPUT FILE
C
      PARAMETER (MXMON=10)
C     MXMON IS THE MAXIMUM ALLOWABLE NUMBER OF MONITOR COORDIATES
C     MXMON MUST BE >= NMON READ FORM INPUT FILE
C
      PARAMETER (MXMONC=10)
C     MXMONC IS THE MAXIMUM NUMBER OF MONITOR COORDIATES
C       TO WILL BE CALCULATED
C     MXMONC MUST BE >= THE NUMBER OF UNSTARRED MONITOR COORD
C       READ FORM INPUT FILE
C
      PARAMETER (NTPSCL=60)
C     NTPSCL IS THE NUMBER OF TIME PERIODS INTO THE INJECTION HISTORY
C     WHICH WILL BE USED BEFORE CHANGING TO A MORE COARSE TIME SCALE (10
C     NTPSCL SHOULD BE AS LARGE AS POSSIBLE WITHOUT EXAUSTING THE
C     AVAILABLE MEMORY.  VALUES DOWN TO ABOUT 40 SHOULD WORK.
C
      PARAMETER (NTPTEN=70)
C     NTPTEN IS THE MAXIMUM NUMBER OF COARSE TIME PERIODS ALLOWED
C     THE VALUE OF NTPSCL+10*NTPTEN MUST BE >= NUMBER OF TIME
C     PERIODS FROM INPUT FILE
C
```

```
      PARAMETER (MXCTP=4)
C     MXCTP IS THE MAXIMUM NUMBER OF TIME PERIODS THAT CAN BE SPECIFIED
C     FOR OUTPUT INTO THE (.PCNT) FILE FOR PRESSURE CONTOUR PLOTS
```

ATTACHMENT 3
DUPONT MULTILAYER PRESSURE MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
OUTPUT FILE - PRYOR_FLOW_2028.PMON

```
* * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *
 YEAR     1    5   89

 PRESSURES AT MONITOR COORDINATES FOR FORMATION LEVEL  4
 ---- ARBUCKLE LAYER 4                ----         0.0
```

		(1)	(2)	(3)	(4)	(5)
1	1970	35.6	27.7	23.7	16.4	13.0
2	1971	37.3	29.4	25.4	18.1	14.7
3	1972	38.2	30.4	26.4	19.1	15.7
4	1973	38.9	31.1	27.1	19.8	16.4
5	1974	39.5	31.6	27.7	20.3	17.0
6	1975	39.9	32.1	28.1	20.8	17.4
7	1976	40.3	32.4	28.5	21.2	17.8
8	1977	40.6	32.8	28.8	21.5	18.1
9	1978	40.9	33.1	29.1	21.8	18.4
10	1979	41.2	33.3	29.4	22.0	18.7
11	1980	41.4	33.5	29.6	22.3	18.9
12	1981	41.6	33.8	29.8	22.5	19.1
13	1982	41.8	34.0	30.0	22.7	19.3
14	1983	42.0	34.1	30.2	22.9	19.5
15	1984	42.2	34.3	30.4	23.0	19.6
16	1985	42.3	34.5	30.5	23.2	19.8
17	1986	42.5	34.6	30.7	23.3	19.9
18	1987	42.6	34.8	30.8	23.5	20.1
19	1988	42.8	34.9	30.9	23.6	20.2
20	1989	42.9	35.0	31.1	23.7	20.3
21	1990	43.0	35.1	31.2	23.9	20.5
22	1991	43.1	35.2	31.3	24.0	20.6
23	1992	43.2	35.4	31.4	24.1	20.7
24	1993	67.1	54.0	47.4	35.2	29.5
25	1994	68.4	55.2	48.7	36.4	30.8
26	1995	69.1	56.0	49.4	37.2	31.5
27	1996	69.7	56.6	50.0	37.7	32.1
28	1997	70.2	57.0	50.4	38.2	32.5
29	1998	70.5	57.4	50.8	38.6	32.9
30	1999	70.9	57.7	51.2	38.9	33.2
31	2000	47.4	39.5	35.6	28.2	24.8

32	2001	46.5	38.6	34.7	27.4	24.0
33	2002	13.1	12.6	12.3	11.7	11.5
34	2003	11.2	10.7	10.4	9.9	9.6
35	2004	10.0	9.4	9.2	8.7	8.5
36	2005	8.9	8.5	8.2	7.8	7.6
37	2006	8.1	7.7	7.5	7.1	6.9
38	2007	7.2	6.9	6.7	6.4	6.3
39	2008	7.0	6.7	6.5	6.2	6.0
40	2009	13.8	11.9	10.9	9.1	8.3
41	2010	34.3	27.8	24.6	18.6	15.8
42	2011	52.2	42.0	36.9	27.4	23.0
43	2012	50.0	40.6	35.9	27.1	23.0
44	2013	52.7	42.8	37.9	28.6	24.4
45	2014	52.4	42.7	37.9	28.8	24.6
46	2015	47.4	38.9	34.6	26.7	23.0
47	2016	48.9	40.1	35.7	27.4	23.6
48	2017	74.6	60.1	52.9	39.4	33.2
49	2018	76.0	61.5	54.3	40.8	34.5
50	2019	76.9	62.4	55.1	41.6	35.4
51	2020	77.5	63.0	55.8	42.3	36.0
52	2021	78.0	63.5	56.3	42.8	36.6
53	2022	78.5	64.0	56.7	43.2	37.0
54	2023	78.8	64.4	57.1	43.6	37.4
55	2024	79.2	64.7	57.4	43.9	37.7
56	2025	79.5	65.0	57.7	44.3	38.0
57	2026	79.8	65.3	58.0	44.5	38.3
58	2027	80.0	65.5	58.3	44.8	38.5
59	2028	80.2	65.7	58.5	45.0	38.8
60	PC 1	15.0	15.0	15.0	15.0	15.0
61	PC 2	12.1	12.1	12.1	12.1	12.1
62	PC 3	10.5	10.5	10.5	10.5	10.5
63	PC 4	9.4	9.4	9.4	9.4	9.3
64	PC 5	8.5	8.5	8.5	8.5	8.5
65	PC 6	7.9	7.9	7.9	7.9	7.9
66	PC 7	7.3	7.3	7.3	7.3	7.3
67	PC 8	6.9	6.9	6.9	6.9	6.9
68	PC 9	6.5	6.5	6.5	6.5	6.5

69	PC10	6.1	6.1	6.1	6.1	6.1
70	PC11	5.8	5.8	5.8	5.8	5.8
71	PC12	5.6	5.6	5.6	5.6	5.6
72	PC13	5.3	5.3	5.3	5.3	5.3
73	PC14	5.1	5.1	5.1	5.1	5.1
74	PC15	4.9	4.9	4.9	4.9	4.9
75	PC16	4.7	4.7	4.7	4.7	4.7
76	PC17	4.6	4.6	4.6	4.6	4.6
77	PC18	4.4	4.4	4.4	4.4	4.4
78	PC19	4.3	4.3	4.3	4.3	4.3
79	PC20	4.1	4.1	4.1	4.1	4.1
80	PC21	4.0	4.0	4.0	4.0	4.0
81	PC22	3.9	3.9	3.9	3.9	3.9
82	PC23	3.8	3.8	3.8	3.8	3.8
83	PC24	3.7	3.7	3.7	3.7	3.7
84	PC25	3.6	3.6	3.6	3.6	3.6
85	PC26	3.5	3.5	3.5	3.5	3.5
86	PC27	3.4	3.4	3.4	3.4	3.4
87	PC28	3.3	3.3	3.3	3.3	3.3
88	PC29	3.2	3.2	3.2	3.2	3.2
89	PC30	3.1	3.1	3.1	3.1	3.1

INPUT PARAMETERS

THK	PHI	PERM	VISC	COMP	
300.00	0.135	.100E-14	1.00	6.890E-05	SHALE LAYER 1
10.00	0.100	.100	1.00	5.000E-07	SAND LAYER 2
50.00	0.135	.100E-14	1.00	6.890E-05	WOODFORD SHALE LAYER 3
30.00	0.100	3.15	1.00	5.000E-07	ARBUCKLE LAYER 4

ATTACHMENT 3
DUPONT MULTILAYER PRESSURE MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
PLOT FILE - PRYOR_FLOW_2028.PCNT

```
1  INJECTION WELLS
       1       0.0       0.0
  5  MONITOR COORDINATES
       1       0.0     100.0
       2       0.0     500.0
       3       0.0    1117.0
       4       0.0    5000.0
       5       0.0   10000.0
  2 YEAR  CONTOUR PERIODS
 47 2016 59 2028
  1  ACTIVE INJECTION LEVELS
    1   25   25     ARBUCKLE LAYER 4
  -47240.0  -27419.2  -15914.7   -9237.3   -5361.5   -3111.9   -1806.2   -1048.4
    -608.5    -353.2    -205.0     -50.0       0.5      50.0     205.0     353.2
     608.5    1048.4    1806.2    3111.9    5361.5    9237.3   15914.7   27419.2
   47240.0
  -47240.0  -27419.2  -15914.7   -9237.3   -5361.5   -3111.9   -1806.2   -1048.4
    -608.5    -353.2    -205.0     -50.0       0.5      50.0     205.0     353.2
     608.5    1048.4    1806.2    3111.9    5361.5    9237.3   15914.7   27419.2
   47240.0
     1     1
    13.215    14.315    14.815    15.006    15.073    15.096    15.104    15.107
    15.108    15.108    15.108    15.108    15.108    15.108    15.108    15.108
    15.108    15.107    15.104    15.096    15.073    15.006    14.815    14.315
    13.215    14.315    16.186    17.293    17.794    17.986    18.054    18.077
    18.085    18.088    18.088    18.089    18.089    18.089    18.089    18.089
    18.088    18.088    18.085    18.077    18.054    17.986    17.794    17.293
    16.186    14.315    14.815    17.293    19.174    20.279    20.782    20.974
    21.042    21.065    21.073    21.076    21.077    21.077    21.077    21.077
    21.077    21.076    21.073    21.065    21.042    20.974    20.782    20.279
    19.174    17.293    14.815    15.006    17.794    20.279    22.162    23.269
    23.771    23.963    24.031    24.054    24.062    24.065    24.066    24.066
    24.066    24.065    24.062    24.054    24.031    23.963    23.771    23.269
    22.162    20.279    17.794    15.006    15.073    17.986    20.782    23.269
    25.151    26.258    26.761    26.953    27.021    27.044    27.052    27.056
    27.056    27.056    27.052    27.044    27.021    26.953    26.761    26.258
```

Pressure in Arbuckle Dolomite at Year-End 2028 (File Name: pryor_flow_2028.pcnt)

25.151	23.269	20.782	17.986	15.073	15.096	18.054	20.974
23.771	26.258	28.141	29.248	29.751	29.943	30.011	30.034
30.045	30.046	30.045	30.034	30.011	29.943	29.751	29.248
28.141	26.258	23.771	20.974	18.054	15.096	15.104	18.077
21.042	23.963	26.761	29.248	31.131	32.238	32.741	32.933
33.001	33.034	33.036	33.034	33.001	32.933	32.741	32.238
31.131	29.248	26.761	23.963	21.042	18.077	15.104	15.107
18.085	21.065	24.031	26.953	29.751	32.238	34.121	35.228
35.731	35.923	36.020	36.026	36.020	35.923	35.731	35.228
34.121	32.238	29.751	26.953	24.031	21.065	18.085	15.107
15.108	18.088	21.073	24.054	27.021	29.943	32.741	35.228
37.111	38.218	38.721	38.998	39.016	38.998	38.721	38.218
37.111	35.228	32.741	29.943	27.021	24.054	21.073	18.088
15.108	15.108	18.088	21.076	24.062	27.044	30.011	32.933
35.731	38.218	40.101	41.208	41.952	42.006	41.952	41.208
40.101	38.218	35.731	32.933	30.011	27.044	24.062	21.076
18.088	15.108	15.108	18.089	21.077	24.065	27.052	30.034
33.001	35.923	38.721	41.208	43.091	44.837	44.996	44.837
43.091	41.208	38.721	35.923	33.001	30.034	27.052	24.065
21.077	18.089	15.108	15.108	18.089	21.077	24.066	27.056
30.045	33.034	36.020	38.998	41.952	44.837	50.847	52.751
50.847	44.837	41.952	38.998	36.020	33.034	30.045	27.056
24.066	21.077	18.089	15.108	15.108	18.089	21.077	24.066
27.056	30.046	33.036	36.026	39.016	42.006	44.996	52.751
76.159	52.751	44.996	42.006	39.016	36.026	33.036	30.046
27.056	24.066	21.077	18.089	15.108	15.108	18.089	21.077
24.066	27.056	30.045	33.034	36.020	38.998	41.952	44.837
50.847	52.751	50.847	44.837	41.952	38.998	36.020	33.034
30.045	27.056	24.066	21.077	18.089	15.108	15.108	18.089
21.077	24.065	27.052	30.034	33.001	35.923	38.721	41.208
43.091	44.837	44.996	44.837	43.091	41.208	38.721	35.923
33.001	30.034	27.052	24.065	21.077	18.089	15.108	15.108
18.088	21.076	24.062	27.044	30.011	32.933	35.731	38.218
40.101	41.208	41.952	42.006	41.952	41.208	40.101	38.218
35.731	32.933	30.011	27.044	24.062	21.076	18.088	15.108
15.108	18.088	21.073	24.054	27.021	29.943	32.741	35.228
37.111	38.218	38.721	38.998	39.016	38.998	38.721	38.218

37.111	35.228	32.741	29.943	27.021	24.054	21.073	18.088
15.108	15.107	18.085	21.065	24.031	26.953	29.751	32.238
34.121	35.228	35.731	35.923	36.020	36.026	36.020	35.923
35.731	35.228	34.121	32.238	29.751	26.953	24.031	21.065
18.085	15.107	15.104	18.077	21.042	23.963	26.761	29.248
31.131	32.238	32.741	32.933	33.001	33.034	33.036	33.034
33.001	32.933	32.741	32.238	31.131	29.248	26.761	23.963
21.042	18.077	15.104	15.096	18.054	20.974	23.771	26.258
28.141	29.248	29.751	29.943	30.011	30.034	30.045	30.046
30.045	30.034	30.011	29.943	29.751	29.248	28.141	26.258
23.771	20.974	18.054	15.096	15.073	17.986	20.782	23.269
25.151	26.258	26.761	26.953	27.021	27.044	27.052	27.056
27.056	27.056	27.052	27.044	27.021	26.953	26.761	26.258
25.151	23.269	20.782	17.986	15.073	15.006	17.794	20.279
22.162	23.269	23.771	23.963	24.031	24.054	24.062	24.065
24.066	24.066	24.066	24.065	24.062	24.054	24.031	23.963
23.771	23.269	22.162	20.279	17.794	15.006	14.815	17.293
19.174	20.279	20.782	20.974	21.042	21.065	21.073	21.076
21.077	21.077	21.077	21.077	21.077	21.076	21.073	21.065
21.042	20.974	20.782	20.279	19.174	17.293	14.815	14.315
16.186	17.293	17.794	17.986	18.054	18.077	18.085	18.088
18.088	18.089	18.089	18.089	18.089	18.089	18.088	18.088
18.085	18.077	18.054	17.986	17.794	17.293	16.186	14.315
13.215	14.315	14.815	15.006	15.073	15.096	15.104	15.107
15.108	15.108	15.108	15.108	15.108	15.108	15.108	15.108
15.108	15.107	15.104	15.096	15.073	15.006	14.815	14.315
13.215							
2	1						
21.688	23.495	24.315	24.629	24.740	24.777	24.790	24.795
24.796	24.797	24.797	24.797	24.797	24.797	24.797	24.797
24.796	24.795	24.790	24.777	24.740	24.629	24.315	23.495
21.688	23.495	26.567	28.381	29.203	29.517	29.629	29.667
29.680	29.684	29.685	29.686	29.686	29.686	29.686	29.686
29.685	29.684	29.680	29.667	29.629	29.517	29.203	28.381
26.567	23.495	24.315	28.381	31.464	33.276	34.100	34.415
34.526	34.564	34.577	34.582	34.583	34.584	34.584	34.584
34.583	34.582	34.577	34.564	34.526	34.415	34.100	33.276

Pressure in Arbuckle Dolomite at Year-End 2028 (File Name: pryor_flow_2028.pcnt)

31.464	28.381	24.315	24.629	29.203	33.276	36.361	38.175
38.998	39.313	39.424	39.463	39.475	39.480	39.482	39.482
39.482	39.480	39.475	39.463	39.424	39.313	38.998	38.175
36.361	33.276	29.203	24.629	24.740	29.517	34.100	38.175
41.260	43.074	43.897	44.212	44.324	44.362	44.375	44.381
44.381	44.381	44.375	44.362	44.324	44.212	43.897	43.074
41.260	38.175	34.100	29.517	24.740	24.777	29.629	34.415
38.998	43.074	46.159	47.973	48.796	49.112	49.223	49.261
49.279	49.280	49.279	49.261	49.223	49.112	48.796	47.973
46.159	43.074	38.998	34.415	29.629	24.777	24.790	29.667
34.526	39.313	43.897	47.973	51.059	52.872	53.696	54.011
54.122	54.176	54.180	54.176	54.122	54.011	53.696	52.872
51.059	47.973	43.897	39.313	34.526	29.667	24.790	24.795
29.680	34.564	39.424	44.212	48.796	52.872	55.958	57.772
58.595	58.910	59.069	59.079	59.069	58.910	58.595	57.772
55.958	52.872	48.796	44.212	39.424	34.564	29.680	24.795
24.796	29.684	34.577	39.463	44.324	49.112	53.696	57.772
60.857	62.671	63.495	63.948	63.979	63.948	63.495	62.671
60.857	57.772	53.696	49.112	44.324	39.463	34.577	29.684
24.796	24.797	29.685	34.582	39.475	44.362	49.223	54.011
58.595	62.671	65.757	67.571	68.789	68.878	68.789	67.571
65.757	62.671	58.595	54.011	49.223	44.362	39.475	34.582
29.685	24.797	24.797	29.686	34.583	39.480	44.375	49.261
54.122	58.910	63.495	67.571	70.656	73.517	73.777	73.517
70.656	67.571	63.495	58.910	54.122	49.261	44.375	39.480
34.583	29.686	24.797	24.797	29.686	34.584	39.482	44.381
49.279	54.176	59.069	63.948	68.789	73.517	83.364	86.485
83.364	73.517	68.789	63.948	59.069	54.176	49.279	44.381
39.482	34.584	29.686	24.797	24.797	29.686	34.584	39.482
44.381	49.280	54.180	59.079	63.979	68.878	73.777	86.485
124.839	86.485	73.777	68.878	63.979	59.079	54.180	49.280
44.381	39.482	34.584	29.686	24.797	24.797	29.686	34.584
39.482	44.381	49.279	54.176	59.069	63.948	68.789	73.517
83.364	86.485	83.364	73.517	68.789	63.948	59.069	54.176
49.279	44.381	39.482	34.584	29.686	24.797	24.797	29.686
34.583	39.480	44.375	49.261	54.122	58.910	63.495	67.571
70.656	73.517	73.777	73.517	70.656	67.571	63.495	58.910

Pressure in Arbuckle Dolomite at Year-End 2028 (File Name: pryor_flow_2028.pcnt)

54.122	49.261	44.375	39.480	34.583	29.686	24.797	24.797
29.685	34.582	39.475	44.362	49.223	54.011	58.595	62.671
65.757	67.571	68.789	68.878	68.789	67.571	65.757	62.671
58.595	54.011	49.223	44.362	39.475	34.582	29.685	24.797
24.796	29.684	34.577	39.463	44.324	49.112	53.696	57.772
60.857	62.671	63.495	63.948	63.979	63.948	63.495	62.671
60.857	57.772	53.696	49.112	44.324	39.463	34.577	29.684
24.796	24.795	29.680	34.564	39.424	44.212	48.796	52.872
55.958	57.772	58.595	58.910	59.069	59.079	59.069	58.910
58.595	57.772	55.958	52.872	48.796	44.212	39.424	34.564
29.680	24.795	24.790	29.667	34.526	39.313	43.897	47.973
51.059	52.872	53.696	54.011	54.122	54.176	54.180	54.176
54.122	54.011	53.696	52.872	51.059	47.973	43.897	39.313
34.526	29.667	24.790	24.777	29.629	34.415	38.998	43.074
46.159	47.973	48.796	49.112	49.223	49.261	49.279	49.280
49.279	49.261	49.223	49.112	48.796	47.973	46.159	43.074
38.998	34.415	29.629	24.777	24.740	29.517	34.100	38.175
41.260	43.074	43.897	44.212	44.324	44.362	44.375	44.381
44.381	44.381	44.375	44.362	44.324	44.212	43.897	43.074
41.260	38.175	34.100	29.517	24.740	24.629	29.203	33.276
36.361	38.175	38.998	39.313	39.424	39.463	39.475	39.480
39.482	39.482	39.482	39.480	39.475	39.463	39.424	39.313
38.998	38.175	36.361	33.276	29.203	24.629	24.315	28.381
31.464	33.276	34.100	34.415	34.526	34.564	34.577	34.582
34.583	34.584	34.584	34.584	34.583	34.582	34.577	34.564
34.526	34.415	34.100	33.276	31.464	28.381	24.315	23.495
26.567	28.381	29.203	29.517	29.629	29.667	29.680	29.684
29.685	29.686	29.686	29.686	29.686	29.686	29.685	29.684
29.680	29.667	29.629	29.517	29.203	28.381	26.567	23.495
21.688	23.495	24.315	24.629	24.740	24.777	24.790	24.795
24.796	24.797	24.797	24.797	24.797	24.797	24.797	24.797
24.796	24.795	24.790	24.777	24.740	24.629	24.315	23.495
21.688							

ATTACHMENT 3
DUPONT MULTILAYER PRESSURE MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
PLOT FILE - PRYOR_FLOW_2028.SUM

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* * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

 INJECTION PERIOD    ---      59.00  YEAR
 POST CLOSURE PERIOD ---      30.00  YEAR

CALCULATED INJECTION LEVELS IN INJECTION RANGE
  4
SKIPPED LEVELS IN INJECTION RANGE


 NO FAULT INCLUDED IN CALCULATION

 DEFAULT BORE RADIUS (0.5 FT) USED FOR ALL WELLS

 NO SKIN FACTORS APPLIED TO INJECTION WELLS

 PRESSURES CALCULATED ON A GRID FOR CONTOUR PLOTTING

 CONTOURS CALCULATED OUT TO   8.00     MILES

 THE CONTOUR PLOT DATA WILL BE CENTERED AT THE CENTROID
  OF ACTIVE WELLS IN EACH INJECTION LAYER

  CONTOURS CALCULATED FOR THE FOLLOWING YEAR :
  47     2016
  59     2028
```

```
INJECTION HISTORY
     YEAR          WELL ID
             (  1)
    1 1970    95.1
             04-04
    2 1971    95.1
             04-04
    3 1972    95.1
             04-04
    4 1973    95.1
             04-04
    5 1974    95.1
             04-04
    6 1975    95.1
             04-04
    7 1976    95.1
             04-04
    8 1977    95.1
             04-04
    9 1978    95.1
             04-04
   10 1979    95.1
             04-04
   11 1980    95.1
             04-04
   12 1981    95.1
             04-04
   13 1982    95.1
             04-04
   14 1983    95.1
             04-04
   15 1984    95.1
             04-04
   16 1985    95.1
             04-04
   17 1986    95.1
             04-04
```

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18 1987    95.1
          04-04
19 1988    95.1
          04-04
20 1989    95.1
          04-04
21 1990    95.1
          04-04
22 1991    95.1
          04-04
23 1992    95.1
          04-04
24 1993   158.8
          04-04
25 1994   158.8
          04-04
26 1995   158.8
          04-04
27 1996   158.8
          04-04
28 1997   158.8
          04-04
29 1998   158.8
          04-04
30 1999   158.8
          04-04
31 2000    95.1
          04-04
32 2001    95.1
          04-04
33 2002     7.0
          04-04
34 2003     6.7
          04-04
35 2004     6.2
          04-04
36 2005     5.5
```

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          04-04
37 2006     4.8
          04-04
38 2007     3.6
          04-04
39 2008     4.4
          04-04
40 2009    23.4
          04-04
41 2010    77.9
          04-04
42 2011   123.5
          04-04
43 2012   114.1
          04-04
44 2013   119.6
          04-04
45 2014   117.3
          04-04
46 2015   102.9
          04-04
47 2016   106.8
          04-04
48 2017   175.0
          04-04
49 2018*  175.0
          04-04
50 2019*  175.0
          04-04
51 2020*  175.0
          04-04
52 2021*  175.0
          04-04
53 2022*  175.0
          04-04
54 2023*  175.0
          04-04
```

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55 2024*  175.0
          04-04
56 2025*  175.0
          04-04
57 2026*  175.0
          04-04
58 2027*  175.0
          04-04
59 2028*  175.0
          04-04
60 PC 1#    0.0
          04-04
61 PC 2#    0.0
          04-04
62 PC 3#    0.0
          04-04
63 PC 4#    0.0
          04-04
64 PC 5#    0.0
          04-04
65 PC 6#    0.0
          04-04
66 PC 7#    0.0
          04-04
67 PC 8#    0.0
          04-04
68 PC 9#    0.0
          04-04
69 PC10#    0.0
          04-04
70 PC11#    0.0
          04-04
71 PC12#    0.0
          04-04
72 PC13#    0.0
          04-04
73 PC14#    0.0
```

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          04-04
 74 PC15#   0.0
          04-04
 75 PC16#   0.0
          04-04
 76 PC17#   0.0
          04-04
 77 PC18#   0.0
          04-04
 78 PC19#   0.0
          04-04
 79 PC20#   0.0
          04-04
 80 PC21#   0.0
          04-04
 81 PC22#   0.0
          04-04
 82 PC23#   0.0
          04-04
 83 PC24#   0.0
          04-04
 84 PC25#   0.0
          04-04
 85 PC26#   0.0
          04-04
 86 PC27#   0.0
          04-04
 87 PC28#   0.0
          04-04
 88 PC29#   0.0
          04-04
 89 PC30#   0.0
          04-04
 * 2017 INJECTION RATES PROJECTED FORWARD
 # YEAR  POST CLOSURE

INJECTION IN AQUIFER LEVELS    4
```

1

* * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

LEVEL		INPUT PARAMETERS THICKNESS	POROSITY	PERMEABILITY	VISCOSITY	COMPRESSIBILITY*
		FT		DARCY	CP	1/PSI
1	SHALE LAYER 1	300.00	0.135	0.1000E-14	1.000	0.689E-04
2	SAND LAYER 2	10.00	0.100	0.1000	1.000	0.500E-06
3	WOODFORD SHALE LAYER 3	50.00	0.135	0.1000E-14	1.000	0.689E-04
4	ARBUCKLE LAYER 4	30.00	0.100	3.150	1.000	0.500E-06

* Alpha as defined in Groundwater, Freeze and Cherry, Eqn. 2.52, pg. 54
== (porosity) * (oilfield formation compressibility)

LEVEL		DERIVED PARAMETERS STORATIVITY	VERT. LEAKANCE 1/YEAR	TRANSMISSIVITY DARCY-FT
1	SHALE LAYER 1	0.9010E-02	0.3324E-14	0.3000E-12
2	SAND LAYER 2	0.3482E-05	9.971	1.000
3	WOODFORD SHALE LAYER 3	0.1502E-02	0.1994E-13	0.5000E-13
4	ARBUCKLE LAYER 4	0.1044E-04	104.7	94.50

```
  INJECTION WELL              DIST TO OTHER INJ WELLS  (FT)
 #  ID    COORDINATES       (  1)
 1 (  1)      0.      0.       0.0


 PRESS MONITOR POINTS           DIST TO INJ WELLS  (FT)
 #  ID    COORDINATES       (  1)
 1 (  1)      0.    100.     100.0
 2 (  2)      0.    500.     500.0
 3 (  3)      0.   1117.    1117.0
 4 (  4)      0.   5000.    5000.0
 5 (  5)      0.  10000.   10000.0
0.100E+01 0.100E-15    0   -4  0.1212E-08  0.1470E+01  0.1212E-08  0.1425E+01
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    1 (1970)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     61.49*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)       50.0


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     35.56    27.68    23.74    16.41    13.02
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    2 (1971)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     63.18*
                                 * PERFORATED INJECTION ZONE

  INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      100.0


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     37.25    29.37    25.44    18.11    14.72
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    3 (1972)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     64.18*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      150.1


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     38.24    30.37    26.43    19.10    15.71
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    4 (1973)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     64.88*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      200.1



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     38.95    31.07    27.14    19.80    16.41
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    5 (1974)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     65.43*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      250.1


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     39.49    31.62    27.68    20.35    16.96
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    6 (1975)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     65.87*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      300.1


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     39.94    32.06    28.13    20.79    17.40
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

----------------------------------YEAR    7 (1976)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     66.25*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      350.1



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     40.32    32.44    28.51    21.17    17.78
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    8 (1977)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     66.58*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      400.1


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     40.64    32.77    28.83    21.50    18.11
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR    9 (1978)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     66.86*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      450.2


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     40.93    33.05    29.12    21.79    18.39
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   10 (1979)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     67.12*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      500.2



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     41.19    33.31    29.38    22.04    18.65
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   11 (1980)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     67.35*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      550.2


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     41.42    33.55    29.61    22.28    18.88
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   12 (1981)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     67.57*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      600.2


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     41.64    33.76    29.82    22.49    19.10
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   13 (1982)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     67.76*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      650.2


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     41.83    33.95    30.02    22.69    19.29
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   14 (1983)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     67.94*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      700.2


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     42.01    34.14    30.20    22.87    19.47
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   15 (1984)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     68.11*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      750.3


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     42.18    34.30    30.37    23.04    19.64
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   16 (1985)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     68.27*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      800.3


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     42.34    34.46    30.53    23.19    19.80
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   17 (1986)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     68.42*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      850.3


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     42.49    34.61    30.68    23.34    19.95
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   18 (1987)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     68.56*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      900.3


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     42.63    34.75    30.82    23.48    20.09
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   19 (1988)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     68.69*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)      950.3


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     42.76    34.88    30.95    23.61    20.22
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   20 (1989)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     68.82*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)     1000.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     42.89    35.01    31.07    23.74    20.35
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   21 (1990)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     68.94*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)     1050.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     43.01    35.13    31.19    23.86    20.47
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   22 (1991)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     69.05*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)     1100.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     43.12    35.24    31.31    23.97    20.58
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   23 (1992)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     69.16*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)     1150.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     43.23    35.35    31.42    24.08    20.69
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   24 (1993)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    110.45*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    158.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1233.9


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     67.15    53.99    47.43    35.18    29.52
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   25 (1994)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    111.68*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    158.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1317.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     68.38    55.23    48.66    36.41    30.75
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   26 (1995)-------------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    112.45*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    158.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1401.0



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     69.14    55.99    49.42    37.17    31.51
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   27 (1996)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    113.01*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    158.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1484.5



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     69.71    56.55    49.99    37.74    32.07
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   28 (1997)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    113.46*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    158.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1568.0



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     70.16    57.01    50.44    38.19    32.53
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   29 (1998)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    113.85*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    158.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1651.5



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     70.55    57.39    50.83    38.58    32.91
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   30 (1999)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    114.18*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    158.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1735.1



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     70.88    57.73    51.16    38.91    33.25
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   31 (2000)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     73.30*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)     1785.1



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     47.37    39.49    35.56    28.22    24.82
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   32 (2001)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     72.43*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     95.10

CUMULATIVE INJECTION TO DATE (MMGAL)     1835.1



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     46.50    38.62    34.69    27.35    23.96
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   33 (2002)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     15.05*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      7.00

CUMULATIVE INJECTION TO DATE (MMGAL)     1838.8



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     13.15    12.57    12.28    11.73    11.48
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   34 (2003)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     13.05*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      6.70

CUMULATIVE INJECTION TO DATE (MMGAL)     1842.3



PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     11.22    10.67    10.39     9.87     9.63
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   35 (2004)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     11.65*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      6.20

CUMULATIVE INJECTION TO DATE (MMGAL)     1845.6


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      9.96     9.44     9.19     8.71     8.48
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   36 (2005)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     10.43*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      5.50

CUMULATIVE INJECTION TO DATE (MMGAL)     1848.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      8.93     8.48     8.25     7.82     7.63
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   37 (2006)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      9.39*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      4.80

CUMULATIVE INJECTION TO DATE (MMGAL)     1851.0


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      8.08     7.68     7.48     7.11     6.94
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   38 (2007)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      8.13*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      3.60

CUMULATIVE INJECTION TO DATE (MMGAL)     1852.9


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      7.15     6.85     6.71     6.43     6.30
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   39 (2008)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      8.24*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      4.40

CUMULATIVE INJECTION TO DATE (MMGAL)     1855.2


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      7.04     6.68     6.49     6.15     6.00
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   40 (2009)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     20.20*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     23.40

CUMULATIVE INJECTION TO DATE (MMGAL)     1867.5


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     13.82    11.88    10.91     9.11     8.27
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   41 (2010)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     55.50*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                     77.90

CUMULATIVE INJECTION TO DATE (MMGAL)     1908.5


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     34.25    27.80    24.58    18.57    15.80
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   42 (2011)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     85.90*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    123.50

CUMULATIVE INJECTION TO DATE (MMGAL)     1973.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     52.23    42.00    36.89    27.37    22.96
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   43 (2012)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     81.14*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    114.10

CUMULATIVE INJECTION TO DATE (MMGAL)     2033.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     50.02    40.57    35.85    27.05    22.98
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   44 (2013)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     85.32*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    119.60

CUMULATIVE INJECTION TO DATE (MMGAL)     2096.3


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     52.71    42.80    37.86    28.63    24.37
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   45 (2014)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     84.40*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    117.30

CUMULATIVE INJECTION TO DATE (MMGAL)     2158.0


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     52.42    42.70    37.85    28.80    24.62
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   46 (2015)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     75.48*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    102.90

CUMULATIVE INJECTION TO DATE (MMGAL)     2212.1


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     47.42    38.90    34.64    26.70    23.03
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   47 (2016)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     78.06*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    106.80

CUMULATIVE INJECTION TO DATE (MMGAL)     2268.3


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     48.94    40.10    35.68    27.44    23.63
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   48 (2017)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    122.35*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     2360.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     74.63    60.13    52.89    39.40    33.16
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   49 (2018)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    123.73*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     2452.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     76.01    61.52    54.28    40.78    34.54
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   50 (2019)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    124.59*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     2544.4


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     76.87    62.38    55.14    41.64    35.40
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   51 (2020)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    125.23*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     2636.5


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     77.51    63.02    55.78    42.28    36.04
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   52 (2021)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    125.75*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     2728.5


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     78.03    63.54    56.30    42.80    36.56
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   53 (2022)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    126.19*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     2820.6


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     78.47    63.97    56.73    43.24    36.99
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   54 (2023)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    126.56*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     2912.6


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     78.85    64.35    57.11    43.61    37.37
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   55 (2024)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    126.90*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3004.6


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     79.18    64.69    57.45    43.95    37.71
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   56 (2025)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    127.20*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3096.7


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     79.48    64.99    57.75    44.25    38.01
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   57 (2026)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    127.48*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3188.7


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     79.76    65.26    58.02    44.52    38.28
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   58 (2027)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    127.73*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3280.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     80.01    65.51    58.28    44.78    38.53
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   59 (2028)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                    127.96*
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                    175.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     80.24    65.75    58.51    45.01    38.77
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   60 (PC 1)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     15.03
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     15.03    15.03    15.03    15.03    15.02
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   61 (PC 2)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     12.11
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     12.11    12.11    12.11    12.11    12.10
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   62 (PC 3)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                     10.47
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                     10.47    10.47    10.47    10.47    10.47
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   63 (PC 4)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      9.35
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      9.35     9.35     9.35     9.35     9.35
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   64 (PC 5)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      8.51
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      8.51     8.51     8.51     8.51     8.51
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   65 (PC 6)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      7.85
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      7.85     7.85     7.85     7.85     7.85
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   66 (PC 7)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      7.31
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      7.31     7.31     7.31     7.31     7.31
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   67 (PC 8)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      6.86
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      6.86     6.86     6.86     6.86     6.86
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   68 (PC 9)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      6.47
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      6.47     6.47     6.47     6.47     6.47
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   69 (PC10)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      6.13
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      6.13     6.13     6.13     6.13     6.13
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   70 (PC11)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      5.83
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      5.83     5.83     5.83     5.83     5.83
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   71 (PC12)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      5.57
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      5.57     5.57     5.57     5.57     5.56
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   72 (PC13)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      5.32
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      5.32     5.32     5.32     5.32     5.32
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   73 (PC14)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      5.11
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      5.11     5.11     5.11     5.11     5.10
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   74 (PC15)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      4.91
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      4.91     4.91     4.91     4.91     4.91
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   75 (PC16)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      4.72
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      4.72     4.72     4.72     4.72     4.72
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   76 (PC17)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      4.56
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      4.56     4.56     4.56     4.56     4.56
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   77 (PC18)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      4.40
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      4.40     4.40     4.40     4.40     4.40
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   78 (PC19)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      4.26
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      4.26     4.26     4.26     4.26     4.26
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   79 (PC20)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      4.13
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      4.13     4.13     4.13     4.13     4.13
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   80 (PC21)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      4.00
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      4.00     4.00     4.00     4.00     4.00
```

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 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   81 (PC22)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.88
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.88     3.88     3.88     3.88     3.88
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   82 (PC23)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.77
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.77     3.77     3.77     3.77     3.77
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   83 (PC24)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.67
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.67     3.67     3.67     3.67     3.67
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   84 (PC25)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.56
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.56     3.56     3.56     3.56     3.56
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   85 (PC26)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.47
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.47     3.47     3.47     3.47     3.47
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   86 (PC27)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.38
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.38     3.38     3.38     3.38     3.38
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   87 (PC28)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.29
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.29     3.29     3.29     3.29     3.29
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   88 (PC29)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.21
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.21     3.21     3.21     3.21     3.21
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *

--------------------------------YEAR   89 (PC30)-----------------------------------------------
PRESSURES AT INJECTION WELL COORD (PSI)
                                 WELL ID  (  1)
     FORMATION LEVEL
  2  SAND LAYER 2                          0.00
  4  ARBUCKLE LAYER 4                      3.13
                                 * PERFORATED INJECTION ZONE

INJECTION RATES (GPM)
                                 WELL ID  (  1)
     INJECTION LEVEL
  4  ARBUCKLE LAYER 4                      0.00

CUMULATIVE INJECTION TO DATE (MMGAL)     3372.8


PRESSURES AT MONITOR COORD (PSI)
                              MONITOR ID  (  1)    (  2)    (  3)    (  4)    (  5)
     FORMATION LEVEL
  4  ARBUCKLE LAYER 4                      3.13     3.13     3.13     3.13     3.13
```

```
 * * * PRYOR CHEMICALS FLOWING MODEL 2028 * * *


RESIDUAL UPWARD PENETRATION INTO CONFINING LAYERS -- [FEET]
CALCULATED USING INJECTION HISTORY FROM 1970 TO PC30
 CONFINING    THICKNESS
  LAYERS       [FEET]                                                    WELLS
                                        (  1)

     1           300.0                  0.000

     3            50.0                  0.000
                                                          * PENETRATION GREATER THAN CONFINING
LAYER THICKESS
```

ATTACHMENT 4

ATTACHMENT 4
DUPONT BASIC PLUME MODEL
COMPUTER RUN AND OUTPUT FILES

ATTACHMENT 4
DUPONT BASIC PLUME MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
INPUT FILE - PRYORPLUME2028.RCV

```
2.0                     VELOCITY MULTIPLIER
3.                      VTYPE (TYPE OF VELOCITIES CALCULATED)
N                       FAULT?
0.                      FAULT COORDINATES (NEEDED EVEN IF NO FAULT)
1.                      OUTPUT INTERVALS PER TIME PERIOD
```

ATTACHMENT 4
DUPONT BASIC PLUME MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
INPUT FILE - PRYORPLUME2028.PRM

```
      PARAMETER (NPT=400)
C     NPT IS THE NUMBER OF POINTS USED TO REPRESENT THE WELL PLUMES
C
      PARAMETER (MXWELL=5)
C     MXWELL IS THE NUMBER OF INJECITON WELLS INCLUDED
C     MXWELL MUST BE = NWELL READ FROM INPUT FILE
C
      PARAMETER (MXTM=80)
C     MXTM IS THE MAXIMUM ALLOWABLE NUMBER OF TIME PERIODS FOR CALC
C     MXTM MUST BE >= NUMBER OF TIME PERIODS FROM INPUT FILE
C
```

ATTACHMENT 4
DUPONT BASIC PLUME MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
INPUT RATE FILE – PRYORPLUME2028.INJ

```
   1 INJECTION WELLS -- ARBUCKLE LAYER 4
 WELL  X COORD   Y COORD
   1        0.        0.

     30.0 = THICKNESS OF INJECTION ZONE (FT)
    0.100 = POROSITY
 3.15     = PERMEABILITY (DARCIES)

     50.0 = THICKNESS OF UPPER CONFINING ZONE (FT)
    0.135 = POROSITY
0.100E-14 = PERMEABILITY (DARCIES)

 INJECTION HISTORY (GPM)
YEAR                          WELL #
         1     2     3     4     5     6     7     8     9    10
2345678901234567890123456789012345678901234567890123456789012345678901234567890
1970  95.1
1971  95.1
1972  95.1
1973  95.1
1974  95.1
1975  95.1
1976  95.1
1977  95.1
1978  95.1
1979  95.1
1980  95.1
1981  95.1
1982  95.1
1983  95.1
1984  95.1
1985  95.1
1986  95.1
1987  95.1
1988  95.1
1989  95.1
1990  95.1
```

1991	95.1
1992	95.1
1993	158.8
1994	158.8
1995	158.8
1996	158.8
1997	158.8
1998	158.8
1999	158.8
2000	95.1
2001	95.1
2002	7.0
2003	6.7
2004	6.2
2005	5.5
2006	4.8
2007	3.6
2008	4.4
2009	23.4
2010	77.9
2011	123.5
2012	114.1
2013	119.6
2014	117.3
2015	102.9
2016	106.8
2017	175.0
2018	175.0
2019	175.0
2020	175.0
2021	175.0
2022	175.0
2023	175.0
2024	175.0
2025	175.0
2026	175.0
2027	175.0

```
2028 175.0
```

ATTACHMENT 4
DUPONT BASIC PLUME MODEL
COMPUTER RUN AND OUTPUT FILES

MAXIMUM RATE (175 GPM)
PLOT OUTPUT FILE – PRYORPLUME2028.PLT

400

1	1								
1191.2	0.0	1191.0	18.7	1190.6	37.4	1189.9	56.1	1188.8	74.8
1187.5	93.5	1185.9	112.1	1184.0	130.7	1181.8	149.3	1179.3	167.8
1176.5	186.3	1173.4	204.8	1170.1	223.2	1166.4	241.6	1162.5	259.8
1158.3	278.1	1153.7	296.2	1149.0	314.3	1143.9	332.3	1138.5	350.3
1132.9	368.1	1127.0	385.8	1120.8	403.5	1114.3	421.0	1107.5	438.5
1100.5	455.8	1093.2	473.1	1085.6	490.2	1077.8	507.2	1069.7	524.0
1061.3	540.8	1052.7	557.4	1043.8	573.9	1034.7	590.2	1025.3	606.4
1015.6	622.4	1005.7	638.3	995.6	654.0	985.2	669.5	974.6	684.9
963.7	700.2	952.6	715.2	941.2	730.1	929.6	744.8	917.8	759.3
905.8	773.6	893.5	787.7	881.0	801.7	868.3	815.4	855.4	829.0
842.3	842.3	829.0	855.4	815.4	868.3	801.7	881.0	787.7	893.5
773.6	905.8	759.3	917.8	744.8	929.6	730.1	941.2	715.2	952.6
700.2	963.7	684.9	974.6	669.5	985.2	654.0	995.6	638.3	1005.7
622.4	1015.6	606.4	1025.3	590.2	1034.7	573.9	1043.8	557.4	1052.7
540.8	1061.3	524.0	1069.7	507.2	1077.8	490.2	1085.6	473.1	1093.2
455.8	1100.5	438.5	1107.5	421.0	1114.3	403.5	1120.8	385.8	1127.0
368.1	1132.9	350.3	1138.5	332.3	1143.9	314.3	1149.0	296.2	1153.7
278.1	1158.3	259.8	1162.5	241.6	1166.4	223.2	1170.1	204.8	1173.4
186.3	1176.5	167.8	1179.3	149.3	1181.8	130.7	1184.0	112.1	1185.9
93.5	1187.5	74.8	1188.8	56.1	1189.9	37.4	1190.6	18.7	1191.0
0.0	1191.2	-18.7	1191.0	-37.4	1190.6	-56.1	1189.9	-74.8	1188.8
-93.5	1187.5	-112.1	1185.9	-130.7	1184.0	-149.3	1181.8	-167.8	1179.3
-186.3	1176.5	-204.8	1173.4	-223.2	1170.1	-241.6	1166.4	-259.8	1162.5
-278.1	1158.3	-296.2	1153.7	-314.3	1149.0	-332.3	1143.9	-350.3	1138.5
-368.1	1132.9	-385.8	1127.0	-403.5	1120.8	-421.0	1114.3	-438.5	1107.5
-455.8	1100.5	-473.1	1093.2	-490.2	1085.6	-507.2	1077.8	-524.0	1069.7
-540.8	1061.3	-557.4	1052.7	-573.9	1043.8	-590.2	1034.7	-606.4	1025.3
-622.4	1015.6	-638.3	1005.7	-654.0	995.6	-669.5	985.2	-684.9	974.6
-700.2	963.7	-715.2	952.6	-730.1	941.2	-744.8	929.6	-759.3	917.8
-773.6	905.8	-787.7	893.5	-801.7	881.0	-815.4	868.3	-829.0	855.4
-842.3	842.3	-855.4	829.0	-868.3	815.4	-881.0	801.7	-893.5	787.7
-905.8	773.6	-917.8	759.3	-929.6	744.8	-941.2	730.1	-952.6	715.2
-963.7	700.2	-974.6	684.9	-985.2	669.5	-995.6	654.0	-1005.7	638.3
-1015.6	622.4	-1025.3	606.4	-1034.7	590.2	-1043.8	573.9	-1052.7	557.4

-1061.3	540.8	-1069.7	524.0	-1077.8	507.2	-1085.6	490.2	-1093.2	473.1
-1100.5	455.8	-1107.5	438.5	-1114.3	421.0	-1120.8	403.5	-1127.0	385.8
-1132.9	368.1	-1138.5	350.3	-1143.9	332.3	-1149.0	314.3	-1153.7	296.2
-1158.3	278.1	-1162.5	259.8	-1166.4	241.6	-1170.1	223.2	-1173.4	204.8
-1176.5	186.3	-1179.3	167.8	-1181.8	149.3	-1184.0	130.7	-1185.9	112.1
-1187.5	93.5	-1188.8	74.8	-1189.9	56.1	-1190.6	37.4	-1191.0	18.7
-1191.2	0.0	-1191.0	-18.7	-1190.6	-37.4	-1189.9	-56.1	-1188.8	-74.8
-1187.5	-93.5	-1185.9	-112.1	-1184.0	-130.7	-1181.8	-149.3	-1179.3	-167.8
-1176.5	-186.3	-1173.4	-204.8	-1170.1	-223.2	-1166.4	-241.6	-1162.5	-259.8
-1158.3	-278.1	-1153.7	-296.2	-1149.0	-314.3	-1143.9	-332.3	-1138.5	-350.3
-1132.9	-368.1	-1127.0	-385.8	-1120.8	-403.5	-1114.3	-421.0	-1107.5	-438.5
-1100.5	-455.8	-1093.2	-473.1	-1085.6	-490.2	-1077.8	-507.2	-1069.7	-524.0
-1061.3	-540.8	-1052.7	-557.4	-1043.8	-573.9	-1034.7	-590.2	-1025.3	-606.4
-1015.6	-622.4	-1005.7	-638.3	-995.6	-654.0	-985.2	-669.5	-974.6	-684.9
-963.7	-700.2	-952.6	-715.2	-941.2	-730.1	-929.6	-744.8	-917.8	-759.3
-905.8	-773.6	-893.5	-787.7	-881.0	-801.7	-868.3	-815.4	-855.4	-829.0
-842.3	-842.3	-829.0	-855.4	-815.4	-868.3	-801.7	-881.0	-787.7	-893.5
-773.6	-905.8	-759.3	-917.8	-744.8	-929.6	-730.1	-941.2	-715.2	-952.6
-700.2	-963.7	-684.9	-974.6	-669.5	-985.2	-654.0	-995.6	-638.3	-1005.7
-622.4	-1015.6	-606.4	-1025.3	-590.2	-1034.7	-573.9	-1043.8	-557.4	-1052.7
-540.8	-1061.3	-524.0	-1069.7	-507.2	-1077.8	-490.2	-1085.6	-473.1	-1093.2
-455.8	-1100.5	-438.5	-1107.5	-421.0	-1114.3	-403.5	-1120.8	-385.8	-1127.0
-368.1	-1132.9	-350.3	-1138.5	-332.3	-1143.9	-314.3	-1149.0	-296.2	-1153.7
-278.1	-1158.3	-259.8	-1162.5	-241.6	-1166.4	-223.2	-1170.1	-204.8	-1173.4
-186.3	-1176.5	-167.8	-1179.3	-149.3	-1181.8	-130.7	-1184.0	-112.1	-1185.9
-93.5	-1187.5	-74.8	-1188.8	-56.1	-1189.9	-37.4	-1190.6	-18.7	-1191.0
0.0	-1191.2	18.7	-1191.0	37.4	-1190.6	56.1	-1189.9	74.8	-1188.8
93.5	-1187.5	112.1	-1185.9	130.7	-1184.0	149.3	-1181.8	167.8	-1179.3
186.3	-1176.5	204.8	-1173.4	223.2	-1170.1	241.6	-1166.4	259.8	-1162.5
278.1	-1158.3	296.2	-1153.7	314.3	-1149.0	332.3	-1143.9	350.3	-1138.5
368.1	-1132.9	385.8	-1127.0	403.5	-1120.8	421.0	-1114.3	438.5	-1107.5
455.8	-1100.5	473.1	-1093.2	490.2	-1085.6	507.2	-1077.8	524.0	-1069.7
540.8	-1061.3	557.4	-1052.7	573.9	-1043.8	590.2	-1034.7	606.4	-1025.3
622.4	-1015.6	638.3	-1005.7	654.0	-995.6	669.5	-985.2	684.9	-974.6
700.2	-963.7	715.2	-952.6	730.1	-941.2	744.8	-929.6	759.3	-917.8
773.6	-905.8	787.7	-893.5	801.7	-881.0	815.4	-868.3	829.0	-855.4
842.3	-842.3	855.4	-829.0	868.3	-815.4	881.0	-801.7	893.5	-787.7

905.8	-773.6	917.8	-759.3	929.6	-744.8	941.2	-730.1	952.6	-715.2
963.7	-700.2	974.6	-684.9	985.2	-669.5	995.6	-654.0	1005.7	-638.3
1015.6	-622.4	1025.3	-606.4	1034.7	-590.2	1043.8	-573.9	1052.7	-557.4
1061.3	-540.8	1069.7	-524.0	1077.8	-507.2	1085.6	-490.2	1093.2	-473.1
1100.5	-455.8	1107.5	-438.5	1114.3	-421.0	1120.8	-403.5	1127.0	-385.8
1132.9	-368.1	1138.5	-350.3	1143.9	-332.3	1149.0	-314.3	1153.7	-296.2
1158.3	-278.1	1162.5	-259.8	1166.4	-241.6	1170.1	-223.2	1173.4	-204.8
1176.5	-186.3	1179.3	-167.8	1181.8	-149.3	1184.0	-130.7	1185.9	-112.1
1187.5	-93.5	1188.8	-74.8	1189.9	-56.1	1190.6	-37.4	1191.0	-18.7

2 1

1684.6	0.0	1684.4	26.5	1683.7	52.9	1682.7	79.4	1681.2	105.8
1679.4	132.2	1677.1	158.5	1674.4	184.9	1671.3	211.1	1667.8	237.4
1663.8	263.5	1659.5	289.6	1654.7	315.7	1649.6	341.6	1644.0	367.5
1638.0	393.3	1631.6	418.9	1624.9	444.5	1617.7	470.0	1610.1	495.3
1602.1	520.6	1593.7	545.7	1585.0	570.6	1575.8	595.5	1566.3	620.1
1556.3	644.7	1546.0	669.0	1535.3	693.2	1524.2	717.3	1512.8	741.1
1501.0	764.8	1488.8	788.3	1476.2	811.5	1463.3	834.6	1450.0	857.5
1436.3	880.2	1422.3	902.6	1408.0	924.9	1393.3	946.9	1378.2	968.6
1362.8	990.2	1347.1	1011.5	1331.1	1032.5	1314.7	1053.3	1298.0	1073.8
1281.0	1094.0	1263.6	1114.0	1246.0	1133.7	1228.0	1153.2	1209.7	1172.3
1191.2	1191.2	1172.3	1209.7	1153.2	1228.0	1133.7	1246.0	1114.0	1263.6
1094.0	1281.0	1073.8	1298.0	1053.3	1314.7	1032.5	1331.1	1011.5	1347.1
990.2	1362.8	968.6	1378.2	946.9	1393.3	924.9	1408.0	902.6	1422.3
880.2	1436.3	857.5	1450.0	834.6	1463.3	811.5	1476.2	788.3	1488.8
764.8	1501.0	741.1	1512.8	717.3	1524.2	693.2	1535.3	669.0	1546.0
644.7	1556.3	620.1	1566.3	595.5	1575.8	570.6	1585.0	545.7	1593.7
520.6	1602.1	495.3	1610.1	470.0	1617.7	444.5	1624.9	418.9	1631.6
393.3	1638.0	367.5	1644.0	341.6	1649.6	315.7	1654.7	289.6	1659.5
263.5	1663.8	237.4	1667.8	211.1	1671.3	184.9	1674.4	158.5	1677.1
132.2	1679.4	105.8	1681.2	79.4	1682.7	52.9	1683.7	26.5	1684.4
0.0	1684.6	-26.5	1684.4	-52.9	1683.7	-79.4	1682.7	-105.8	1681.2
-132.2	1679.4	-158.5	1677.1	-184.9	1674.4	-211.1	1671.3	-237.4	1667.8
-263.5	1663.8	-289.6	1659.5	-315.7	1654.7	-341.6	1649.6	-367.5	1644.0
-393.3	1638.0	-418.9	1631.6	-444.5	1624.9	-470.0	1617.7	-495.3	1610.1
-520.6	1602.1	-545.7	1593.7	-570.6	1585.0	-595.5	1575.8	-620.1	1566.3
-644.7	1556.3	-669.0	1546.0	-693.2	1535.3	-717.3	1524.2	-741.1	1512.8

-764.8	1501.0	-788.3	1488.8	-811.5	1476.2	-834.6	1463.3	-857.5	1450.0
-880.2	1436.3	-902.6	1422.3	-924.9	1408.0	-946.9	1393.3	-968.6	1378.2
-990.2	1362.8	-1011.5	1347.1	-1032.5	1331.1	-1053.3	1314.7	-1073.8	1298.0
-1094.0	1281.0	-1114.0	1263.6	-1133.7	1246.0	-1153.2	1228.0	-1172.3	1209.7
-1191.2	1191.2	-1209.7	1172.3	-1228.0	1153.2	-1246.0	1133.7	-1263.6	1114.0
-1281.0	1094.0	-1298.0	1073.8	-1314.7	1053.3	-1331.1	1032.5	-1347.1	1011.5
-1362.8	990.2	-1378.2	968.6	-1393.3	946.9	-1408.0	924.9	-1422.3	902.6
-1436.3	880.2	-1450.0	857.5	-1463.3	834.6	-1476.2	811.5	-1488.8	788.3
-1501.0	764.8	-1512.8	741.1	-1524.2	717.3	-1535.3	693.2	-1546.0	669.0
-1556.3	644.7	-1566.3	620.1	-1575.8	595.5	-1585.0	570.6	-1593.7	545.7
-1602.1	520.6	-1610.1	495.3	-1617.7	470.0	-1624.9	444.5	-1631.6	418.9
-1638.0	393.3	-1644.0	367.5	-1649.6	341.6	-1654.7	315.7	-1659.5	289.6
-1663.8	263.5	-1667.8	237.4	-1671.3	211.1	-1674.4	184.9	-1677.1	158.5
-1679.4	132.2	-1681.2	105.8	-1682.7	79.4	-1683.7	52.9	-1684.4	26.5
-1684.6	0.0	-1684.4	-26.5	-1683.7	-52.9	-1682.7	-79.4	-1681.2	-105.8
-1679.4	-132.2	-1677.1	-158.5	-1674.4	-184.9	-1671.3	-211.1	-1667.8	-237.4
-1663.8	-263.5	-1659.5	-289.6	-1654.7	-315.7	-1649.6	-341.6	-1644.0	-367.5
-1638.0	-393.3	-1631.6	-418.9	-1624.9	-444.5	-1617.7	-470.0	-1610.1	-495.3
-1602.1	-520.6	-1593.7	-545.7	-1585.0	-570.6	-1575.8	-595.5	-1566.3	-620.1
-1556.3	-644.7	-1546.0	-669.0	-1535.3	-693.2	-1524.2	-717.3	-1512.8	-741.1
-1501.0	-764.8	-1488.8	-788.3	-1476.2	-811.5	-1463.3	-834.6	-1450.0	-857.5
-1436.3	-880.2	-1422.3	-902.6	-1408.0	-924.9	-1393.3	-946.9	-1378.2	-968.6
-1362.8	-990.2	-1347.1	-1011.5	-1331.1	-1032.5	-1314.7	-1053.3	-1298.0	-1073.8
-1281.0	-1094.0	-1263.6	-1114.0	-1246.0	-1133.7	-1228.0	-1153.2	-1209.7	-1172.3
-1191.2	-1191.2	-1172.3	-1209.7	-1153.2	-1228.0	-1133.7	-1246.0	-1114.0	-1263.6
-1094.0	-1281.0	-1073.8	-1298.0	-1053.3	-1314.7	-1032.5	-1331.1	-1011.5	-1347.1
-990.2	-1362.8	-968.6	-1378.2	-946.9	-1393.3	-924.9	-1408.0	-902.6	-1422.3
-880.2	-1436.3	-857.5	-1450.0	-834.6	-1463.3	-811.5	-1476.2	-788.3	-1488.8
-764.8	-1501.0	-741.1	-1512.8	-717.3	-1524.2	-693.2	-1535.3	-669.0	-1546.0
-644.7	-1556.3	-620.1	-1566.3	-595.5	-1575.8	-570.6	-1585.0	-545.7	-1593.7
-520.6	-1602.1	-495.3	-1610.1	-470.0	-1617.7	-444.5	-1624.9	-418.9	-1631.6
-393.3	-1638.0	-367.5	-1644.0	-341.6	-1649.6	-315.7	-1654.7	-289.6	-1659.5
-263.5	-1663.8	-237.4	-1667.8	-211.1	-1671.3	-184.9	-1674.4	-158.5	-1677.1
-132.2	-1679.4	-105.8	-1681.2	-79.4	-1682.7	-52.9	-1683.7	-26.5	-1684.4
0.0	-1684.6	26.5	-1684.4	52.9	-1683.7	79.4	-1682.7	105.8	-1681.2
132.2	-1679.4	158.5	-1677.1	184.9	-1674.4	211.1	-1671.3	237.4	-1667.8
263.5	-1663.8	289.6	-1659.5	315.7	-1654.7	341.6	-1649.6	367.5	-1644.0

393.3	-1638.0	418.9	-1631.6	444.5	-1624.9	470.0	-1617.7	495.3	-1610.1
520.6	-1602.1	545.7	-1593.7	570.6	-1585.0	595.5	-1575.8	620.1	-1566.3
644.7	-1556.3	669.0	-1546.0	693.2	-1535.3	717.3	-1524.2	741.1	-1512.8
764.8	-1501.0	788.3	-1488.8	811.5	-1476.2	834.6	-1463.3	857.5	-1450.0
880.2	-1436.3	902.6	-1422.3	924.9	-1408.0	946.9	-1393.3	968.6	-1378.2
990.2	-1362.8	1011.5	-1347.1	1032.5	-1331.1	1053.3	-1314.7	1073.8	-1298.0
1094.0	-1281.0	1114.0	-1263.6	1133.7	-1246.0	1153.2	-1228.0	1172.3	-1209.7
1191.2	-1191.2	1209.7	-1172.3	1228.0	-1153.2	1246.0	-1133.7	1263.6	-1114.0
1281.0	-1094.0	1298.0	-1073.8	1314.7	-1053.3	1331.1	-1032.5	1347.1	-1011.5
1362.8	-990.2	1378.2	-968.6	1393.3	-946.9	1408.0	-924.9	1422.3	-902.6
1436.3	-880.2	1450.0	-857.5	1463.3	-834.6	1476.2	-811.5	1488.8	-788.3
1501.0	-764.8	1512.8	-741.1	1524.2	-717.3	1535.3	-693.2	1546.0	-669.0
1556.3	-644.7	1566.3	-620.1	1575.8	-595.5	1585.0	-570.6	1593.7	-545.7
1602.1	-520.6	1610.1	-495.3	1617.7	-470.0	1624.9	-444.5	1631.6	-418.9
1638.0	-393.3	1644.0	-367.5	1649.6	-341.6	1654.7	-315.7	1659.5	-289.6
1663.8	-263.5	1667.8	-237.4	1671.3	-211.1	1674.4	-184.9	1677.1	-158.5
1679.4	-132.2	1681.2	-105.8	1682.7	-79.4	1683.7	-52.9	1684.4	-26.5

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2063.2	0.0	2062.9	32.4	2062.2	64.8	2060.9	97.2	2059.1	129.5
2056.8	161.9	2054.0	194.2	2050.7	226.4	2046.9	258.6	2042.6	290.7
2037.8	322.8	2032.4	354.7	2026.6	386.6	2020.3	418.4	2013.5	450.1
2006.2	481.6	1998.4	513.1	1990.0	544.4	1981.3	575.6	1972.0	606.7
1962.2	637.6	1951.9	668.3	1941.2	698.9	1930.0	729.3	1918.3	759.5
1906.1	789.5	1893.5	819.4	1880.4	849.0	1866.8	878.5	1852.8	907.7
1838.3	936.7	1823.4	965.4	1808.0	993.9	1792.1	1022.2	1775.9	1050.2
1759.1	1078.0	1742.0	1105.5	1724.4	1132.7	1706.4	1159.7	1688.0	1186.3
1669.1	1212.7	1649.9	1238.8	1630.2	1264.5	1610.2	1290.0	1589.7	1315.1
1568.8	1339.9	1547.6	1364.4	1526.0	1388.5	1504.0	1412.3	1481.6	1435.8
1458.9	1458.9	1435.8	1481.6	1412.3	1504.0	1388.5	1526.0	1364.4	1547.6
1339.9	1568.8	1315.1	1589.7	1290.0	1610.2	1264.5	1630.2	1238.8	1649.9
1212.7	1669.1	1186.3	1688.0	1159.7	1706.4	1132.7	1724.4	1105.5	1742.0
1078.0	1759.1	1050.2	1775.9	1022.2	1792.1	993.9	1808.0	965.4	1823.4
936.7	1838.3	907.7	1852.8	878.5	1866.8	849.0	1880.4	819.4	1893.5
789.5	1906.1	759.5	1918.3	729.3	1930.0	698.9	1941.2	668.3	1951.9
637.6	1962.2	606.7	1972.0	575.6	1981.3	544.4	1990.0	513.1	1998.4
481.6	2006.2	450.1	2013.5	418.4	2020.3	386.6	2026.6	354.7	2032.4

322.8	2037.8	290.7	2042.6	258.6	2046.9	226.4	2050.7	194.2	2054.0
161.9	2056.8	129.5	2059.1	97.2	2060.9	64.8	2062.2	32.4	2062.9
0.0	2063.2	-32.4	2062.9	-64.8	2062.2	-97.2	2060.9	-129.5	2059.1
-161.9	2056.8	-194.2	2054.0	-226.4	2050.7	-258.6	2046.9	-290.7	2042.6
-322.8	2037.8	-354.7	2032.4	-386.6	2026.6	-418.4	2020.3	-450.1	2013.5
-481.6	2006.2	-513.1	1998.4	-544.4	1990.0	-575.6	1981.3	-606.7	1972.0
-637.6	1962.2	-668.3	1951.9	-698.9	1941.2	-729.3	1930.0	-759.5	1918.3
-789.5	1906.1	-819.4	1893.5	-849.0	1880.4	-878.5	1866.8	-907.7	1852.8
-936.7	1838.3	-965.4	1823.4	-993.9	1808.0	-1022.2	1792.1	-1050.2	1775.9
-1078.0	1759.1	-1105.5	1742.0	-1132.7	1724.4	-1159.7	1706.4	-1186.3	1688.0
-1212.7	1669.1	-1238.8	1649.9	-1264.5	1630.2	-1290.0	1610.2	-1315.1	1589.7
-1339.9	1568.8	-1364.4	1547.6	-1388.5	1526.0	-1412.3	1504.0	-1435.8	1481.6
-1458.9	1458.9	-1481.6	1435.8	-1504.0	1412.3	-1526.0	1388.5	-1547.6	1364.4
-1568.8	1339.9	-1589.7	1315.1	-1610.2	1290.0	-1630.2	1264.5	-1649.9	1238.8
-1669.1	1212.7	-1688.0	1186.3	-1706.4	1159.7	-1724.4	1132.7	-1742.0	1105.5
-1759.1	1078.0	-1775.9	1050.2	-1792.1	1022.2	-1808.0	993.9	-1823.4	965.4
-1838.3	936.7	-1852.8	907.7	-1866.8	878.5	-1880.4	849.0	-1893.5	819.4
-1906.1	789.5	-1918.3	759.5	-1930.0	729.3	-1941.2	698.9	-1951.9	668.3
-1962.2	637.6	-1972.0	606.7	-1981.3	575.6	-1990.0	544.4	-1998.4	513.1
-2006.2	481.6	-2013.5	450.1	-2020.3	418.4	-2026.6	386.6	-2032.4	354.7
-2037.8	322.8	-2042.6	290.7	-2046.9	258.6	-2050.7	226.4	-2054.0	194.2
-2056.8	161.9	-2059.1	129.5	-2060.9	97.2	-2062.2	64.8	-2062.9	32.4
-2063.2	0.0	-2062.9	-32.4	-2062.2	-64.8	-2060.9	-97.2	-2059.1	-129.5
-2056.8	-161.9	-2054.0	-194.2	-2050.7	-226.4	-2046.9	-258.6	-2042.6	-290.7
-2037.8	-322.8	-2032.4	-354.7	-2026.6	-386.6	-2020.3	-418.4	-2013.5	-450.1
-2006.2	-481.6	-1998.4	-513.1	-1990.0	-544.4	-1981.3	-575.6	-1972.0	-606.7
-1962.2	-637.6	-1951.9	-668.3	-1941.2	-698.9	-1930.0	-729.3	-1918.3	-759.5
-1906.1	-789.5	-1893.5	-819.4	-1880.4	-849.0	-1866.8	-878.5	-1852.8	-907.7
-1838.3	-936.7	-1823.4	-965.4	-1808.0	-993.9	-1792.1	-1022.2	-1775.9	-1050.2
-1759.1	-1078.0	-1742.0	-1105.5	-1724.4	-1132.7	-1706.4	-1159.7	-1688.0	-1186.3
-1669.1	-1212.7	-1649.9	-1238.8	-1630.2	-1264.5	-1610.2	-1290.0	-1589.7	-1315.1
-1568.8	-1339.9	-1547.6	-1364.4	-1526.0	-1388.5	-1504.0	-1412.3	-1481.6	-1435.8
-1458.9	-1458.9	-1435.8	-1481.6	-1412.3	-1504.0	-1388.5	-1526.0	-1364.4	-1547.6
-1339.9	-1568.8	-1315.1	-1589.7	-1290.0	-1610.2	-1264.5	-1630.2	-1238.8	-1649.9
-1212.7	-1669.1	-1186.3	-1688.0	-1159.7	-1706.4	-1132.7	-1724.4	-1105.5	-1742.0
-1078.0	-1759.1	-1050.2	-1775.9	-1022.2	-1792.1	-993.9	-1808.0	-965.4	-1823.4
-936.7	-1838.3	-907.7	-1852.8	-878.5	-1866.8	-849.0	-1880.4	-819.4	-1893.5

-789.5	-1906.1	-759.5	-1918.3	-729.3	-1930.0	-698.9	-1941.2	-668.3	-1951.9
-637.6	-1962.2	-606.7	-1972.0	-575.6	-1981.3	-544.4	-1990.0	-513.1	-1998.4
-481.6	-2006.2	-450.1	-2013.5	-418.4	-2020.3	-386.6	-2026.6	-354.7	-2032.4
-322.8	-2037.8	-290.7	-2042.6	-258.6	-2046.9	-226.4	-2050.7	-194.2	-2054.0
-161.9	-2056.8	-129.5	-2059.1	-97.2	-2060.9	-64.8	-2062.2	-32.4	-2062.9
0.0	-2063.2	32.4	-2062.9	64.8	-2062.2	97.2	-2060.9	129.5	-2059.1
161.9	-2056.8	194.2	-2054.0	226.4	-2050.7	258.6	-2046.9	290.7	-2042.6
322.8	-2037.8	354.7	-2032.4	386.6	-2026.6	418.4	-2020.3	450.1	-2013.5
481.6	-2006.2	513.1	-1998.4	544.4	-1990.0	575.6	-1981.3	606.7	-1972.0
637.6	-1962.2	668.3	-1951.9	698.9	-1941.2	729.3	-1930.0	759.5	-1918.3
789.5	-1906.1	819.4	-1893.5	849.0	-1880.4	878.5	-1866.8	907.7	-1852.8
936.7	-1838.3	965.4	-1823.4	993.9	-1808.0	1022.2	-1792.1	1050.2	-1775.9
1078.0	-1759.1	1105.5	-1742.0	1132.7	-1724.4	1159.7	-1706.4	1186.3	-1688.0
1212.7	-1669.1	1238.8	-1649.9	1264.5	-1630.2	1290.0	-1610.2	1315.1	-1589.7
1339.9	-1568.8	1364.4	-1547.6	1388.5	-1526.0	1412.3	-1504.0	1435.8	-1481.6
1458.9	-1458.9	1481.6	-1435.8	1504.0	-1412.3	1526.0	-1388.5	1547.6	-1364.4
1568.8	-1339.9	1589.7	-1315.1	1610.2	-1290.0	1630.2	-1264.5	1649.9	-1238.8
1669.1	-1212.7	1688.0	-1186.3	1706.4	-1159.7	1724.4	-1132.7	1742.0	-1105.5
1759.1	-1078.0	1775.9	-1050.2	1792.1	-1022.2	1808.0	-993.9	1823.4	-965.4
1838.3	-936.7	1852.8	-907.7	1866.8	-878.5	1880.4	-849.0	1893.5	-819.4
1906.1	-789.5	1918.3	-759.5	1930.0	-729.3	1941.2	-698.9	1951.9	-668.3
1962.2	-637.6	1972.0	-606.7	1981.3	-575.6	1990.0	-544.4	1998.4	-513.1
2006.2	-481.6	2013.5	-450.1	2020.3	-418.4	2026.6	-386.6	2032.4	-354.7
2037.8	-322.8	2042.6	-290.7	2046.9	-258.6	2050.7	-226.4	2054.0	-194.2
2056.8	-161.9	2059.1	-129.5	2060.9	-97.2	2062.2	-64.8	2062.9	-32.4

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2382.0	0.0	2381.7	37.4	2380.8	74.8	2379.4	112.2	2377.3	149.6
2374.7	186.9	2371.5	224.2	2367.6	261.4	2363.2	298.5	2358.3	335.6
2352.7	372.6	2346.6	409.5	2339.8	446.3	2332.5	483.0	2324.7	519.6
2316.2	556.1	2307.2	592.4	2297.6	628.6	2287.4	664.6	2276.7	700.4
2265.4	736.1	2253.6	771.6	2241.2	806.9	2228.3	842.0	2214.8	876.9
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2122.4	1081.4	2105.2	1114.6	2087.4	1147.5	2069.1	1180.2	2050.3	1212.5
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556.1	2316.2	519.6	2324.7	483.0	2332.5	446.3	2339.8	409.5	2346.6
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2373.0	-1209.1	2391.7	-1171.7	2409.8	-1134.0	2427.3	-1096.0	2444.2	-1057.7
2460.5	-1019.2	2476.2	-980.4	2491.3	-941.4	2505.8	-902.1	2519.7	-862.7

2532.9	-823.0	2545.5	-783.1	2557.5	-743.0	2568.9	-702.8	2579.6	-662.3
2589.7	-621.7	2599.1	-581.0	2607.9	-540.1	2616.1	-499.0	2623.6	-457.9
2630.5	-416.6	2636.7	-375.3	2642.3	-333.8	2647.2	-292.3	2651.4	-250.6
2655.0	-209.0	2658.0	-167.2	2660.3	-125.5	2661.9	-83.7	2662.9	-41.8

6 1

2917.5	0.0	2917.1	45.8	2916.1	91.6	2914.3	137.4	2911.7	183.2
2908.5	228.9	2904.6	274.6	2899.9	320.2	2894.5	365.7	2888.4	411.1
2881.6	456.4	2874.1	501.6	2865.8	546.7	2856.9	591.6	2847.2	636.4
2836.9	681.1	2825.8	725.6	2814.1	769.9	2801.7	814.0	2788.5	857.9
2774.7	901.6	2760.2	945.0	2745.0	988.3	2729.2	1031.3	2712.6	1074.0
2695.4	1116.5	2677.6	1158.7	2659.0	1200.6	2639.8	1242.2	2620.0	1283.5
2599.5	1324.5	2578.4	1365.2	2556.6	1405.5	2534.2	1445.5	2511.2	1485.1
2487.6	1524.4	2463.3	1563.3	2438.5	1601.8	2413.0	1639.9	2387.0	1677.6
2360.3	1714.9	2333.1	1751.7	2305.3	1788.2	2276.9	1824.1	2248.0	1859.7
2218.5	1894.8	2188.5	1929.4	2157.9	1963.5	2126.8	1997.2	2095.1	2030.3
2063.0	2063.0	2030.3	2095.1	1997.2	2126.8	1963.5	2157.9	1929.4	2188.5
1894.8	2218.5	1859.7	2248.0	1824.1	2276.9	1788.2	2305.3	1751.7	2333.1
1714.9	2360.3	1677.6	2387.0	1639.9	2413.0	1601.8	2438.5	1563.3	2463.3
1524.4	2487.6	1485.1	2511.2	1445.5	2534.2	1405.5	2556.6	1365.2	2578.4
1324.5	2599.5	1283.5	2620.0	1242.2	2639.8	1200.6	2659.0	1158.7	2677.6
1116.5	2695.4	1074.0	2712.6	1031.3	2729.2	988.3	2745.0	945.0	2760.2
901.6	2774.7	857.9	2788.5	814.0	2801.7	769.9	2814.1	725.6	2825.8
681.1	2836.9	636.4	2847.2	591.6	2856.9	546.7	2865.8	501.6	2874.1
456.4	2881.6	411.1	2888.4	365.7	2894.5	320.2	2899.9	274.6	2904.6
228.9	2908.5	183.2	2911.7	137.4	2914.3	91.6	2916.1	45.8	2917.1
0.0	2917.5	-45.8	2917.1	-91.6	2916.1	-137.4	2914.3	-183.2	2911.7
-228.9	2908.5	-274.6	2904.6	-320.2	2899.9	-365.7	2894.5	-411.1	2888.4
-456.4	2881.6	-501.6	2874.1	-546.7	2865.8	-591.6	2856.9	-636.4	2847.2
-681.1	2836.9	-725.6	2825.8	-769.9	2814.1	-814.0	2801.7	-857.9	2788.5
-901.6	2774.7	-945.0	2760.2	-988.3	2745.0	-1031.3	2729.2	-1074.0	2712.6
-1116.5	2695.4	-1158.7	2677.6	-1200.6	2659.0	-1242.2	2639.8	-1283.5	2620.0
-1324.5	2599.5	-1365.2	2578.4	-1405.5	2556.6	-1445.5	2534.2	-1485.1	2511.2
-1524.4	2487.6	-1563.3	2463.3	-1601.8	2438.5	-1639.9	2413.0	-1677.6	2387.0
-1714.9	2360.3	-1751.7	2333.1	-1788.2	2305.3	-1824.1	2276.9	-1859.7	2248.0
-1894.8	2218.5	-1929.4	2188.5	-1963.5	2157.9	-1997.2	2126.8	-2030.3	2095.1
-2063.0	2063.0	-2095.1	2030.3	-2126.8	1997.2	-2157.9	1963.5	-2188.5	1929.4

-2218.5	1894.8	-2248.0	1859.7	-2276.9	1824.1	-2305.3	1788.2	-2333.1	1751.7
-2360.3	1714.9	-2387.0	1677.6	-2413.0	1639.9	-2438.5	1601.8	-2463.3	1563.3
-2487.6	1524.4	-2511.2	1485.1	-2534.2	1445.5	-2556.6	1405.5	-2578.4	1365.2
-2599.5	1324.5	-2620.0	1283.5	-2639.8	1242.2	-2659.0	1200.6	-2677.6	1158.7
-2695.4	1116.5	-2712.6	1074.0	-2729.2	1031.3	-2745.0	988.3	-2760.2	945.0
-2774.7	901.6	-2788.5	857.9	-2801.7	814.0	-2814.1	769.9	-2825.8	725.6
-2836.9	681.1	-2847.2	636.4	-2856.9	591.6	-2865.8	546.7	-2874.1	501.6
-2881.6	456.4	-2888.4	411.1	-2894.5	365.7	-2899.9	320.2	-2904.6	274.6
-2908.5	228.9	-2911.7	183.2	-2914.3	137.4	-2916.1	91.6	-2917.1	45.8
-2917.5	0.0	-2917.1	-45.8	-2916.1	-91.6	-2914.3	-137.4	-2911.7	-183.2
-2908.5	-228.9	-2904.6	-274.6	-2899.9	-320.2	-2894.5	-365.7	-2888.4	-411.1
-2881.6	-456.4	-2874.1	-501.6	-2865.8	-546.7	-2856.9	-591.6	-2847.2	-636.4
-2836.9	-681.1	-2825.8	-725.6	-2814.1	-769.9	-2801.7	-814.0	-2788.5	-857.9
-2774.7	-901.6	-2760.2	-945.0	-2745.0	-988.3	-2729.2	-1031.3	-2712.6	-1074.0
-2695.4	-1116.5	-2677.6	-1158.7	-2659.0	-1200.6	-2639.8	-1242.2	-2620.0	-1283.5
-2599.5	-1324.5	-2578.4	-1365.2	-2556.6	-1405.5	-2534.2	-1445.5	-2511.2	-1485.1
-2487.6	-1524.4	-2463.3	-1563.3	-2438.5	-1601.8	-2413.0	-1639.9	-2387.0	-1677.6
-2360.3	-1714.9	-2333.1	-1751.7	-2305.3	-1788.2	-2276.9	-1824.1	-2248.0	-1859.7
-2218.5	-1894.8	-2188.5	-1929.4	-2157.9	-1963.5	-2126.8	-1997.2	-2095.1	-2030.3
-2063.0	-2063.0	-2030.3	-2095.1	-1997.2	-2126.8	-1963.5	-2157.9	-1929.4	-2188.5
-1894.8	-2218.5	-1859.7	-2248.0	-1824.1	-2276.9	-1788.2	-2305.3	-1751.7	-2333.1
-1714.9	-2360.3	-1677.6	-2387.0	-1639.9	-2413.0	-1601.8	-2438.5	-1563.3	-2463.3
-1524.4	-2487.6	-1485.1	-2511.2	-1445.5	-2534.2	-1405.5	-2556.6	-1365.2	-2578.4
-1324.5	-2599.5	-1283.5	-2620.0	-1242.2	-2639.8	-1200.6	-2659.0	-1158.7	-2677.6
-1116.5	-2695.4	-1074.0	-2712.6	-1031.3	-2729.2	-988.3	-2745.0	-945.0	-2760.2
-901.6	-2774.7	-857.9	-2788.5	-814.0	-2801.7	-769.9	-2814.1	-725.6	-2825.8
-681.1	-2836.9	-636.4	-2847.2	-591.6	-2856.9	-546.7	-2865.8	-501.6	-2874.1
-456.4	-2881.6	-411.1	-2888.4	-365.7	-2894.5	-320.2	-2899.9	-274.6	-2904.6
-228.9	-2908.5	-183.2	-2911.7	-137.4	-2914.3	-91.6	-2916.1	-45.8	-2917.1
0.0	-2917.5	45.8	-2917.1	91.6	-2916.1	137.4	-2914.3	183.2	-2911.7
228.9	-2908.5	274.6	-2904.6	320.2	-2899.9	365.7	-2894.5	411.1	-2888.4
456.4	-2881.6	501.6	-2874.1	546.7	-2865.8	591.6	-2856.9	636.4	-2847.2
681.1	-2836.9	725.6	-2825.8	769.9	-2814.1	814.0	-2801.7	857.9	-2788.5
901.6	-2774.7	945.0	-2760.2	988.3	-2745.0	1031.3	-2729.2	1074.0	-2712.6
1116.5	-2695.4	1158.7	-2677.6	1200.6	-2659.0	1242.2	-2639.8	1283.5	-2620.0
1324.5	-2599.5	1365.2	-2578.4	1405.5	-2556.6	1445.5	-2534.2	1485.1	-2511.2
1524.4	-2487.6	1563.3	-2463.3	1601.8	-2438.5	1639.9	-2413.0	1677.6	-2387.0

1714.9	-2360.3	1751.7	-2333.1	1788.2	-2305.3	1824.1	-2276.9	1859.7	-2248.0
1894.8	-2218.5	1929.4	-2188.5	1963.5	-2157.9	1997.2	-2126.8	2030.3	-2095.1
2063.0	-2063.0	2095.1	-2030.3	2126.8	-1997.2	2157.9	-1963.5	2188.5	-1929.4
2218.5	-1894.8	2248.0	-1859.7	2276.9	-1824.1	2305.3	-1788.2	2333.1	-1751.7
2360.3	-1714.9	2387.0	-1677.6	2413.0	-1639.9	2438.5	-1601.8	2463.3	-1563.3
2487.6	-1524.4	2511.2	-1485.1	2534.2	-1445.5	2556.6	-1405.5	2578.4	-1365.2
2599.5	-1324.5	2620.0	-1283.5	2639.8	-1242.2	2659.0	-1200.6	2677.6	-1158.7
2695.4	-1116.5	2712.6	-1074.0	2729.2	-1031.3	2745.0	-988.3	2760.2	-945.0
2774.7	-901.6	2788.5	-857.9	2801.7	-814.0	2814.1	-769.9	2825.8	-725.6
2836.9	-681.1	2847.2	-636.4	2856.9	-591.6	2865.8	-546.7	2874.1	-501.6
2881.6	-456.4	2888.4	-411.1	2894.5	-365.7	2899.9	-320.2	2904.6	-274.6
2908.5	-228.9	2911.7	-183.2	2914.3	-137.4	2916.1	-91.6	2917.1	-45.8

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3151.3	0.0	3150.9	49.5	3149.7	99.0	3147.8	148.4	3145.1	197.9
3141.6	247.2	3137.3	296.6	3132.3	345.8	3126.5	395.0	3119.9	444.0
3112.5	493.0	3104.4	541.8	3095.5	590.5	3085.8	639.0	3075.4	687.4
3064.2	735.7	3052.3	783.7	3039.6	831.5	3026.2	879.2	3012.0	926.6
2997.1	973.8	2981.4	1020.8	2965.0	1067.5	2947.9	1113.9	2930.0	1160.1
2911.4	1206.0	2892.1	1251.5	2872.1	1296.8	2851.4	1341.8	2830.0	1386.4
2807.8	1430.7	2785.0	1474.6	2761.5	1518.2	2737.3	1561.3	2712.5	1604.1
2686.9	1646.6	2660.7	1688.6	2633.9	1730.1	2606.4	1771.3	2578.2	1812.0
2549.5	1852.3	2520.0	1892.1	2490.0	1931.5	2459.4	1970.3	2428.1	2008.7
2396.3	2046.6	2363.8	2084.0	2330.8	2120.9	2297.2	2157.2	2263.0	2193.0
2228.3	2228.3	2193.0	2263.0	2157.2	2297.2	2120.9	2330.8	2084.0	2363.8
2046.6	2396.3	2008.7	2428.1	1970.3	2459.4	1931.5	2490.0	1892.1	2520.0
1852.3	2549.5	1812.0	2578.2	1771.3	2606.4	1730.1	2633.9	1688.6	2660.7
1646.6	2686.9	1604.1	2712.5	1561.3	2737.3	1518.2	2761.5	1474.6	2785.0
1430.7	2807.8	1386.4	2830.0	1341.8	2851.4	1296.8	2872.1	1251.5	2892.1
1206.0	2911.4	1160.1	2930.0	1113.9	2947.9	1067.5	2965.0	1020.8	2981.4
973.8	2997.1	926.6	3012.0	879.2	3026.2	831.5	3039.6	783.7	3052.3
735.7	3064.2	687.4	3075.4	639.0	3085.8	590.5	3095.5	541.8	3104.4
493.0	3112.5	444.0	3119.9	395.0	3126.5	345.8	3132.3	296.6	3137.3
247.2	3141.6	197.9	3145.1	148.4	3147.8	99.0	3149.7	49.5	3150.9
0.0	3151.3	-49.5	3150.9	-99.0	3149.7	-148.4	3147.8	-197.9	3145.1
-247.2	3141.6	-296.6	3137.3	-345.8	3132.3	-395.0	3126.5	-444.0	3119.9
-493.0	3112.5	-541.8	3104.4	-590.5	3095.5	-639.0	3085.8	-687.4	3075.4

-735.7	3064.2	-783.7	3052.3	-831.5	3039.6	-879.2	3026.2	-926.6	3012.0
-973.8	2997.1	-1020.8	2981.4	-1067.5	2965.0	-1113.9	2947.9	-1160.1	2930.0
-1206.0	2911.4	-1251.5	2892.1	-1296.8	2872.1	-1341.8	2851.4	-1386.4	2830.0
-1430.7	2807.8	-1474.6	2785.0	-1518.2	2761.5	-1561.3	2737.3	-1604.1	2712.5
-1646.6	2686.9	-1688.6	2660.7	-1730.1	2633.9	-1771.3	2606.4	-1812.0	2578.2
-1852.3	2549.5	-1892.1	2520.0	-1931.5	2490.0	-1970.3	2459.4	-2008.7	2428.1
-2046.6	2396.3	-2084.0	2363.8	-2120.9	2330.8	-2157.2	2297.2	-2193.0	2263.0
-2228.3	2228.3	-2263.0	2193.0	-2297.2	2157.2	-2330.8	2120.9	-2363.8	2084.0
-2396.3	2046.6	-2428.1	2008.7	-2459.4	1970.3	-2490.0	1931.5	-2520.0	1892.1
-2549.5	1852.3	-2578.2	1812.0	-2606.4	1771.3	-2633.9	1730.1	-2660.7	1688.6
-2686.9	1646.6	-2712.5	1604.1	-2737.3	1561.3	-2761.5	1518.2	-2785.0	1474.6
-2807.8	1430.7	-2830.0	1386.4	-2851.4	1341.8	-2872.1	1296.8	-2892.1	1251.5
-2911.4	1206.0	-2930.0	1160.1	-2947.9	1113.9	-2965.0	1067.5	-2981.4	1020.8
-2997.1	973.8	-3012.0	926.6	-3026.2	879.2	-3039.6	831.5	-3052.3	783.7
-3064.2	735.7	-3075.4	687.4	-3085.8	639.0	-3095.5	590.5	-3104.4	541.8
-3112.5	493.0	-3119.9	444.0	-3126.5	395.0	-3132.3	345.8	-3137.3	296.6
-3141.6	247.2	-3145.1	197.9	-3147.8	148.4	-3149.7	99.0	-3150.9	49.5
-3151.3	0.0	-3150.9	-49.5	-3149.7	-99.0	-3147.8	-148.4	-3145.1	-197.9
-3141.6	-247.2	-3137.3	-296.6	-3132.3	-345.8	-3126.5	-395.0	-3119.9	-444.0
-3112.5	-493.0	-3104.4	-541.8	-3095.5	-590.5	-3085.8	-639.0	-3075.4	-687.4
-3064.2	-735.7	-3052.3	-783.7	-3039.6	-831.5	-3026.2	-879.2	-3012.0	-926.6
-2997.1	-973.8	-2981.4	-1020.8	-2965.0	-1067.5	-2947.9	-1113.9	-2930.0	-1160.1
-2911.4	-1206.0	-2892.1	-1251.5	-2872.1	-1296.8	-2851.4	-1341.8	-2830.0	-1386.4
-2807.8	-1430.7	-2785.0	-1474.6	-2761.5	-1518.2	-2737.3	-1561.3	-2712.5	-1604.1
-2686.9	-1646.6	-2660.7	-1688.6	-2633.9	-1730.1	-2606.4	-1771.3	-2578.2	-1812.0
-2549.5	-1852.3	-2520.0	-1892.1	-2490.0	-1931.5	-2459.4	-1970.3	-2428.1	-2008.7
-2396.3	-2046.6	-2363.8	-2084.0	-2330.8	-2120.9	-2297.2	-2157.2	-2263.0	-2193.0
-2228.3	-2228.3	-2193.0	-2263.0	-2157.2	-2297.2	-2120.9	-2330.8	-2084.0	-2363.8
-2046.6	-2396.3	-2008.7	-2428.1	-1970.3	-2459.4	-1931.5	-2490.0	-1892.1	-2520.0
-1852.3	-2549.5	-1812.0	-2578.2	-1771.3	-2606.4	-1730.1	-2633.9	-1688.6	-2660.7
-1646.6	-2686.9	-1604.1	-2712.5	-1561.3	-2737.3	-1518.2	-2761.5	-1474.6	-2785.0
-1430.7	-2807.8	-1386.4	-2830.0	-1341.8	-2851.4	-1296.8	-2872.1	-1251.5	-2892.1
-1206.0	-2911.4	-1160.1	-2930.0	-1113.9	-2947.9	-1067.5	-2965.0	-1020.8	-2981.4
-973.8	-2997.1	-926.6	-3012.0	-879.2	-3026.2	-831.5	-3039.6	-783.7	-3052.3
-735.7	-3064.2	-687.4	-3075.4	-639.0	-3085.8	-590.5	-3095.5	-541.8	-3104.4
-493.0	-3112.5	-444.0	-3119.9	-395.0	-3126.5	-345.8	-3132.3	-296.6	-3137.3
-247.2	-3141.6	-197.9	-3145.1	-148.4	-3147.8	-99.0	-3149.7	-49.5	-3150.9

0.0	-3151.3	49.5	-3150.9	99.0	-3149.7	148.4	-3147.8	197.9	-3145.1
247.2	-3141.6	296.6	-3137.3	345.8	-3132.3	395.0	-3126.5	444.0	-3119.9
493.0	-3112.5	541.8	-3104.4	590.5	-3095.5	639.0	-3085.8	687.4	-3075.4
735.7	-3064.2	783.7	-3052.3	831.5	-3039.6	879.2	-3026.2	926.6	-3012.0
973.8	-2997.1	1020.8	-2981.4	1067.5	-2965.0	1113.9	-2947.9	1160.1	-2930.0
1206.0	-2911.4	1251.5	-2892.1	1296.8	-2872.1	1341.8	-2851.4	1386.4	-2830.0
1430.7	-2807.8	1474.6	-2785.0	1518.2	-2761.5	1561.3	-2737.3	1604.1	-2712.5
1646.6	-2686.9	1688.6	-2660.7	1730.1	-2633.9	1771.3	-2606.4	1812.0	-2578.2
1852.3	-2549.5	1892.1	-2520.0	1931.5	-2490.0	1970.3	-2459.4	2008.7	-2428.1
2046.6	-2396.3	2084.0	-2363.8	2120.9	-2330.8	2157.2	-2297.2	2193.0	-2263.0
2228.3	-2228.3	2263.0	-2193.0	2297.2	-2157.2	2330.8	-2120.9	2363.8	-2084.0
2396.3	-2046.6	2428.1	-2008.7	2459.4	-1970.3	2490.0	-1931.5	2520.0	-1892.1
2549.5	-1852.3	2578.2	-1812.0	2606.4	-1771.3	2633.9	-1730.1	2660.7	-1688.6
2686.9	-1646.6	2712.5	-1604.1	2737.3	-1561.3	2761.5	-1518.2	2785.0	-1474.6
2807.8	-1430.7	2830.0	-1386.4	2851.4	-1341.8	2872.1	-1296.8	2892.1	-1251.5
2911.4	-1206.0	2930.0	-1160.1	2947.9	-1113.9	2965.0	-1067.5	2981.4	-1020.8
2997.1	-973.8	3012.0	-926.6	3026.2	-879.2	3039.6	-831.5	3052.3	-783.7
3064.2	-735.7	3075.4	-687.4	3085.8	-639.0	3095.5	-590.5	3104.4	-541.8
3112.5	-493.0	3119.9	-444.0	3126.5	-395.0	3132.3	-345.8	3137.3	-296.6
3141.6	-247.2	3145.1	-197.9	3147.8	-148.4	3149.7	-99.0	3150.9	-49.5

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3368.9	0.0	3368.5	52.9	3367.3	105.8	3365.2	158.7	3362.3	211.5
3358.5	264.3	3354.0	317.0	3348.6	369.7	3342.4	422.2	3335.3	474.7
3327.4	527.0	3318.8	579.2	3309.2	631.3	3298.9	683.2	3287.8	734.9
3275.8	786.5	3263.1	837.8	3249.5	889.0	3235.2	939.9	3220.0	990.6
3204.0	1041.1	3187.3	1091.3	3169.8	1141.2	3151.4	1190.8	3132.3	1240.2
3112.5	1289.2	3091.8	1338.0	3070.4	1386.4	3048.3	1434.4	3025.4	1482.1
3001.7	1529.5	2977.3	1576.4	2952.2	1623.0	2926.3	1669.2	2899.8	1714.9
2872.5	1760.3	2844.5	1805.2	2815.8	1849.6	2786.4	1893.6	2756.3	1937.1
2725.5	1980.2	2694.1	2022.8	2662.0	2064.8	2629.2	2106.4	2595.8	2147.4
2561.7	2187.9	2527.1	2227.9	2491.8	2267.3	2455.8	2306.2	2419.3	2344.5
2382.2	2382.2	2344.5	2419.3	2306.2	2455.8	2267.3	2491.8	2227.9	2527.1
2187.9	2561.7	2147.4	2595.8	2106.4	2629.2	2064.8	2662.0	2022.8	2694.1
1980.2	2725.5	1937.1	2756.3	1893.6	2786.4	1849.6	2815.8	1805.2	2844.5
1760.3	2872.5	1714.9	2899.8	1669.2	2926.3	1623.0	2952.2	1576.4	2977.3
1529.5	3001.7	1482.1	3025.4	1434.4	3048.3	1386.4	3070.4	1338.0	3091.8

1289.2	3112.5	1240.2	3132.3	1190.8	3151.4	1141.2	3169.8	1091.3	3187.3
1041.1	3204.0	990.6	3220.0	939.9	3235.2	889.0	3249.5	837.8	3263.1
786.5	3275.8	734.9	3287.8	683.2	3298.9	631.3	3309.2	579.2	3318.8
527.0	3327.4	474.7	3335.3	422.2	3342.4	369.7	3348.6	317.0	3354.0
264.3	3358.5	211.5	3362.3	158.7	3365.2	105.8	3367.3	52.9	3368.5
0.0	3368.9	-52.9	3368.5	-105.8	3367.3	-158.7	3365.2	-211.5	3362.3
-264.3	3358.5	-317.0	3354.0	-369.7	3348.6	-422.2	3342.4	-474.7	3335.3
-527.0	3327.4	-579.2	3318.8	-631.3	3309.2	-683.2	3298.9	-734.9	3287.8
-786.5	3275.8	-837.8	3263.1	-889.0	3249.5	-939.9	3235.2	-990.6	3220.0
-1041.1	3204.0	-1091.3	3187.3	-1141.2	3169.8	-1190.8	3151.4	-1240.2	3132.3
-1289.2	3112.5	-1338.0	3091.8	-1386.4	3070.4	-1434.4	3048.3	-1482.1	3025.4
-1529.5	3001.7	-1576.4	2977.3	-1623.0	2952.2	-1669.2	2926.3	-1714.9	2899.8
-1760.3	2872.5	-1805.2	2844.5	-1849.6	2815.8	-1893.6	2786.4	-1937.1	2756.3
-1980.2	2725.5	-2022.8	2694.1	-2064.8	2662.0	-2106.4	2629.2	-2147.4	2595.8
-2187.9	2561.7	-2227.9	2527.1	-2267.3	2491.8	-2306.2	2455.8	-2344.5	2419.3
-2382.2	2382.2	-2419.3	2344.5	-2455.8	2306.2	-2491.8	2267.3	-2527.1	2227.9
-2561.7	2187.9	-2595.8	2147.4	-2629.2	2106.4	-2662.0	2064.8	-2694.1	2022.8
-2725.5	1980.2	-2756.3	1937.1	-2786.4	1893.6	-2815.8	1849.6	-2844.5	1805.2
-2872.5	1760.3	-2899.8	1714.9	-2926.3	1669.2	-2952.2	1623.0	-2977.3	1576.4
-3001.7	1529.5	-3025.4	1482.1	-3048.3	1434.4	-3070.4	1386.4	-3091.8	1338.0
-3112.5	1289.2	-3132.3	1240.2	-3151.4	1190.8	-3169.8	1141.2	-3187.3	1091.3
-3204.0	1041.1	-3220.0	990.6	-3235.2	939.9	-3249.5	889.0	-3263.1	837.8
-3275.8	786.5	-3287.8	734.9	-3298.9	683.2	-3309.2	631.3	-3318.8	579.2
-3327.4	527.0	-3335.3	474.7	-3342.4	422.2	-3348.6	369.7	-3354.0	317.0
-3358.5	264.3	-3362.3	211.5	-3365.2	158.7	-3367.3	105.8	-3368.5	52.9
-3368.9	0.0	-3368.5	-52.9	-3367.3	-105.8	-3365.2	-158.7	-3362.3	-211.5
-3358.5	-264.3	-3354.0	-317.0	-3348.6	-369.7	-3342.4	-422.2	-3335.3	-474.7
-3327.4	-527.0	-3318.8	-579.2	-3309.2	-631.3	-3298.9	-683.2	-3287.8	-734.9
-3275.8	-786.5	-3263.1	-837.8	-3249.5	-889.0	-3235.2	-939.9	-3220.0	-990.6
-3204.0	-1041.1	-3187.3	-1091.3	-3169.8	-1141.2	-3151.4	-1190.8	-3132.3	-1240.2
-3112.5	-1289.2	-3091.8	-1338.0	-3070.4	-1386.4	-3048.3	-1434.4	-3025.4	-1482.1
-3001.7	-1529.5	-2977.3	-1576.4	-2952.2	-1623.0	-2926.3	-1669.2	-2899.8	-1714.9
-2872.5	-1760.3	-2844.5	-1805.2	-2815.8	-1849.6	-2786.4	-1893.6	-2756.3	-1937.1
-2725.5	-1980.2	-2694.1	-2022.8	-2662.0	-2064.8	-2629.2	-2106.4	-2595.8	-2147.4
-2561.7	-2187.9	-2527.1	-2227.9	-2491.8	-2267.3	-2455.8	-2306.2	-2419.3	-2344.5
-2382.2	-2382.2	-2344.5	-2419.3	-2306.2	-2455.8	-2267.3	-2491.8	-2227.9	-2527.1
-2187.9	-2561.7	-2147.4	-2595.8	-2106.4	-2629.2	-2064.8	-2662.0	-2022.8	-2694.1

-1980.2	-2725.5	-1937.1	-2756.3	-1893.6	-2786.4	-1849.6	-2815.8	-1805.2	-2844.5
-1760.3	-2872.5	-1714.9	-2899.8	-1669.2	-2926.3	-1623.0	-2952.2	-1576.4	-2977.3
-1529.5	-3001.7	-1482.1	-3025.4	-1434.4	-3048.3	-1386.4	-3070.4	-1338.0	-3091.8
-1289.2	-3112.5	-1240.2	-3132.3	-1190.8	-3151.4	-1141.2	-3169.8	-1091.3	-3187.3
-1041.1	-3204.0	-990.6	-3220.0	-939.9	-3235.2	-889.0	-3249.5	-837.8	-3263.1
-786.5	-3275.8	-734.9	-3287.8	-683.2	-3298.9	-631.3	-3309.2	-579.2	-3318.8
-527.0	-3327.4	-474.7	-3335.3	-422.2	-3342.4	-369.7	-3348.6	-317.0	-3354.0
-264.3	-3358.5	-211.5	-3362.3	-158.7	-3365.2	-105.8	-3367.3	-52.9	-3368.5
0.0	-3368.9	52.9	-3368.5	105.8	-3367.3	158.7	-3365.2	211.5	-3362.3
264.3	-3358.5	317.0	-3354.0	369.7	-3348.6	422.2	-3342.4	474.7	-3335.3
527.0	-3327.4	579.2	-3318.8	631.3	-3309.2	683.2	-3298.9	734.9	-3287.8
786.5	-3275.8	837.8	-3263.1	889.0	-3249.5	939.9	-3235.2	990.6	-3220.0
1041.1	-3204.0	1091.3	-3187.3	1141.2	-3169.8	1190.8	-3151.4	1240.2	-3132.3
1289.2	-3112.5	1338.0	-3091.8	1386.4	-3070.4	1434.4	-3048.3	1482.1	-3025.4
1529.5	-3001.7	1576.4	-2977.3	1623.0	-2952.2	1669.2	-2926.3	1714.9	-2899.8
1760.3	-2872.5	1805.2	-2844.5	1849.6	-2815.8	1893.6	-2786.4	1937.1	-2756.3
1980.2	-2725.5	2022.8	-2694.1	2064.8	-2662.0	2106.4	-2629.2	2147.4	-2595.8
2187.9	-2561.7	2227.9	-2527.1	2267.3	-2491.8	2306.2	-2455.8	2344.5	-2419.3
2382.2	-2382.2	2419.3	-2344.5	2455.8	-2306.2	2491.8	-2267.3	2527.1	-2227.9
2561.7	-2187.9	2595.8	-2147.4	2629.2	-2106.4	2662.0	-2064.8	2694.1	-2022.8
2725.5	-1980.2	2756.3	-1937.1	2786.4	-1893.6	2815.8	-1849.6	2844.5	-1805.2
2872.5	-1760.3	2899.8	-1714.9	2926.3	-1669.2	2952.2	-1623.0	2977.3	-1576.4
3001.7	-1529.5	3025.4	-1482.1	3048.3	-1434.4	3070.4	-1386.4	3091.8	-1338.0
3112.5	-1289.2	3132.3	-1240.2	3151.4	-1190.8	3169.8	-1141.2	3187.3	-1091.3
3204.0	-1041.1	3220.0	-990.6	3235.2	-939.9	3249.5	-889.0	3263.1	-837.8
3275.8	-786.5	3287.8	-734.9	3298.9	-683.2	3309.2	-631.3	3318.8	-579.2
3327.4	-527.0	3335.3	-474.7	3342.4	-422.2	3348.6	-369.7	3354.0	-317.0
3358.5	-264.3	3362.3	-211.5	3365.2	-158.7	3367.3	-105.8	3368.5	-52.9

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3573.3	0.0	3572.9	56.1	3571.5	112.2	3569.3	168.3	3566.3	224.4
3562.3	280.4	3557.4	336.3	3551.7	392.1	3545.1	447.9	3537.7	503.5
3529.3	559.0	3520.1	614.4	3510.0	669.6	3499.1	724.6	3487.2	779.5
3474.6	834.2	3461.0	888.6	3446.7	942.9	3431.4	996.9	3415.3	1050.7
3398.4	1104.2	3380.7	1157.5	3362.1	1210.4	3342.6	1263.1	3322.4	1315.4
3301.3	1367.4	3279.4	1419.1	3256.7	1470.5	3233.2	1521.4	3208.9	1572.0
3183.8	1622.2	3158.0	1672.1	3131.3	1721.5	3103.9	1770.4	3075.7	1819.0

3046.7	1867.0	3017.0	1914.7	2986.6	1961.8	2955.4	2008.5	2923.5	2054.7
2890.9	2100.3	2857.5	2145.5	2823.5	2190.1	2788.7	2234.2	2753.3	2277.7
2717.2	2320.7	2680.4	2363.1	2642.9	2404.9	2604.8	2446.1	2566.1	2486.7
2526.7	2526.7	2486.7	2566.1	2446.1	2604.8	2404.9	2642.9	2363.1	2680.4
2320.7	2717.2	2277.7	2753.3	2234.2	2788.7	2190.1	2823.5	2145.5	2857.5
2100.3	2890.9	2054.7	2923.5	2008.5	2955.4	1961.8	2986.6	1914.7	3017.0
1867.0	3046.7	1819.0	3075.7	1770.4	3103.9	1721.5	3131.3	1672.1	3158.0
1622.2	3183.8	1572.0	3208.9	1521.4	3233.2	1470.5	3256.7	1419.1	3279.4
1367.4	3301.3	1315.4	3322.4	1263.1	3342.6	1210.4	3362.1	1157.5	3380.7
1104.2	3398.4	1050.7	3415.3	996.9	3431.4	942.9	3446.7	888.6	3461.0
834.2	3474.6	779.5	3487.2	724.6	3499.1	669.6	3510.0	614.4	3520.1
559.0	3529.3	503.5	3537.7	447.9	3545.1	392.1	3551.7	336.3	3557.4
280.4	3562.3	224.4	3566.3	168.3	3569.3	112.2	3571.5	56.1	3572.9
0.0	3573.3	-56.1	3572.9	-112.2	3571.5	-168.3	3569.3	-224.4	3566.3
-280.4	3562.3	-336.3	3557.4	-392.1	3551.7	-447.9	3545.1	-503.5	3537.7
-559.0	3529.3	-614.4	3520.1	-669.6	3510.0	-724.6	3499.1	-779.5	3487.2
-834.2	3474.6	-888.6	3461.0	-942.9	3446.7	-996.9	3431.4	-1050.7	3415.3
-1104.2	3398.4	-1157.5	3380.7	-1210.4	3362.1	-1263.1	3342.6	-1315.4	3322.4
-1367.4	3301.3	-1419.1	3279.4	-1470.5	3256.7	-1521.4	3233.2	-1572.0	3208.9
-1622.2	3183.8	-1672.1	3158.0	-1721.5	3131.3	-1770.4	3103.9	-1819.0	3075.7
-1867.0	3046.7	-1914.7	3017.0	-1961.8	2986.6	-2008.5	2955.4	-2054.7	2923.5
-2100.3	2890.9	-2145.5	2857.5	-2190.1	2823.5	-2234.2	2788.7	-2277.7	2753.3
-2320.7	2717.2	-2363.1	2680.4	-2404.9	2642.9	-2446.1	2604.8	-2486.7	2566.1
-2526.7	2526.7	-2566.1	2486.7	-2604.8	2446.1	-2642.9	2404.9	-2680.4	2363.1
-2717.2	2320.7	-2753.3	2277.7	-2788.7	2234.2	-2823.5	2190.1	-2857.5	2145.5
-2890.9	2100.3	-2923.5	2054.7	-2955.4	2008.5	-2986.6	1961.8	-3017.0	1914.7
-3046.7	1867.0	-3075.7	1819.0	-3103.9	1770.4	-3131.3	1721.5	-3158.0	1672.1
-3183.8	1622.2	-3208.9	1572.0	-3233.2	1521.4	-3256.7	1470.5	-3279.4	1419.1
-3301.3	1367.4	-3322.4	1315.4	-3342.6	1263.1	-3362.1	1210.4	-3380.7	1157.5
-3398.4	1104.2	-3415.3	1050.7	-3431.4	996.9	-3446.7	942.9	-3461.0	888.6
-3474.6	834.2	-3487.2	779.5	-3499.1	724.6	-3510.0	669.6	-3520.1	614.4
-3529.3	559.0	-3537.7	503.5	-3545.1	447.9	-3551.7	392.1	-3557.4	336.3
-3562.3	280.4	-3566.3	224.4	-3569.3	168.3	-3571.5	112.2	-3572.9	56.1
-3573.3	0.0	-3572.9	-56.1	-3571.5	-112.2	-3569.3	-168.3	-3566.3	-224.4
-3562.3	-280.4	-3557.4	-336.3	-3551.7	-392.1	-3545.1	-447.9	-3537.7	-503.5
-3529.3	-559.0	-3520.1	-614.4	-3510.0	-669.6	-3499.1	-724.6	-3487.2	-779.5
-3474.6	-834.2	-3461.0	-888.6	-3446.7	-942.9	-3431.4	-996.9	-3415.3	-1050.7

-3398.4	-1104.2	-3380.7	-1157.5	-3362.1	-1210.4	-3342.6	-1263.1	-3322.4	-1315.4
-3301.3	-1367.4	-3279.4	-1419.1	-3256.7	-1470.5	-3233.2	-1521.4	-3208.9	-1572.0
-3183.8	-1622.2	-3158.0	-1672.1	-3131.3	-1721.5	-3103.9	-1770.4	-3075.7	-1819.0
-3046.7	-1867.0	-3017.0	-1914.7	-2986.6	-1961.8	-2955.4	-2008.5	-2923.5	-2054.7
-2890.9	-2100.3	-2857.5	-2145.5	-2823.5	-2190.1	-2788.7	-2234.2	-2753.3	-2277.7
-2717.2	-2320.7	-2680.4	-2363.1	-2642.9	-2404.9	-2604.8	-2446.1	-2566.1	-2486.7
-2526.7	-2526.7	-2486.7	-2566.1	-2446.1	-2604.8	-2404.9	-2642.9	-2363.1	-2680.4
-2320.7	-2717.2	-2277.7	-2753.3	-2234.2	-2788.7	-2190.1	-2823.5	-2145.5	-2857.5
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-3757.1	-1220.8	-3737.5	-1279.6	-3716.9	-1338.2	-3695.5	-1396.4	-3673.1	-1454.3
-3649.8	-1511.8	-3625.6	-1568.9	-3600.5	-1625.7	-3574.5	-1682.0	-3547.6	-1738.0
-3519.9	-1793.5	-3491.3	-1848.5	-3461.8	-1903.2	-3431.5	-1957.3	-3400.3	-2011.0
-3368.3	-2064.1	-3335.5	-2116.8	-3301.8	-2168.9	-3267.4	-2220.5	-3232.1	-2271.5
-3196.0	-2322.0	-3159.1	-2371.9	-3121.5	-2421.3	-3083.1	-2470.0	-3043.9	-2518.1
-3004.0	-2565.6	-2963.3	-2612.5	-2921.9	-2658.7	-2879.8	-2704.3	-2836.9	-2749.2
-2793.4	-2793.4	-2749.2	-2836.9	-2704.3	-2879.8	-2658.7	-2921.9	-2612.5	-2963.3
-2565.6	-3004.0	-2518.1	-3043.9	-2470.0	-3083.1	-2421.3	-3121.5	-2371.9	-3159.1
-2322.0	-3196.0	-2271.5	-3232.1	-2220.5	-3267.4	-2168.9	-3301.8	-2116.8	-3335.5
-2064.1	-3368.3	-2011.0	-3400.3	-1957.3	-3431.5	-1903.2	-3461.8	-1848.5	-3491.3
-1793.5	-3519.9	-1738.0	-3547.6	-1682.0	-3574.5	-1625.7	-3600.5	-1568.9	-3625.6
-1511.8	-3649.8	-1454.3	-3673.1	-1396.4	-3695.5	-1338.2	-3716.9	-1279.6	-3737.5
-1220.8	-3757.1	-1161.6	-3775.8	-1102.1	-3793.6	-1042.4	-3810.5	-982.4	-3826.4
-922.2	-3841.3	-861.8	-3855.3	-801.1	-3868.4	-740.2	-3880.5	-679.2	-3891.7
-618.0	-3901.8	-556.6	-3911.1	-495.1	-3919.3	-433.5	-3926.6	-371.8	-3932.9
-310.0	-3938.3	-248.1	-3942.7	-186.1	-3946.1	-124.1	-3948.5	-62.1	-3950.0
0.0	-3950.5	62.1	-3950.0	124.1	-3948.5	186.1	-3946.1	248.1	-3942.7
310.0	-3938.3	371.8	-3932.9	433.5	-3926.6	495.1	-3919.3	556.6	-3911.1
618.0	-3901.8	679.2	-3891.7	740.2	-3880.5	801.1	-3868.4	861.8	-3855.3
922.2	-3841.3	982.4	-3826.4	1042.4	-3810.5	1102.1	-3793.6	1161.6	-3775.8
1220.8	-3757.1	1279.6	-3737.5	1338.2	-3716.9	1396.4	-3695.5	1454.3	-3673.1

1511.8	-3649.8	1568.9	-3625.6	1625.7	-3600.5	1682.0	-3574.5	1738.0	-3547.6
1793.5	-3519.9	1848.5	-3491.3	1903.2	-3461.8	1957.3	-3431.5	2011.0	-3400.3
2064.1	-3368.3	2116.8	-3335.5	2168.9	-3301.8	2220.5	-3267.4	2271.5	-3232.1
2322.0	-3196.0	2371.9	-3159.1	2421.3	-3121.5	2470.0	-3083.1	2518.1	-3043.9
2565.6	-3004.0	2612.5	-2963.3	2658.7	-2921.9	2704.3	-2879.8	2749.2	-2836.9
2793.4	-2793.4	2836.9	-2749.2	2879.8	-2704.3	2921.9	-2658.7	2963.3	-2612.5
3004.0	-2565.6	3043.9	-2518.1	3083.1	-2470.0	3121.5	-2421.3	3159.1	-2371.9
3196.0	-2322.0	3232.1	-2271.5	3267.4	-2220.5	3301.8	-2168.9	3335.5	-2116.8
3368.3	-2064.1	3400.3	-2011.0	3431.5	-1957.3	3461.8	-1903.2	3491.3	-1848.5
3519.9	-1793.5	3547.6	-1738.0	3574.5	-1682.0	3600.5	-1625.7	3625.6	-1568.9
3649.8	-1511.8	3673.1	-1454.3	3695.5	-1396.4	3716.9	-1338.2	3737.5	-1279.6
3757.1	-1220.8	3775.8	-1161.6	3793.6	-1102.1	3810.5	-1042.4	3826.4	-982.4
3841.3	-922.2	3855.3	-861.8	3868.4	-801.1	3880.5	-740.2	3891.7	-679.2
3901.8	-618.0	3911.1	-556.6	3919.3	-495.1	3926.6	-433.5	3932.9	-371.8
3938.3	-310.0	3942.7	-248.1	3946.1	-186.1	3948.5	-124.1	3950.0	-62.1

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4126.2	0.0	4125.6	64.8	4124.1	129.6	4121.6	194.4	4118.0	259.1
4113.4	323.7	4107.8	388.3	4101.2	452.8	4093.6	517.1	4085.0	581.4
4075.4	645.5	4064.7	709.4	4053.1	773.2	4040.4	836.7	4026.8	900.1
4012.2	963.2	3996.5	1026.1	3979.9	1088.8	3962.3	1151.2	3943.8	1213.3
3924.2	1275.1	3903.7	1336.5	3882.2	1397.7	3859.8	1458.5	3836.4	1518.9
3812.1	1579.0	3786.8	1638.7	3760.6	1698.0	3733.5	1756.8	3705.4	1815.3
3676.4	1873.2	3646.6	1930.8	3615.8	1987.8	3584.1	2044.3	3551.6	2100.4
3518.1	2155.9	3483.8	2210.9	3448.7	2265.4	3412.7	2319.2	3375.8	2372.6
3338.1	2425.3	3299.6	2477.4	3260.3	2529.0	3220.2	2579.8	3179.3	2630.1
3137.6	2679.7	3095.1	2728.7	3051.8	2777.0	3007.8	2824.5	2963.1	2871.4
2917.6	2917.6	2871.4	2963.1	2824.5	3007.8	2777.0	3051.8	2728.7	3095.1
2679.7	3137.6	2630.1	3179.3	2579.8	3220.2	2529.0	3260.3	2477.4	3299.6
2425.3	3338.1	2372.6	3375.8	2319.2	3412.7	2265.4	3448.7	2210.9	3483.8
2155.9	3518.1	2100.4	3551.6	2044.3	3584.1	1987.8	3615.8	1930.8	3646.6
1873.2	3676.4	1815.3	3705.4	1756.8	3733.5	1698.0	3760.6	1638.7	3786.8
1579.0	3812.1	1518.9	3836.4	1458.5	3859.8	1397.7	3882.2	1336.5	3903.7
1275.1	3924.2	1213.3	3943.8	1151.2	3962.3	1088.8	3979.9	1026.1	3996.5
963.2	4012.2	900.1	4026.8	836.7	4040.4	773.2	4053.1	709.4	4064.7
645.5	4075.4	581.4	4085.0	517.1	4093.6	452.8	4101.2	388.3	4107.8
323.7	4113.4	259.1	4118.0	194.4	4121.6	129.6	4124.1	64.8	4125.6

0.0	4126.2	-64.8	4125.6	-129.6	4124.1	-194.4	4121.6	-259.1	4118.0
-323.7	4113.4	-388.3	4107.8	-452.8	4101.2	-517.1	4093.6	-581.4	4085.0
-645.5	4075.4	-709.4	4064.7	-773.2	4053.1	-836.7	4040.4	-900.1	4026.8
-963.2	4012.2	-1026.1	3996.5	-1088.8	3979.9	-1151.2	3962.3	-1213.3	3943.8
-1275.1	3924.2	-1336.5	3903.7	-1397.7	3882.2	-1458.5	3859.8	-1518.9	3836.4
-1579.0	3812.1	-1638.7	3786.8	-1698.0	3760.6	-1756.8	3733.5	-1815.3	3705.4
-1873.2	3676.4	-1930.8	3646.6	-1987.8	3615.8	-2044.3	3584.1	-2100.4	3551.6
-2155.9	3518.1	-2210.9	3483.8	-2265.4	3448.7	-2319.2	3412.7	-2372.6	3375.8
-2425.3	3338.1	-2477.4	3299.6	-2529.0	3260.3	-2579.8	3220.2	-2630.1	3179.3
-2679.7	3137.6	-2728.7	3095.1	-2777.0	3051.8	-2824.5	3007.8	-2871.4	2963.1
-2917.6	2917.6	-2963.1	2871.4	-3007.8	2824.5	-3051.8	2777.0	-3095.1	2728.7
-3137.6	2679.7	-3179.3	2630.1	-3220.2	2579.8	-3260.3	2529.0	-3299.6	2477.4
-3338.1	2425.3	-3375.8	2372.6	-3412.7	2319.2	-3448.7	2265.4	-3483.8	2210.9
-3518.1	2155.9	-3551.6	2100.4	-3584.1	2044.3	-3615.8	1987.8	-3646.6	1930.8
-3676.4	1873.2	-3705.4	1815.3	-3733.5	1756.8	-3760.6	1698.0	-3786.8	1638.7
-3812.1	1579.0	-3836.4	1518.9	-3859.8	1458.5	-3882.2	1397.7	-3903.7	1336.5
-3924.2	1275.1	-3943.8	1213.3	-3962.3	1151.2	-3979.9	1088.8	-3996.5	1026.1
-4012.2	963.2	-4026.8	900.1	-4040.4	836.7	-4053.1	773.2	-4064.7	709.4
-4075.4	645.5	-4085.0	581.4	-4093.6	517.1	-4101.2	452.8	-4107.8	388.3
-4113.4	323.7	-4118.0	259.1	-4121.6	194.4	-4124.1	129.6	-4125.6	64.8
-4126.2	0.0	-4125.6	-64.8	-4124.1	-129.6	-4121.6	-194.4	-4118.0	-259.1
-4113.4	-323.7	-4107.8	-388.3	-4101.2	-452.8	-4093.6	-517.1	-4085.0	-581.4
-4075.4	-645.5	-4064.7	-709.4	-4053.1	-773.2	-4040.4	-836.7	-4026.8	-900.1
-4012.2	-963.2	-3996.5	-1026.1	-3979.9	-1088.8	-3962.3	-1151.2	-3943.8	-1213.3
-3924.2	-1275.1	-3903.7	-1336.5	-3882.2	-1397.7	-3859.8	-1458.5	-3836.4	-1518.9
-3812.1	-1579.0	-3786.8	-1638.7	-3760.6	-1698.0	-3733.5	-1756.8	-3705.4	-1815.3
-3676.4	-1873.2	-3646.6	-1930.8	-3615.8	-1987.8	-3584.1	-2044.3	-3551.6	-2100.4
-3518.1	-2155.9	-3483.8	-2210.9	-3448.7	-2265.4	-3412.7	-2319.2	-3375.8	-2372.6
-3338.1	-2425.3	-3299.6	-2477.4	-3260.3	-2529.0	-3220.2	-2579.8	-3179.3	-2630.1
-3137.6	-2679.7	-3095.1	-2728.7	-3051.8	-2777.0	-3007.8	-2824.5	-2963.1	-2871.4
-2917.6	-2917.6	-2871.4	-2963.1	-2824.5	-3007.8	-2777.0	-3051.8	-2728.7	-3095.1
-2679.7	-3137.6	-2630.1	-3179.3	-2579.8	-3220.2	-2529.0	-3260.3	-2477.4	-3299.6
-2425.3	-3338.1	-2372.6	-3375.8	-2319.2	-3412.7	-2265.4	-3448.7	-2210.9	-3483.8
-2155.9	-3518.1	-2100.4	-3551.6	-2044.3	-3584.1	-1987.8	-3615.8	-1930.8	-3646.6
-1873.2	-3676.4	-1815.3	-3705.4	-1756.8	-3733.5	-1698.0	-3760.6	-1638.7	-3786.8
-1579.0	-3812.1	-1518.9	-3836.4	-1458.5	-3859.8	-1397.7	-3882.2	-1336.5	-3903.7
-1275.1	-3924.2	-1213.3	-3943.8	-1151.2	-3962.3	-1088.8	-3979.9	-1026.1	-3996.5

-963.2	-4012.2	-900.1	-4026.8	-836.7	-4040.4	-773.2	-4053.1	-709.4	-4064.7
-645.5	-4075.4	-581.4	-4085.0	-517.1	-4093.6	-452.8	-4101.2	-388.3	-4107.8
-323.7	-4113.4	-259.1	-4118.0	-194.4	-4121.6	-129.6	-4124.1	-64.8	-4125.6
0.0	-4126.2	64.8	-4125.6	129.6	-4124.1	194.4	-4121.6	259.1	-4118.0
323.7	-4113.4	388.3	-4107.8	452.8	-4101.2	517.1	-4093.6	581.4	-4085.0
645.5	-4075.4	709.4	-4064.7	773.2	-4053.1	836.7	-4040.4	900.1	-4026.8
963.2	-4012.2	1026.1	-3996.5	1088.8	-3979.9	1151.2	-3962.3	1213.3	-3943.8
1275.1	-3924.2	1336.5	-3903.7	1397.7	-3882.2	1458.5	-3859.8	1518.9	-3836.4
1579.0	-3812.1	1638.7	-3786.8	1698.0	-3760.6	1756.8	-3733.5	1815.3	-3705.4
1873.2	-3676.4	1930.8	-3646.6	1987.8	-3615.8	2044.3	-3584.1	2100.4	-3551.6
2155.9	-3518.1	2210.9	-3483.8	2265.4	-3448.7	2319.2	-3412.7	2372.6	-3375.8
2425.3	-3338.1	2477.4	-3299.6	2529.0	-3260.3	2579.8	-3220.2	2630.1	-3179.3
2679.7	-3137.6	2728.7	-3095.1	2777.0	-3051.8	2824.5	-3007.8	2871.4	-2963.1
2917.6	-2917.6	2963.1	-2871.4	3007.8	-2824.5	3051.8	-2777.0	3095.1	-2728.7
3137.6	-2679.7	3179.3	-2630.1	3220.2	-2579.8	3260.3	-2529.0	3299.6	-2477.4
3338.1	-2425.3	3375.8	-2372.6	3412.7	-2319.2	3448.7	-2265.4	3483.8	-2210.9
3518.1	-2155.9	3551.6	-2100.4	3584.1	-2044.3	3615.8	-1987.8	3646.6	-1930.8
3676.4	-1873.2	3705.4	-1815.3	3733.5	-1756.8	3760.6	-1698.0	3786.8	-1638.7
3812.1	-1579.0	3836.4	-1518.9	3859.8	-1458.5	3882.2	-1397.7	3903.7	-1336.5
3924.2	-1275.1	3943.8	-1213.3	3962.3	-1151.2	3979.9	-1088.8	3996.5	-1026.1
4012.2	-963.2	4026.8	-900.1	4040.4	-836.7	4053.1	-773.2	4064.7	-709.4
4075.4	-645.5	4085.0	-581.4	4093.6	-517.1	4101.2	-452.8	4107.8	-388.3
4113.4	-323.7	4118.0	-259.1	4121.6	-194.4	4124.1	-129.6	4125.6	-64.8

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4294.7	0.0	4294.1	67.5	4292.5	134.9	4289.9	202.3	4286.2	269.7
4281.4	337.0	4275.6	404.2	4268.7	471.3	4260.8	538.3	4251.8	605.1
4241.8	671.8	4230.7	738.4	4218.6	804.7	4205.4	870.9	4191.2	936.9
4176.0	1002.6	4159.7	1068.0	4142.4	1133.2	4124.1	1198.2	4104.8	1262.8
4084.5	1327.1	4063.1	1391.1	4040.8	1454.8	4017.4	1518.1	3993.1	1581.0
3967.7	1643.5	3941.4	1705.6	3914.2	1767.3	3885.9	1828.6	3856.7	1889.4
3826.6	1949.7	3795.5	2009.6	3763.4	2069.0	3730.5	2127.8	3696.6	2186.2
3661.8	2244.0	3626.1	2301.2	3589.5	2357.9	3552.0	2414.0	3513.7	2469.4
3474.4	2524.3	3434.4	2578.6	3393.4	2632.2	3351.7	2685.2	3309.1	2737.5
3265.7	2789.2	3221.5	2840.1	3176.5	2890.4	3130.7	2939.9	3084.1	2988.7
3036.8	3036.8	2988.7	3084.1	2939.9	3130.7	2890.4	3176.5	2840.1	3221.5
2789.2	3265.7	2737.5	3309.1	2685.2	3351.7	2632.2	3393.4	2578.6	3434.4

2524.3	3474.4	2469.4	3513.7	2414.0	3552.0	2357.9	3589.5	2301.2	3626.1
2244.0	3661.8	2186.2	3696.6	2127.8	3730.5	2069.0	3763.4	2009.6	3795.5
1949.7	3826.6	1889.4	3856.7	1828.6	3885.9	1767.3	3914.2	1705.6	3941.4
1643.5	3967.7	1581.0	3993.1	1518.1	4017.4	1454.8	4040.8	1391.1	4063.1
1327.1	4084.5	1262.8	4104.8	1198.2	4124.1	1133.2	4142.4	1068.0	4159.7
1002.6	4176.0	936.9	4191.2	870.9	4205.4	804.7	4218.6	738.4	4230.7
671.8	4241.8	605.1	4251.8	538.3	4260.8	471.3	4268.7	404.2	4275.6
337.0	4281.4	269.7	4286.2	202.3	4289.9	134.9	4292.5	67.5	4294.1
0.0	4294.7	-67.5	4294.1	-134.9	4292.5	-202.3	4289.9	-269.7	4286.2
-337.0	4281.4	-404.2	4275.6	-471.3	4268.7	-538.3	4260.8	-605.1	4251.8
-671.8	4241.8	-738.4	4230.7	-804.7	4218.6	-870.9	4205.4	-936.9	4191.2
-1002.6	4176.0	-1068.0	4159.7	-1133.2	4142.4	-1198.2	4124.1	-1262.8	4104.8
-1327.1	4084.5	-1391.1	4063.1	-1454.8	4040.8	-1518.1	4017.4	-1581.0	3993.1
-1643.5	3967.7	-1705.6	3941.4	-1767.3	3914.2	-1828.6	3885.9	-1889.4	3856.7
-1949.7	3826.6	-2009.6	3795.5	-2069.0	3763.4	-2127.8	3730.5	-2186.2	3696.6
-2244.0	3661.8	-2301.2	3626.1	-2357.9	3589.5	-2414.0	3552.0	-2469.4	3513.7
-2524.3	3474.4	-2578.6	3434.4	-2632.2	3393.4	-2685.2	3351.7	-2737.5	3309.1
-2789.2	3265.7	-2840.1	3221.5	-2890.4	3176.5	-2939.9	3130.7	-2988.7	3084.1
-3036.8	3036.8	-3084.1	2988.7	-3130.7	2939.9	-3176.5	2890.4	-3221.5	2840.1
-3265.7	2789.2	-3309.1	2737.5	-3351.7	2685.2	-3393.4	2632.2	-3434.4	2578.6
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1705.5	-4117.5	1770.0	-4090.2	1834.0	-4061.9	1897.6	-4032.6	1960.7	-4002.3
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15 1

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3734.5	3189.6	3683.9	3247.8	3632.5	3305.3	3580.1	3361.9	3526.8	3417.7
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2566.1	4187.5	2500.0	4227.3	2433.3	4266.0	2366.0	4303.7	2298.1	4340.3
2229.6	4375.9	2160.6	4410.4	2091.1	4443.8	2021.0	4476.1	1950.5	4507.3
1879.4	4537.3	1807.9	4566.3	1736.0	4594.1	1663.6	4620.8	1590.8	4646.4
1517.6	4670.8	1444.1	4694.1	1370.2	4716.2	1295.9	4737.1	1221.4	4756.9

1146.5	4775.5	1071.3	4792.9	995.9	4809.1	920.3	4824.2	844.4	4838.0
768.3	4850.7	692.0	4862.2	615.5	4872.4	538.9	4881.5	462.2	4889.4
385.3	4896.0	308.4	4901.5	231.3	4905.7	154.3	4908.8	77.1	4910.6
0.0	4911.2	-77.1	4910.6	-154.3	4908.8	-231.3	4905.7	-308.4	4901.5
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385.3	-4896.0	462.2	-4889.4	538.9	-4881.5	615.5	-4872.4	692.0	-4862.2
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2566.1	-4187.5	2631.5	-4146.6	2696.3	-4104.8	2760.5	-4061.9	2824.0	-4018.1
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3734.5	-3189.6	3784.1	-3130.5	3832.8	-3070.7	3880.6	-3010.1	3927.4	-2948.8
3973.2	-2886.7	4018.1	-2824.0	4061.9	-2760.5	4104.8	-2696.3	4146.6	-2631.5
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18 1

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5048.6	1212.1	5028.9	1291.2	5008.0	1370.0	4985.9	1448.5	4962.5	1526.7
4937.9	1604.4	4912.1	1681.8	4885.1	1758.7	4856.9	1835.3	4827.4	1911.3
4796.8	1986.9	4765.0	2062.0	4732.1	2136.6	4697.9	2210.7	4662.6	2284.2
4626.2	2357.1	4588.6	2429.5	4549.8	2501.3	4510.0	2572.4	4469.0	2643.0
4427.0	2712.8	4383.8	2782.0	4339.6	2850.6	4294.2	2918.4	4247.9	2985.5
4200.5	3051.8	4152.0	3117.4	4102.5	3182.2	4052.0	3246.3	4000.5	3309.5
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3372.0	3948.1	3309.5	4000.5	3246.3	4052.0	3182.2	4102.5	3117.4	4152.0
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2712.8	4427.0	2643.0	4469.0	2572.4	4510.0	2501.3	4549.8	2429.5	4588.6
2357.1	4626.2	2284.2	4662.6	2210.7	4697.9	2136.6	4732.1	2062.0	4765.0
1986.9	4796.8	1911.3	4827.4	1835.3	4856.9	1758.7	4885.1	1681.8	4912.1
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1212.1	5048.6	1132.6	5067.0	1052.9	5084.2	972.9	5100.1	892.7	5114.7
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407.4	5176.0	326.0	5181.8	244.6	5186.3	163.1	5189.5	81.6	5191.4
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2038.5	-4921.5	2115.6	-4888.8	2192.1	-4855.0	2268.1	-4820.0	2343.5	-4783.7
2418.4	-4746.3	2492.6	-4707.8	2566.3	-4668.0	2639.3	-4627.1	2711.6	-4585.1

2783.3	-4542.0	2854.3	-4497.7	2924.6	-4452.3	2994.2	-4405.8	3063.0	-4358.2
3131.1	-4309.6	3198.4	-4259.9	3264.9	-4209.1	3330.6	-4157.3	3395.5	-4104.5
3459.6	-4050.6	3522.8	-3995.8	3585.1	-3940.0	3646.5	-3883.2	3707.1	-3825.4
3766.7	-3766.7	3825.4	-3707.1	3883.2	-3646.5	3940.0	-3585.1	3995.8	-3522.8
4050.6	-3459.6	4104.5	-3395.5	4157.3	-3330.6	4209.1	-3264.9	4259.9	-3198.4
4309.6	-3131.1	4358.2	-3063.0	4405.8	-2994.2	4452.3	-2924.6	4497.7	-2854.3
4542.0	-2783.3	4585.1	-2711.6	4627.1	-2639.3	4668.0	-2566.3	4707.8	-2492.6
4746.3	-2418.4	4783.7	-2343.5	4820.0	-2268.1	4855.0	-2192.1	4888.8	-2115.6
4921.5	-2038.5	4952.9	-1961.0	4983.1	-1882.9	5012.0	-1804.4	5039.7	-1725.5
5066.2	-1646.1	5091.5	-1566.3	5115.4	-1486.2	5138.1	-1405.6	5159.6	-1324.8
5179.8	-1243.5	5198.7	-1162.0	5216.3	-1080.2	5232.6	-998.2	5247.6	-915.9
5261.4	-833.3	5273.8	-750.6	5284.9	-667.6	5294.8	-584.5	5303.3	-501.3
5310.5	-417.9	5316.4	-334.5	5321.0	-250.9	5324.3	-167.3	5326.3	-83.7

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5458.5	0.0	5457.8	85.7	5455.8	171.5	5452.4	257.1	5447.7	342.7
5441.7	428.3	5434.3	513.7	5425.5	599.0	5415.5	684.1	5404.0	769.1
5391.3	853.9	5377.2	938.5	5361.8	1022.8	5345.1	1106.9	5327.0	1190.7
5307.7	1274.3	5287.0	1357.5	5265.0	1440.4	5241.8	1522.9	5217.2	1605.0
5191.3	1686.8	5164.2	1768.1	5135.8	1849.0	5106.1	1929.4	5075.2	2009.4
5043.0	2088.9	5009.6	2167.8	4974.9	2246.3	4939.0	2324.1	4901.9	2401.4
4863.6	2478.1	4824.0	2554.2	4783.3	2629.7	4741.4	2704.5	4698.4	2778.6
4654.1	2852.1	4608.8	2924.8	4562.3	2996.8	4514.6	3068.1	4465.9	3138.7
4416.0	3208.4	4365.1	3277.4	4313.1	3345.6	4260.0	3412.9	4205.8	3479.4
4150.7	3545.0	4094.5	3609.8	4037.3	3673.6	3979.1	3736.6	3919.9	3798.6
3859.7	3859.7	3798.6	3919.9	3736.6	3979.1	3673.6	4037.3	3609.8	4094.5
3545.0	4150.7	3479.4	4205.8	3412.9	4260.0	3345.6	4313.1	3277.4	4365.1
3208.4	4416.0	3138.7	4465.9	3068.1	4514.6	2996.8	4562.3	2924.8	4608.8
2852.1	4654.1	2778.6	4698.4	2704.5	4741.4	2629.7	4783.3	2554.2	4824.0
2478.1	4863.6	2401.4	4901.9	2324.1	4939.0	2246.3	4974.9	2167.8	5009.6
2088.9	5043.0	2009.4	5075.2	1929.4	5106.1	1849.0	5135.8	1768.1	5164.2
1686.8	5191.3	1605.0	5217.2	1522.9	5241.8	1440.4	5265.0	1357.5	5287.0
1274.3	5307.7	1190.7	5327.0	1106.9	5345.1	1022.8	5361.8	938.5	5377.2
853.9	5391.3	769.1	5404.0	684.1	5415.5	599.0	5425.5	513.7	5434.3
428.3	5441.7	342.7	5447.7	257.1	5452.4	171.5	5455.8	85.7	5457.8
0.0	5458.5	-85.7	5457.8	-171.5	5455.8	-257.1	5452.4	-342.7	5447.7
-428.3	5441.7	-513.7	5434.3	-599.0	5425.5	-684.1	5415.5	-769.1	5404.0

-853.9	5391.3	-938.5	5377.2	-1022.8	5361.8	-1106.9	5345.1	-1190.7	5327.0
-1274.3	5307.7	-1357.5	5287.0	-1440.4	5265.0	-1522.9	5241.8	-1605.0	5217.2
-1686.8	5191.3	-1768.1	5164.2	-1849.0	5135.8	-1929.4	5106.1	-2009.4	5075.2
-2088.9	5043.0	-2167.8	5009.6	-2246.3	4974.9	-2324.1	4939.0	-2401.4	4901.9
-2478.1	4863.6	-2554.2	4824.0	-2629.7	4783.3	-2704.5	4741.4	-2778.6	4698.4
-2852.1	4654.1	-2924.8	4608.8	-2996.8	4562.3	-3068.1	4514.6	-3138.7	4465.9
-3208.4	4416.0	-3277.4	4365.1	-3345.6	4313.1	-3412.9	4260.0	-3479.4	4205.8
-3545.0	4150.7	-3609.8	4094.5	-3673.6	4037.3	-3736.6	3979.1	-3798.6	3919.9
-3859.7	3859.7	-3919.9	3798.6	-3979.1	3736.6	-4037.3	3673.6	-4094.5	3609.8
-4150.7	3545.0	-4205.8	3479.4	-4260.0	3412.9	-4313.1	3345.6	-4365.1	3277.4
-4416.0	3208.4	-4465.9	3138.7	-4514.6	3068.1	-4562.3	2996.8	-4608.8	2924.8
-4654.1	2852.1	-4698.4	2778.6	-4741.4	2704.5	-4783.3	2629.7	-4824.0	2554.2
-4863.6	2478.1	-4901.9	2401.4	-4939.0	2324.1	-4974.9	2246.3	-5009.6	2167.8
-5043.0	2088.9	-5075.2	2009.4	-5106.1	1929.4	-5135.8	1849.0	-5164.2	1768.1
-5191.3	1686.8	-5217.2	1605.0	-5241.8	1522.9	-5265.0	1440.4	-5287.0	1357.5
-5307.7	1274.3	-5327.0	1190.7	-5345.1	1106.9	-5361.8	1022.8	-5377.2	938.5
-5391.3	853.9	-5404.0	769.1	-5415.5	684.1	-5425.5	599.0	-5434.3	513.7
-5441.7	428.3	-5447.7	342.7	-5452.4	257.1	-5455.8	171.5	-5457.8	85.7
-5458.5	0.0	-5457.8	-85.7	-5455.8	-171.5	-5452.4	-257.1	-5447.7	-342.7
-5441.7	-428.3	-5434.3	-513.7	-5425.5	-599.0	-5415.5	-684.1	-5404.0	-769.1
-5391.3	-853.9	-5377.2	-938.5	-5361.8	-1022.8	-5345.1	-1106.9	-5327.0	-1190.7
-5307.7	-1274.3	-5287.0	-1357.5	-5265.0	-1440.4	-5241.8	-1522.9	-5217.2	-1605.0
-5191.3	-1686.8	-5164.2	-1768.1	-5135.8	-1849.0	-5106.1	-1929.4	-5075.2	-2009.4
-5043.0	-2088.9	-5009.6	-2167.8	-4974.9	-2246.3	-4939.0	-2324.1	-4901.9	-2401.4
-4863.6	-2478.1	-4824.0	-2554.2	-4783.3	-2629.7	-4741.4	-2704.5	-4698.4	-2778.6
-4654.1	-2852.1	-4608.8	-2924.8	-4562.3	-2996.8	-4514.6	-3068.1	-4465.9	-3138.7
-4416.0	-3208.4	-4365.1	-3277.4	-4313.1	-3345.6	-4260.0	-3412.9	-4205.8	-3479.4
-4150.7	-3545.0	-4094.5	-3609.8	-4037.3	-3673.6	-3979.1	-3736.6	-3919.9	-3798.6
-3859.7	-3859.7	-3798.6	-3919.9	-3736.6	-3979.1	-3673.6	-4037.3	-3609.8	-4094.5
-3545.0	-4150.7	-3479.4	-4205.8	-3412.9	-4260.0	-3345.6	-4313.1	-3277.4	-4365.1
-3208.4	-4416.0	-3138.7	-4465.9	-3068.1	-4514.6	-2996.8	-4562.3	-2924.8	-4608.8
-2852.1	-4654.1	-2778.6	-4698.4	-2704.5	-4741.4	-2629.7	-4783.3	-2554.2	-4824.0
-2478.1	-4863.6	-2401.4	-4901.9	-2324.1	-4939.0	-2246.3	-4974.9	-2167.8	-5009.6
-2088.9	-5043.0	-2009.4	-5075.2	-1929.4	-5106.1	-1849.0	-5135.8	-1768.1	-5164.2
-1686.8	-5191.3	-1605.0	-5217.2	-1522.9	-5241.8	-1440.4	-5265.0	-1357.5	-5287.0
-1274.3	-5307.7	-1190.7	-5327.0	-1106.9	-5345.1	-1022.8	-5361.8	-938.5	-5377.2
-853.9	-5391.3	-769.1	-5404.0	-684.1	-5415.5	-599.0	-5425.5	-513.7	-5434.3

-428.3	-5441.7	-342.7	-5447.7	-257.1	-5452.4	-171.5	-5455.8	-85.7	-5457.8
0.0	-5458.5	85.7	-5457.8	171.5	-5455.8	257.1	-5452.4	342.7	-5447.7
428.3	-5441.7	513.7	-5434.3	599.0	-5425.5	684.1	-5415.5	769.1	-5404.0
853.9	-5391.3	938.5	-5377.2	1022.8	-5361.8	1106.9	-5345.1	1190.7	-5327.0
1274.3	-5307.7	1357.5	-5287.0	1440.4	-5265.0	1522.9	-5241.8	1605.0	-5217.2
1686.8	-5191.3	1768.1	-5164.2	1849.0	-5135.8	1929.4	-5106.1	2009.4	-5075.2
2088.9	-5043.0	2167.8	-5009.6	2246.3	-4974.9	2324.1	-4939.0	2401.4	-4901.9
2478.1	-4863.6	2554.2	-4824.0	2629.7	-4783.3	2704.5	-4741.4	2778.6	-4698.4
2852.1	-4654.1	2924.8	-4608.8	2996.8	-4562.3	3068.1	-4514.6	3138.7	-4465.9
3208.4	-4416.0	3277.4	-4365.1	3345.6	-4313.1	3412.9	-4260.0	3479.4	-4205.8
3545.0	-4150.7	3609.8	-4094.5	3673.6	-4037.3	3736.6	-3979.1	3798.6	-3919.9
3859.7	-3859.7	3919.9	-3798.6	3979.1	-3736.6	4037.3	-3673.6	4094.5	-3609.8
4150.7	-3545.0	4205.8	-3479.4	4260.0	-3412.9	4313.1	-3345.6	4365.1	-3277.4
4416.0	-3208.4	4465.9	-3138.7	4514.6	-3068.1	4562.3	-2996.8	4608.8	-2924.8
4654.1	-2852.1	4698.4	-2778.6	4741.4	-2704.5	4783.3	-2629.7	4824.0	-2554.2
4863.6	-2478.1	4901.9	-2401.4	4939.0	-2324.1	4974.9	-2246.3	5009.6	-2167.8
5043.0	-2088.9	5075.2	-2009.4	5106.1	-1929.4	5135.8	-1849.0	5164.2	-1768.1
5191.3	-1686.8	5217.2	-1605.0	5241.8	-1522.9	5265.0	-1440.4	5287.0	-1357.5
5307.7	-1274.3	5327.0	-1190.7	5345.1	-1106.9	5361.8	-1022.8	5377.2	-938.5
5391.3	-853.9	5404.0	-769.1	5415.5	-684.1	5425.5	-599.0	5434.3	-513.7
5441.7	-428.3	5447.7	-342.7	5452.4	-257.1	5455.8	-171.5	5457.8	-85.7

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5587.0	0.0	5586.3	87.8	5584.2	175.5	5580.8	263.2	5575.9	350.8
5569.7	438.3	5562.2	525.8	5553.2	613.1	5542.9	700.2	5531.2	787.2
5518.2	874.0	5503.8	960.6	5488.0	1046.9	5470.9	1133.0	5452.4	1218.8
5432.6	1304.2	5411.4	1389.4	5388.9	1474.2	5365.1	1558.7	5340.0	1642.8
5313.5	1726.5	5285.7	1809.7	5256.7	1892.5	5226.3	1974.8	5194.6	2056.7
5161.7	2138.0	5127.5	2218.8	5092.0	2299.1	5055.2	2378.8	5017.2	2457.9
4978.0	2536.4	4937.6	2614.3	4895.9	2691.5	4853.0	2768.1	4808.9	2844.0
4763.7	2919.2	4717.2	2993.6	4669.6	3067.4	4620.9	3140.3	4571.0	3212.5
4519.9	3283.9	4467.8	3354.5	4414.6	3424.3	4360.2	3493.2	4304.8	3561.3
4248.4	3628.4	4190.8	3694.7	4132.3	3760.1	4072.7	3824.5	4012.1	3888.0
3950.6	3950.6	3888.0	4012.1	3824.5	4072.7	3760.1	4132.3	3694.7	4190.8
3628.4	4248.4	3561.3	4304.8	3493.2	4360.2	3424.3	4414.6	3354.5	4467.8
3283.9	4519.9	3212.5	4571.0	3140.3	4620.9	3067.4	4669.6	2993.6	4717.2
2919.2	4763.7	2844.0	4808.9	2768.1	4853.0	2691.5	4895.9	2614.3	4937.6

2536.4	4978.0	2457.9	5017.2	2378.8	5055.2	2299.1	5092.0	2218.8	5127.5
2138.0	5161.7	2056.7	5194.6	1974.8	5226.3	1892.5	5256.7	1809.7	5285.7
1726.5	5313.5	1642.8	5340.0	1558.7	5365.1	1474.2	5388.9	1389.4	5411.4
1304.2	5432.6	1218.8	5452.4	1133.0	5470.9	1046.9	5488.0	960.6	5503.8
874.0	5518.2	787.2	5531.2	700.2	5542.9	613.1	5553.2	525.8	5562.2
438.3	5569.7	350.8	5575.9	263.2	5580.8	175.5	5584.2	87.8	5586.3
0.0	5587.0	-87.8	5586.3	-175.5	5584.2	-263.2	5580.8	-350.8	5575.9
-438.3	5569.7	-525.8	5562.2	-613.1	5553.2	-700.2	5542.9	-787.2	5531.2
-874.0	5518.2	-960.6	5503.8	-1046.9	5488.0	-1133.0	5470.9	-1218.8	5452.4
-1304.2	5432.6	-1389.4	5411.4	-1474.2	5388.9	-1558.7	5365.1	-1642.8	5340.0
-1726.5	5313.5	-1809.7	5285.7	-1892.5	5256.7	-1974.8	5226.3	-2056.7	5194.6
-2138.0	5161.7	-2218.8	5127.5	-2299.1	5092.0	-2378.8	5055.2	-2457.9	5017.2
-2536.4	4978.0	-2614.3	4937.6	-2691.5	4895.9	-2768.1	4853.0	-2844.0	4808.9
-2919.2	4763.7	-2993.6	4717.2	-3067.4	4669.6	-3140.3	4620.9	-3212.5	4571.0
-3283.9	4519.9	-3354.5	4467.8	-3424.3	4414.6	-3493.2	4360.2	-3561.3	4304.8
-3628.4	4248.4	-3694.7	4190.8	-3760.1	4132.3	-3824.5	4072.7	-3888.0	4012.1
-3950.6	3950.6	-4012.1	3888.0	-4072.7	3824.5	-4132.3	3760.1	-4190.8	3694.7
-4248.4	3628.4	-4304.8	3561.3	-4360.2	3493.2	-4414.6	3424.3	-4467.8	3354.5
-4519.9	3283.9	-4571.0	3212.5	-4620.9	3140.3	-4669.6	3067.4	-4717.2	2993.6
-4763.7	2919.2	-4808.9	2844.0	-4853.0	2768.1	-4895.9	2691.5	-4937.6	2614.3
-4978.0	2536.4	-5017.2	2457.9	-5055.2	2378.8	-5092.0	2299.1	-5127.5	2218.8
-5161.7	2138.0	-5194.6	2056.7	-5226.3	1974.8	-5256.7	1892.5	-5285.7	1809.7
-5313.5	1726.5	-5340.0	1642.8	-5365.1	1558.7	-5388.9	1474.2	-5411.4	1389.4
-5432.6	1304.2	-5452.4	1218.8	-5470.9	1133.0	-5488.0	1046.9	-5503.8	960.6
-5518.2	874.0	-5531.2	787.2	-5542.9	700.2	-5553.2	613.1	-5562.2	525.8
-5569.7	438.3	-5575.9	350.8	-5580.8	263.2	-5584.2	175.5	-5586.3	87.8
-5587.0	0.0	-5586.3	-87.8	-5584.2	-175.5	-5580.8	-263.2	-5575.9	-350.8
-5569.7	-438.3	-5562.2	-525.8	-5553.2	-613.1	-5542.9	-700.2	-5531.2	-787.2
-5518.2	-874.0	-5503.8	-960.6	-5488.0	-1046.9	-5470.9	-1133.0	-5452.4	-1218.8
-5432.6	-1304.2	-5411.4	-1389.4	-5388.9	-1474.2	-5365.1	-1558.7	-5340.0	-1642.8
-5313.5	-1726.5	-5285.7	-1809.7	-5256.7	-1892.5	-5226.3	-1974.8	-5194.6	-2056.7
-5161.7	-2138.0	-5127.5	-2218.8	-5092.0	-2299.1	-5055.2	-2378.8	-5017.2	-2457.9
-4978.0	-2536.4	-4937.6	-2614.3	-4895.9	-2691.5	-4853.0	-2768.1	-4808.9	-2844.0
-4763.7	-2919.2	-4717.2	-2993.6	-4669.6	-3067.4	-4620.9	-3140.3	-4571.0	-3212.5
-4519.9	-3283.9	-4467.8	-3354.5	-4414.6	-3424.3	-4360.2	-3493.2	-4304.8	-3561.3
-4248.4	-3628.4	-4190.8	-3694.7	-4132.3	-3760.1	-4072.7	-3824.5	-4012.1	-3888.0
-3950.6	-3950.6	-3888.0	-4012.1	-3824.5	-4072.7	-3760.1	-4132.3	-3694.7	-4190.8

-3628.4	-4248.4	-3561.3	-4304.8	-3493.2	-4360.2	-3424.3	-4414.6	-3354.5	-4467.8
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23 1

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26 1

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35 1

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7217.8	568.1	7208.0	681.4	7196.4	794.5	7183.1	907.4	7167.9	1020.1
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4255.7	5857.4	4163.1	5923.5	4069.6	5988.2	3975.0	6051.4	3879.5	6113.1

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3287.0	6451.0	3185.2	6501.9	3082.7	6551.1	2979.4	6598.7	2875.4	6644.7
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2237.3	6885.8	2128.9	6920.1	2019.9	6952.7	1910.5	6983.5	1800.6	7012.7
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41 1

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43 1

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2346.6	7222.2	2232.9	7258.2	2118.6	7292.4	2003.8	7324.7	1888.5	7355.3
1772.8	7384.1	1656.6	7411.0	1539.9	7436.1	1423.0	7459.4	1305.6	7480.8
1187.9	7500.4	1070.0	7518.1	951.8	7534.0	833.3	7548.0	714.6	7560.2
595.8	7570.5	476.8	7578.9	357.7	7585.5	238.5	7590.1	119.3	7593.0
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3967.8	-6474.9	4069.0	-6411.7	4169.2	-6347.0	4268.4	-6280.8	4366.5	-6212.9

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49 1

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8314.1	654.3	8302.8	784.8	8289.4	915.2	8274.0	1045.3	8256.6	1175.1
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8109.4	1946.9	8077.8	2074.0	8044.2	2200.7	8008.7	2326.7	7971.1	2452.2
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7110.9	4357.5	7041.5	4468.7	6970.5	4578.7	6897.7	4687.7	6823.2	4795.4
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4902.0	6747.0	4795.4	6823.2	4687.7	6897.7	4578.7	6970.5	4468.7	7041.5
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3786.2	7430.8	3669.0	7489.4	3550.9	7546.1	3432.0	7600.9	3312.1	7653.9
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2577.1	7931.6	2452.2	7971.1	2326.7	8008.7	2200.7	8044.2	2074.0	8077.8
1946.9	8109.4	1819.3	8139.0	1691.2	8166.5	1562.7	8192.1	1433.9	8215.6
1304.6	8237.1	1175.1	8256.6	1045.3	8274.0	915.2	8289.4	784.8	8302.8
654.3	8314.1	523.7	8323.4	392.9	8330.5	262.0	8335.7	131.0	8338.8

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-8468.7	666.5	-8478.1	533.4	-8485.5	400.2	-8490.7	266.8	-8493.9	133.4
-8494.9	0.0	-8493.9	-133.4	-8490.7	-266.8	-8485.5	-400.2	-8478.1	-533.4
-8468.7	-666.5	-8457.2	-799.4	-8443.6	-932.2	-8427.9	-1064.7	-8410.2	-1196.9
-8390.3	-1328.9	-8368.4	-1460.5	-8344.4	-1591.8	-8318.4	-1722.7	-8290.3	-1853.1
-8260.2	-1983.1	-8228.0	-2112.6	-8193.8	-2241.6	-8157.6	-2370.0	-8119.4	-2497.8
-8079.1	-2625.1	-8036.9	-2751.6	-7992.7	-2877.5	-7946.5	-3002.7	-7898.4	-3127.2
-7848.3	-3250.9	-7796.2	-3373.7	-7742.3	-3495.8	-7686.4	-3617.0	-7628.7	-3737.2
-7569.0	-3856.6	-7507.5	-3975.0	-7444.1	-4092.5	-7378.9	-4208.9	-7311.9	-4324.3
-7243.1	-4438.6	-7172.5	-4551.8	-7100.1	-4663.9	-7026.0	-4774.8	-6950.1	-4884.6
-6872.5	-4993.2	-6793.2	-5100.5	-6712.3	-5206.6	-6629.7	-5311.4	-6545.4	-5414.9

-6459.6	-5517.0	-6372.1	-5617.8	-6283.1	-5717.2	-6192.5	-5815.2	-6100.4	-5911.7
-6006.8	-6006.8	-5911.7	-6100.4	-5815.2	-6192.5	-5717.2	-6283.1	-5617.8	-6372.1
-5517.0	-6459.6	-5414.9	-6545.4	-5311.4	-6629.7	-5206.6	-6712.3	-5100.5	-6793.2
-4993.2	-6872.5	-4884.6	-6950.1	-4774.8	-7026.0	-4663.9	-7100.1	-4551.8	-7172.5
-4438.6	-7243.1	-4324.3	-7311.9	-4208.9	-7378.9	-4092.5	-7444.1	-3975.0	-7507.5
-3856.6	-7569.0	-3737.2	-7628.7	-3617.0	-7686.4	-3495.8	-7742.3	-3373.7	-7796.2
-3250.9	-7848.3	-3127.2	-7898.4	-3002.7	-7946.5	-2877.5	-7992.7	-2751.6	-8036.9
-2625.1	-8079.1	-2497.8	-8119.4	-2370.0	-8157.6	-2241.6	-8193.8	-2112.6	-8228.0
-1983.1	-8260.2	-1853.1	-8290.3	-1722.7	-8318.4	-1591.8	-8344.4	-1460.5	-8368.4
-1328.9	-8390.3	-1196.9	-8410.2	-1064.7	-8427.9	-932.2	-8443.6	-799.4	-8457.2
-666.5	-8468.7	-533.4	-8478.1	-400.2	-8485.5	-266.8	-8490.7	-133.4	-8493.9
0.0	-8494.9	133.4	-8493.9	266.8	-8490.7	400.2	-8485.5	533.4	-8478.1
666.5	-8468.7	799.4	-8457.2	932.2	-8443.6	1064.7	-8427.9	1196.9	-8410.2
1328.9	-8390.3	1460.5	-8368.4	1591.8	-8344.4	1722.7	-8318.4	1853.1	-8290.3
1983.1	-8260.2	2112.6	-8228.0	2241.6	-8193.8	2370.0	-8157.6	2497.8	-8119.4
2625.1	-8079.1	2751.6	-8036.9	2877.5	-7992.7	3002.7	-7946.5	3127.2	-7898.4
3250.9	-7848.3	3373.7	-7796.2	3495.8	-7742.3	3617.0	-7686.4	3737.2	-7628.7
3856.6	-7569.0	3975.0	-7507.5	4092.5	-7444.1	4208.9	-7378.9	4324.3	-7311.9
4438.6	-7243.1	4551.8	-7172.5	4663.9	-7100.1	4774.8	-7026.0	4884.6	-6950.1
4993.2	-6872.5	5100.5	-6793.2	5206.6	-6712.3	5311.4	-6629.7	5414.9	-6545.4
5517.0	-6459.6	5617.8	-6372.1	5717.2	-6283.1	5815.2	-6192.5	5911.7	-6100.4
6006.8	-6006.8	6100.4	-5911.7	6192.5	-5815.2	6283.1	-5717.2	6372.1	-5617.8
6459.6	-5517.0	6545.4	-5414.9	6629.7	-5311.4	6712.3	-5206.6	6793.2	-5100.5
6872.5	-4993.2	6950.1	-4884.6	7026.0	-4774.8	7100.1	-4663.9	7172.5	-4551.8
7243.1	-4438.6	7311.9	-4324.3	7378.9	-4208.9	7444.1	-4092.5	7507.5	-3975.0
7569.0	-3856.6	7628.7	-3737.2	7686.4	-3617.0	7742.3	-3495.8	7796.2	-3373.7
7848.3	-3250.9	7898.4	-3127.2	7946.5	-3002.7	7992.7	-2877.5	8036.9	-2751.6
8079.1	-2625.1	8119.4	-2497.8	8157.6	-2370.0	8193.8	-2241.6	8228.0	-2112.6
8260.2	-1983.1	8290.3	-1853.1	8318.4	-1722.7	8344.4	-1591.8	8368.4	-1460.5
8390.3	-1328.9	8410.2	-1196.9	8427.9	-1064.7	8443.6	-932.2	8457.2	-799.4
8468.7	-666.5	8478.1	-533.4	8485.5	-400.2	8490.7	-266.8	8493.9	-133.4

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8647.4	0.0	8646.4	135.8	8643.2	271.6	8637.8	407.4	8630.4	543.0
8620.8	678.5	8609.1	813.8	8595.2	948.9	8579.3	1083.8	8561.2	1218.4
8541.0	1352.8	8518.7	1486.7	8494.3	1620.4	8467.8	1753.6	8439.2	1886.4
8408.5	2018.7	8375.8	2150.5	8341.0	2281.8	8304.1	2412.6	8265.2	2542.7

8224.2	2672.2	8181.2	2801.1	8136.2	2929.2	8089.2	3056.7	8040.2	3183.3
7989.2	3309.2	7936.2	3434.3	7881.3	3558.5	7824.4	3681.9	7765.6	3804.3
7704.9	3925.9	7642.3	4046.4	7577.8	4165.9	7511.4	4284.5	7443.2	4401.9
7373.2	4518.3	7301.3	4633.5	7227.6	4747.6	7152.1	4860.6	7074.9	4972.3
6995.9	5082.8	6915.2	5192.1	6832.8	5300.1	6748.7	5406.8	6663.0	5512.1
6575.6	5616.1	6486.5	5718.7	6395.9	5819.8	6303.7	5919.6	6210.0	6017.9
6114.7	6114.7	6017.9	6210.0	5919.6	6303.7	5819.8	6395.9	5718.7	6486.5
5616.1	6575.6	5512.1	6663.0	5406.8	6748.7	5300.1	6832.8	5192.1	6915.2
5082.8	6995.9	4972.3	7074.9	4860.6	7152.1	4747.6	7227.6	4633.5	7301.3
4518.3	7373.2	4401.9	7443.2	4284.5	7511.4	4165.9	7577.8	4046.4	7642.3
3925.9	7704.9	3804.3	7765.6	3681.9	7824.4	3558.5	7881.3	3434.3	7936.2
3309.2	7989.2	3183.3	8040.2	3056.7	8089.2	2929.2	8136.2	2801.1	8181.2
2672.2	8224.2	2542.7	8265.2	2412.6	8304.1	2281.8	8341.0	2150.5	8375.8
2018.7	8408.5	1886.4	8439.2	1753.6	8467.8	1620.4	8494.3	1486.7	8518.7
1352.8	8541.0	1218.4	8561.2	1083.8	8579.3	948.9	8595.2	813.8	8609.1
678.5	8620.8	543.0	8630.4	407.4	8637.8	271.6	8643.2	135.8	8646.4
0.0	8647.4	-135.8	8646.4	-271.6	8643.2	-407.4	8637.8	-543.0	8630.4
-678.5	8620.8	-813.8	8609.1	-948.9	8595.2	-1083.8	8579.3	-1218.4	8561.2
-1352.8	8541.0	-1486.7	8518.7	-1620.4	8494.3	-1753.6	8467.8	-1886.4	8439.2
-2018.7	8408.5	-2150.5	8375.8	-2281.8	8341.0	-2412.6	8304.1	-2542.7	8265.2
-2672.2	8224.2	-2801.1	8181.2	-2929.2	8136.2	-3056.7	8089.2	-3183.3	8040.2
-3309.2	7989.2	-3434.3	7936.2	-3558.5	7881.3	-3681.9	7824.4	-3804.3	7765.6
-3925.9	7704.9	-4046.4	7642.3	-4165.9	7577.8	-4284.5	7511.4	-4401.9	7443.2
-4518.3	7373.2	-4633.5	7301.3	-4747.6	7227.6	-4860.6	7152.1	-4972.3	7074.9
-5082.8	6995.9	-5192.1	6915.2	-5300.1	6832.8	-5406.8	6748.7	-5512.1	6663.0
-5616.1	6575.6	-5718.7	6486.5	-5819.8	6395.9	-5919.6	6303.7	-6017.9	6210.0
-6114.7	6114.7	-6210.0	6017.9	-6303.7	5919.6	-6395.9	5819.8	-6486.5	5718.7
-6575.6	5616.1	-6663.0	5512.1	-6748.7	5406.8	-6832.8	5300.1	-6915.2	5192.1
-6995.9	5082.8	-7074.9	4972.3	-7152.1	4860.6	-7227.6	4747.6	-7301.3	4633.5
-7373.2	4518.3	-7443.2	4401.9	-7511.4	4284.5	-7577.8	4165.9	-7642.3	4046.4
-7704.9	3925.9	-7765.6	3804.3	-7824.4	3681.9	-7881.3	3558.5	-7936.2	3434.3
-7989.2	3309.2	-8040.2	3183.3	-8089.2	3056.7	-8136.2	2929.2	-8181.2	2801.1
-8224.2	2672.2	-8265.2	2542.7	-8304.1	2412.6	-8341.0	2281.8	-8375.8	2150.5
-8408.5	2018.7	-8439.2	1886.4	-8467.8	1753.6	-8494.3	1620.4	-8518.7	1486.7
-8541.0	1352.8	-8561.2	1218.4	-8579.3	1083.8	-8595.2	948.9	-8609.1	813.8
-8620.8	678.5	-8630.4	543.0	-8637.8	407.4	-8643.2	271.6	-8646.4	135.8
-8647.4	0.0	-8646.4	-135.8	-8643.2	-271.6	-8637.8	-407.4	-8630.4	-543.0

-8620.8	-678.5	-8609.1	-813.8	-8595.2	-948.9	-8579.3	-1083.8	-8561.2	-1218.4
-8541.0	-1352.8	-8518.7	-1486.7	-8494.3	-1620.4	-8467.8	-1753.6	-8439.2	-1886.4
-8408.5	-2018.7	-8375.8	-2150.5	-8341.0	-2281.8	-8304.1	-2412.6	-8265.2	-2542.7
-8224.2	-2672.2	-8181.2	-2801.1	-8136.2	-2929.2	-8089.2	-3056.7	-8040.2	-3183.3
-7989.2	-3309.2	-7936.2	-3434.3	-7881.3	-3558.5	-7824.4	-3681.9	-7765.6	-3804.3
-7704.9	-3925.9	-7642.3	-4046.4	-7577.8	-4165.9	-7511.4	-4284.5	-7443.2	-4401.9
-7373.2	-4518.3	-7301.3	-4633.5	-7227.6	-4747.6	-7152.1	-4860.6	-7074.9	-4972.3
-6995.9	-5082.8	-6915.2	-5192.1	-6832.8	-5300.1	-6748.7	-5406.8	-6663.0	-5512.1
-6575.6	-5616.1	-6486.5	-5718.7	-6395.9	-5819.8	-6303.7	-5919.6	-6210.0	-6017.9
-6114.7	-6114.7	-6017.9	-6210.0	-5919.6	-6303.7	-5819.8	-6395.9	-5718.7	-6486.5
-5616.1	-6575.6	-5512.1	-6663.0	-5406.8	-6748.7	-5300.1	-6832.8	-5192.1	-6915.2
-5082.8	-6995.9	-4972.3	-7074.9	-4860.6	-7152.1	-4747.6	-7227.6	-4633.5	-7301.3
-4518.3	-7373.2	-4401.9	-7443.2	-4284.5	-7511.4	-4165.9	-7577.8	-4046.4	-7642.3
-3925.9	-7704.9	-3804.3	-7765.6	-3681.9	-7824.4	-3558.5	-7881.3	-3434.3	-7936.2
-3309.2	-7989.2	-3183.3	-8040.2	-3056.7	-8089.2	-2929.2	-8136.2	-2801.1	-8181.2
-2672.2	-8224.2	-2542.7	-8265.2	-2412.6	-8304.1	-2281.8	-8341.0	-2150.5	-8375.8
-2018.7	-8408.5	-1886.4	-8439.2	-1753.6	-8467.8	-1620.4	-8494.3	-1486.7	-8518.7
-1352.8	-8541.0	-1218.4	-8561.2	-1083.8	-8579.3	-948.9	-8595.2	-813.8	-8609.1
-678.5	-8620.8	-543.0	-8630.4	-407.4	-8637.8	-271.6	-8643.2	-135.8	-8646.4
0.0	-8647.4	135.8	-8646.4	271.6	-8643.2	407.4	-8637.8	543.0	-8630.4
678.5	-8620.8	813.8	-8609.1	948.9	-8595.2	1083.8	-8579.3	1218.4	-8561.2
1352.8	-8541.0	1486.7	-8518.7	1620.4	-8494.3	1753.6	-8467.8	1886.4	-8439.2
2018.7	-8408.5	2150.5	-8375.8	2281.8	-8341.0	2412.6	-8304.1	2542.7	-8265.2
2672.2	-8224.2	2801.1	-8181.2	2929.2	-8136.2	3056.7	-8089.2	3183.3	-8040.2
3309.2	-7989.2	3434.3	-7936.2	3558.5	-7881.3	3681.9	-7824.4	3804.3	-7765.6
3925.9	-7704.9	4046.4	-7642.3	4165.9	-7577.8	4284.5	-7511.4	4401.9	-7443.2
4518.3	-7373.2	4633.5	-7301.3	4747.6	-7227.6	4860.6	-7152.1	4972.3	-7074.9
5082.8	-6995.9	5192.1	-6915.2	5300.1	-6832.8	5406.8	-6748.7	5512.1	-6663.0
5616.1	-6575.6	5718.7	-6486.5	5819.8	-6395.9	5919.6	-6303.7	6017.9	-6210.0
6114.7	-6114.7	6210.0	-6017.9	6303.7	-5919.6	6395.9	-5819.8	6486.5	-5718.7
6575.6	-5616.1	6663.0	-5512.1	6748.7	-5406.8	6832.8	-5300.1	6915.2	-5192.1
6995.9	-5082.8	7074.9	-4972.3	7152.1	-4860.6	7227.6	-4747.6	7301.3	-4633.5
7373.2	-4518.3	7443.2	-4401.9	7511.4	-4284.5	7577.8	-4165.9	7642.3	-4046.4
7704.9	-3925.9	7765.6	-3804.3	7824.4	-3681.9	7881.3	-3558.5	7936.2	-3434.3
7989.2	-3309.2	8040.2	-3183.3	8089.2	-3056.7	8136.2	-2929.2	8181.2	-2801.1
8224.2	-2672.2	8265.2	-2542.7	8304.1	-2412.6	8341.0	-2281.8	8375.8	-2150.5
8408.5	-2018.7	8439.2	-1886.4	8467.8	-1753.6	8494.3	-1620.4	8518.7	-1486.7

8541.0	-1352.8	8561.2	-1218.4	8579.3	-1083.8	8595.2	-948.9	8609.1	-813.8
8620.8	-678.5	8630.4	-543.0	8637.8	-407.4	8643.2	-271.6	8646.4	-135.8

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8797.1	0.0	8796.0	138.2	8792.8	276.3	8787.4	414.4	8779.8	552.4
8770.0	690.2	8758.1	827.9	8744.0	965.3	8727.7	1102.6	8709.4	1239.5
8688.8	1376.2	8666.1	1512.5	8641.3	1648.4	8614.3	1783.9	8585.3	1919.0
8554.1	2053.6	8520.7	2187.8	8485.3	2321.3	8447.8	2454.3	8408.2	2586.7
8366.6	2718.5	8322.8	2849.5	8277.0	2979.9	8229.2	3109.6	8179.4	3238.4
8127.5	3366.5	8073.6	3493.8	8017.7	3620.1	7959.9	3745.6	7900.1	3870.2
7838.3	3993.8	7774.6	4116.4	7709.0	4238.0	7641.5	4358.6	7572.0	4478.1
7500.8	4596.5	7427.7	4713.7	7352.7	4829.8	7275.9	4944.7	7197.4	5058.4
7117.0	5170.8	7034.9	5282.0	6951.1	5391.8	6865.5	5500.3	6778.3	5607.5
6689.4	5713.3	6598.8	5817.6	6506.6	5920.6	6412.8	6022.0	6317.4	6122.0
6220.5	6220.5	6122.0	6317.4	6022.0	6412.8	5920.6	6506.6	5817.6	6598.8
5713.3	6689.4	5607.5	6778.3	5500.3	6865.5	5391.8	6951.1	5282.0	7034.9
5170.8	7117.0	5058.4	7197.4	4944.7	7275.9	4829.8	7352.7	4713.7	7427.7
4596.5	7500.8	4478.1	7572.0	4358.6	7641.5	4238.0	7709.0	4116.4	7774.6
3993.8	7838.3	3870.2	7900.1	3745.6	7959.9	3620.1	8017.7	3493.8	8073.6
3366.5	8127.5	3238.4	8179.4	3109.6	8229.2	2979.9	8277.0	2849.5	8322.8
2718.5	8366.6	2586.7	8408.2	2454.3	8447.8	2321.3	8485.3	2187.8	8520.7
2053.6	8554.1	1919.0	8585.3	1783.9	8614.3	1648.4	8641.3	1512.5	8666.1
1376.2	8688.8	1239.5	8709.4	1102.6	8727.7	965.3	8744.0	827.9	8758.1
690.2	8770.0	552.4	8779.8	414.4	8787.4	276.3	8792.8	138.2	8796.0
0.0	8797.1	-138.2	8796.0	-276.3	8792.8	-414.4	8787.4	-552.4	8779.8
-690.2	8770.0	-827.9	8758.1	-965.3	8744.0	-1102.6	8727.7	-1239.5	8709.4
-1376.2	8688.8	-1512.5	8666.1	-1648.4	8641.3	-1783.9	8614.3	-1919.0	8585.3
-2053.6	8554.1	-2187.8	8520.7	-2321.3	8485.3	-2454.3	8447.8	-2586.7	8408.2
-2718.5	8366.6	-2849.5	8322.8	-2979.9	8277.0	-3109.6	8229.2	-3238.4	8179.4
-3366.5	8127.5	-3493.8	8073.6	-3620.1	8017.7	-3745.6	7959.9	-3870.2	7900.1
-3993.8	7838.3	-4116.4	7774.6	-4238.0	7709.0	-4358.6	7641.5	-4478.1	7572.0
-4596.5	7500.8	-4713.7	7427.7	-4829.8	7352.7	-4944.7	7275.9	-5058.4	7197.4
-5170.8	7117.0	-5282.0	7034.9	-5391.8	6951.1	-5500.3	6865.5	-5607.5	6778.3
-5713.3	6689.4	-5817.6	6598.8	-5920.6	6506.6	-6022.0	6412.8	-6122.0	6317.4
-6220.5	6220.5	-6317.4	6122.0	-6412.8	6022.0	-6506.6	5920.6	-6598.8	5817.6
-6689.4	5713.3	-6778.3	5607.5	-6865.5	5500.3	-6951.1	5391.8	-7034.9	5282.0
-7117.0	5170.8	-7197.4	5058.4	-7275.9	4944.7	-7352.7	4829.8	-7427.7	4713.7

-7500.8	4596.5	-7572.0	4478.1	-7641.5	4358.6	-7709.0	4238.0	-7774.6	4116.4
-7838.3	3993.8	-7900.1	3870.2	-7959.9	3745.6	-8017.7	3620.1	-8073.6	3493.8
-8127.5	3366.5	-8179.4	3238.4	-8229.2	3109.6	-8277.0	2979.9	-8322.8	2849.5
-8366.6	2718.5	-8408.2	2586.7	-8447.8	2454.3	-8485.3	2321.3	-8520.7	2187.8
-8554.1	2053.6	-8585.3	1919.0	-8614.3	1783.9	-8641.3	1648.4	-8666.1	1512.5
-8688.8	1376.2	-8709.4	1239.5	-8727.7	1102.6	-8744.0	965.3	-8758.1	827.9
-8770.0	690.2	-8779.8	552.4	-8787.4	414.4	-8792.8	276.3	-8796.0	138.2
-8797.1	0.0	-8796.0	-138.2	-8792.8	-276.3	-8787.4	-414.4	-8779.8	-552.4
-8770.0	-690.2	-8758.1	-827.9	-8744.0	-965.3	-8727.7	-1102.6	-8709.4	-1239.5
-8688.8	-1376.2	-8666.1	-1512.5	-8641.3	-1648.4	-8614.3	-1783.9	-8585.3	-1919.0
-8554.1	-2053.6	-8520.7	-2187.8	-8485.3	-2321.3	-8447.8	-2454.3	-8408.2	-2586.7
-8366.6	-2718.5	-8322.8	-2849.5	-8277.0	-2979.9	-8229.2	-3109.6	-8179.4	-3238.4
-8127.5	-3366.5	-8073.6	-3493.8	-8017.7	-3620.1	-7959.9	-3745.6	-7900.1	-3870.2
-7838.3	-3993.8	-7774.6	-4116.4	-7709.0	-4238.0	-7641.5	-4358.6	-7572.0	-4478.1
-7500.8	-4596.5	-7427.7	-4713.7	-7352.7	-4829.8	-7275.9	-4944.7	-7197.4	-5058.4
-7117.0	-5170.8	-7034.9	-5282.0	-6951.1	-5391.8	-6865.5	-5500.3	-6778.3	-5607.5
-6689.4	-5713.3	-6598.8	-5817.6	-6506.6	-5920.6	-6412.8	-6022.0	-6317.4	-6122.0
-6220.5	-6220.5	-6122.0	-6317.4	-6022.0	-6412.8	-5920.6	-6506.6	-5817.6	-6598.8
-5713.3	-6689.4	-5607.5	-6778.3	-5500.3	-6865.5	-5391.8	-6951.1	-5282.0	-7034.9
-5170.8	-7117.0	-5058.4	-7197.4	-4944.7	-7275.9	-4829.8	-7352.7	-4713.7	-7427.7
-4596.5	-7500.8	-4478.1	-7572.0	-4358.6	-7641.5	-4238.0	-7709.0	-4116.4	-7774.6
-3993.8	-7838.3	-3870.2	-7900.1	-3745.6	-7959.9	-3620.1	-8017.7	-3493.8	-8073.6
-3366.5	-8127.5	-3238.4	-8179.4	-3109.6	-8229.2	-2979.9	-8277.0	-2849.5	-8322.8
-2718.5	-8366.6	-2586.7	-8408.2	-2454.3	-8447.8	-2321.3	-8485.3	-2187.8	-8520.7
-2053.6	-8554.1	-1919.0	-8585.3	-1783.9	-8614.3	-1648.4	-8641.3	-1512.5	-8666.1
-1376.2	-8688.8	-1239.5	-8709.4	-1102.6	-8727.7	-965.3	-8744.0	-827.9	-8758.1
-690.2	-8770.0	-552.4	-8779.8	-414.4	-8787.4	-276.3	-8792.8	-138.2	-8796.0
0.0	-8797.1	138.2	-8796.0	276.3	-8792.8	414.4	-8787.4	552.4	-8779.8
690.2	-8770.0	827.9	-8758.1	965.3	-8744.0	1102.6	-8727.7	1239.5	-8709.4
1376.2	-8688.8	1512.5	-8666.1	1648.4	-8641.3	1783.9	-8614.3	1919.0	-8585.3
2053.6	-8554.1	2187.8	-8520.7	2321.3	-8485.3	2454.3	-8447.8	2586.7	-8408.2
2718.5	-8366.6	2849.5	-8322.8	2979.9	-8277.0	3109.6	-8229.2	3238.4	-8179.4
3366.5	-8127.5	3493.8	-8073.6	3620.1	-8017.7	3745.6	-7959.9	3870.2	-7900.1
3993.8	-7838.3	4116.4	-7774.6	4238.0	-7709.0	4358.6	-7641.5	4478.1	-7572.0
4596.5	-7500.8	4713.7	-7427.7	4829.8	-7352.7	4944.7	-7275.9	5058.4	-7197.4
5170.8	-7117.0	5282.0	-7034.9	5391.8	-6951.1	5500.3	-6865.5	5607.5	-6778.3
5713.3	-6689.4	5817.6	-6598.8	5920.6	-6506.6	6022.0	-6412.8	6122.0	-6317.4

6220.5	-6220.5	6317.4	-6122.0	6412.8	-6022.0	6506.6	-5920.6	6598.8	-5817.6
6689.4	-5713.3	6778.3	-5607.5	6865.5	-5500.3	6951.1	-5391.8	7034.9	-5282.0
7117.0	-5170.8	7197.4	-5058.4	7275.9	-4944.7	7352.7	-4829.8	7427.7	-4713.7
7500.8	-4596.5	7572.0	-4478.1	7641.5	-4358.6	7709.0	-4238.0	7774.6	-4116.4
7838.3	-3993.8	7900.1	-3870.2	7959.9	-3745.6	8017.7	-3620.1	8073.6	-3493.8
8127.5	-3366.5	8179.4	-3238.4	8229.2	-3109.6	8277.0	-2979.9	8322.8	-2849.5
8366.6	-2718.5	8408.2	-2586.7	8447.8	-2454.3	8485.3	-2321.3	8520.7	-2187.8
8554.1	-2053.6	8585.3	-1919.0	8614.3	-1783.9	8641.3	-1648.4	8666.1	-1512.5
8688.8	-1376.2	8709.4	-1239.5	8727.7	-1102.6	8744.0	-965.3	8758.1	-827.9
8770.0	-690.2	8779.8	-552.4	8787.4	-414.4	8792.8	-276.3	8796.0	-138.2

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8944.3	0.0	8943.2	140.5	8939.9	280.9	8934.4	421.3	8926.6	561.6
8916.7	701.8	8904.6	841.7	8890.3	981.5	8873.8	1121.0	8855.1	1260.3
8834.2	1399.2	8811.1	1537.8	8785.9	1676.0	8758.4	1813.8	8728.9	1951.1
8697.2	2088.0	8663.3	2224.4	8627.3	2360.2	8589.1	2495.4	8548.9	2630.0
8506.5	2763.9	8462.1	2897.2	8415.5	3029.8	8366.9	3161.6	8316.2	3292.6
8263.4	3422.8	8208.7	3552.2	8151.9	3680.7	8093.0	3808.3	8032.2	3934.9
7969.4	4060.6	7904.7	4185.3	7837.9	4308.9	7769.3	4431.5	7698.7	4553.0
7626.3	4673.4	7551.9	4792.6	7475.7	4910.6	7397.6	5027.4	7317.8	5143.0
7236.1	5257.3	7152.6	5370.3	7067.4	5482.0	6980.4	5592.3	6891.7	5701.3
6801.3	5808.8	6709.2	5915.0	6615.5	6019.6	6520.1	6122.8	6423.1	6224.4
6324.6	6324.6	6224.4	6423.1	6122.8	6520.1	6019.6	6615.5	5915.0	6709.2
5808.8	6801.3	5701.3	6891.7	5592.3	6980.4	5482.0	7067.4	5370.3	7152.6
5257.3	7236.1	5143.0	7317.8	5027.4	7397.6	4910.6	7475.7	4792.6	7551.9
4673.4	7626.3	4553.0	7698.7	4431.5	7769.3	4308.9	7837.9	4185.3	7904.7
4060.6	7969.4	3934.9	8032.2	3808.3	8093.0	3680.7	8151.9	3552.2	8208.7
3422.8	8263.4	3292.6	8316.2	3161.6	8366.9	3029.8	8415.5	2897.2	8462.1
2763.9	8506.5	2630.0	8548.9	2495.4	8589.1	2360.2	8627.3	2224.4	8663.3
2088.0	8697.2	1951.1	8728.9	1813.8	8758.4	1676.0	8785.9	1537.8	8811.1
1399.2	8834.2	1260.3	8855.1	1121.0	8873.8	981.5	8890.3	841.7	8904.6
701.8	8916.7	561.6	8926.6	421.3	8934.4	280.9	8939.9	140.5	8943.2
0.0	8944.3	-140.5	8943.2	-280.9	8939.9	-421.3	8934.4	-561.6	8926.6
-701.8	8916.7	-841.7	8904.6	-981.5	8890.3	-1121.0	8873.8	-1260.3	8855.1
-1399.2	8834.2	-1537.8	8811.1	-1676.0	8785.9	-1813.8	8758.4	-1951.1	8728.9
-2088.0	8697.2	-2224.4	8663.3	-2360.2	8627.3	-2495.4	8589.1	-2630.0	8548.9
-2763.9	8506.5	-2897.2	8462.1	-3029.8	8415.5	-3161.6	8366.9	-3292.6	8316.2

-3422.8	8263.4	-3552.2	8208.7	-3680.7	8151.9	-3808.3	8093.0	-3934.9	8032.2
-4060.6	7969.4	-4185.3	7904.7	-4308.9	7837.9	-4431.5	7769.3	-4553.0	7698.7
-4673.4	7626.3	-4792.6	7551.9	-4910.6	7475.7	-5027.4	7397.6	-5143.0	7317.8
-5257.3	7236.1	-5370.3	7152.6	-5482.0	7067.4	-5592.3	6980.4	-5701.3	6891.7
-5808.8	6801.3	-5915.0	6709.2	-6019.6	6615.5	-6122.8	6520.1	-6224.4	6423.1
-6324.6	6324.6	-6423.1	6224.4	-6520.1	6122.8	-6615.5	6019.6	-6709.2	5915.0
-6801.3	5808.8	-6891.7	5701.3	-6980.4	5592.3	-7067.4	5482.0	-7152.6	5370.3
-7236.1	5257.3	-7317.8	5143.0	-7397.6	5027.4	-7475.7	4910.6	-7551.9	4792.6
-7626.3	4673.4	-7698.7	4553.0	-7769.3	4431.5	-7837.9	4308.9	-7904.7	4185.3
-7969.4	4060.6	-8032.2	3934.9	-8093.0	3808.3	-8151.9	3680.7	-8208.7	3552.2
-8263.4	3422.8	-8316.2	3292.6	-8366.9	3161.6	-8415.5	3029.8	-8462.1	2897.2
-8506.5	2763.9	-8548.9	2630.0	-8589.1	2495.4	-8627.3	2360.2	-8663.3	2224.4
-8697.2	2088.0	-8728.9	1951.1	-8758.4	1813.8	-8785.9	1676.0	-8811.1	1537.8
-8834.2	1399.2	-8855.1	1260.3	-8873.8	1121.0	-8890.3	981.5	-8904.6	841.7
-8916.7	701.8	-8926.6	561.6	-8934.4	421.3	-8939.9	280.9	-8943.2	140.5
-8944.3	0.0	-8943.2	-140.5	-8939.9	-280.9	-8934.4	-421.3	-8926.6	-561.6
-8916.7	-701.8	-8904.6	-841.7	-8890.3	-981.5	-8873.8	-1121.0	-8855.1	-1260.3
-8834.2	-1399.2	-8811.1	-1537.8	-8785.9	-1676.0	-8758.4	-1813.8	-8728.9	-1951.1
-8697.2	-2088.0	-8663.3	-2224.4	-8627.3	-2360.2	-8589.1	-2495.4	-8548.9	-2630.0
-8506.5	-2763.9	-8462.1	-2897.2	-8415.5	-3029.8	-8366.9	-3161.6	-8316.2	-3292.6
-8263.4	-3422.8	-8208.7	-3552.2	-8151.9	-3680.7	-8093.0	-3808.3	-8032.2	-3934.9
-7969.4	-4060.6	-7904.7	-4185.3	-7837.9	-4308.9	-7769.3	-4431.5	-7698.7	-4553.0
-7626.3	-4673.4	-7551.9	-4792.6	-7475.7	-4910.6	-7397.6	-5027.4	-7317.8	-5143.0
-7236.1	-5257.3	-7152.6	-5370.3	-7067.4	-5482.0	-6980.4	-5592.3	-6891.7	-5701.3
-6801.3	-5808.8	-6709.2	-5915.0	-6615.5	-6019.6	-6520.1	-6122.8	-6423.1	-6224.4
-6324.6	-6324.6	-6224.4	-6423.1	-6122.8	-6520.1	-6019.6	-6615.5	-5915.0	-6709.2
-5808.8	-6801.3	-5701.3	-6891.7	-5592.3	-6980.4	-5482.0	-7067.4	-5370.3	-7152.6
-5257.3	-7236.1	-5143.0	-7317.8	-5027.4	-7397.6	-4910.6	-7475.7	-4792.6	-7551.9
-4673.4	-7626.3	-4553.0	-7698.7	-4431.5	-7769.3	-4308.9	-7837.9	-4185.3	-7904.7
-4060.6	-7969.4	-3934.9	-8032.2	-3808.3	-8093.0	-3680.7	-8151.9	-3552.2	-8208.7
-3422.8	-8263.4	-3292.6	-8316.2	-3161.6	-8366.9	-3029.8	-8415.5	-2897.2	-8462.1
-2763.9	-8506.5	-2630.0	-8548.9	-2495.4	-8589.1	-2360.2	-8627.3	-2224.4	-8663.3
-2088.0	-8697.2	-1951.1	-8728.9	-1813.8	-8758.4	-1676.0	-8785.9	-1537.8	-8811.1
-1399.2	-8834.2	-1260.3	-8855.1	-1121.0	-8873.8	-981.5	-8890.3	-841.7	-8904.6
-701.8	-8916.7	-561.6	-8926.6	-421.3	-8934.4	-280.9	-8939.9	-140.5	-8943.2
0.0	-8944.3	140.5	-8943.2	280.9	-8939.9	421.3	-8934.4	561.6	-8926.6
701.8	-8916.7	841.7	-8904.6	981.5	-8890.3	1121.0	-8873.8	1260.3	-8855.1

1399.2	-8834.2	1537.8	-8811.1	1676.0	-8785.9	1813.8	-8758.4	1951.1	-8728.9
2088.0	-8697.2	2224.4	-8663.3	2360.2	-8627.3	2495.4	-8589.1	2630.0	-8548.9
2763.9	-8506.5	2897.2	-8462.1	3029.8	-8415.5	3161.6	-8366.9	3292.6	-8316.2
3422.8	-8263.4	3552.2	-8208.7	3680.7	-8151.9	3808.3	-8093.0	3934.9	-8032.2
4060.6	-7969.4	4185.3	-7904.7	4308.9	-7837.9	4431.5	-7769.3	4553.0	-7698.7
4673.4	-7626.3	4792.6	-7551.9	4910.6	-7475.7	5027.4	-7397.6	5143.0	-7317.8
5257.3	-7236.1	5370.3	-7152.6	5482.0	-7067.4	5592.3	-6980.4	5701.3	-6891.7
5808.8	-6801.3	5915.0	-6709.2	6019.6	-6615.5	6122.8	-6520.1	6224.4	-6423.1
6324.6	-6324.6	6423.1	-6224.4	6520.1	-6122.8	6615.5	-6019.6	6709.2	-5915.0
6801.3	-5808.8	6891.7	-5701.3	6980.4	-5592.3	7067.4	-5482.0	7152.6	-5370.3
7236.1	-5257.3	7317.8	-5143.0	7397.6	-5027.4	7475.7	-4910.6	7551.9	-4792.6
7626.3	-4673.4	7698.7	-4553.0	7769.3	-4431.5	7837.9	-4308.9	7904.7	-4185.3
7969.4	-4060.6	8032.2	-3934.9	8093.0	-3808.3	8151.9	-3680.7	8208.7	-3552.2
8263.4	-3422.8	8316.2	-3292.6	8366.9	-3161.6	8415.5	-3029.8	8462.1	-2897.2
8506.5	-2763.9	8548.9	-2630.0	8589.1	-2495.4	8627.3	-2360.2	8663.3	-2224.4
8697.2	-2088.0	8728.9	-1951.1	8758.4	-1813.8	8785.9	-1676.0	8811.1	-1537.8
8834.2	-1399.2	8855.1	-1260.3	8873.8	-1121.0	8890.3	-981.5	8904.6	-841.7
8916.7	-701.8	8926.6	-561.6	8934.4	-421.3	8939.9	-280.9	8943.2	-140.5

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9089.1	0.0	9088.0	142.8	9084.6	285.5	9079.0	428.2	9071.1	570.7
9061.1	713.1	9048.7	855.4	9034.2	997.4	9017.4	1139.2	8998.4	1280.7
8977.2	1421.8	8953.7	1562.7	8928.1	1703.1	8900.2	1843.1	8870.2	1982.7
8837.9	2121.8	8803.5	2260.4	8766.9	2398.4	8728.2	2535.8	8687.3	2672.6
8644.2	2808.7	8599.0	2944.1	8551.7	3078.8	8502.3	3212.8	8450.8	3345.9
8397.2	3478.2	8341.5	3609.7	8283.8	3740.3	8224.0	3869.9	8162.2	3998.6
8098.4	4126.4	8032.6	4253.0	7964.8	4378.7	7895.1	4503.3	7823.3	4626.7
7749.7	4749.0	7674.2	4870.2	7596.7	4990.1	7517.4	5108.8	7436.2	5226.3
7353.2	5342.4	7268.4	5457.3	7181.8	5570.8	7093.4	5682.9	7003.3	5793.6
6911.4	5902.9	6817.8	6010.7	6722.6	6117.1	6625.6	6221.9	6527.1	6325.2
6426.9	6426.9	6325.2	6527.1	6221.9	6625.6	6117.1	6722.6	6010.7	6817.8
5902.9	6911.4	5793.6	7003.3	5682.9	7093.4	5570.8	7181.8	5457.3	7268.4
5342.4	7353.2	5226.3	7436.2	5108.8	7517.4	4990.1	7596.7	4870.2	7674.2
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4126.4	8098.4	3998.6	8162.2	3869.9	8224.0	3740.3	8283.8	3609.7	8341.5
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2121.8	8837.9	1982.7	8870.2	1843.1	8900.2	1703.1	8928.1	1562.7	8953.7
1421.8	8977.2	1280.7	8998.4	1139.2	9017.4	997.4	9034.2	855.4	9048.7
713.1	9061.1	570.7	9071.1	428.2	9079.0	285.5	9084.6	142.8	9088.0
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9113.0	2187.8	9077.5	2330.7	9039.8	2473.0	8999.8	2614.7	8957.6	2755.7
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8658.5	3586.5	8601.1	3722.0	8541.6	3856.7	8480.0	3990.4	8416.3	4123.1
8350.5	4254.8	8282.6	4385.4	8212.7	4515.0	8140.8	4643.4	8066.8	4770.7
7990.9	4896.8	7913.0	5021.7	7833.1	5145.4	7751.3	5267.8	7667.7	5388.9
7582.1	5508.7	7494.6	5627.1	7405.3	5744.1	7314.1	5859.7	7221.2	5973.9
7126.5	6086.6	7030.0	6197.8	6931.8	6307.4	6831.9	6415.5	6730.2	6522.1
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2187.8	9113.0	2044.4	9146.2	1900.5	9177.2	1756.1	9205.9	1611.3	9232.4
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58 1

9646.5	0.0	9645.3	151.5	9641.8	303.0	9635.8	454.4	9627.5	605.7
9616.8	756.9	9603.7	907.8	9588.3	1058.6	9570.5	1209.0	9550.3	1359.2
9527.8	1509.0	9502.9	1658.5	9475.6	1807.6	9446.1	1956.2	9414.2	2104.3
9380.0	2251.9	9343.5	2399.0	9304.6	2545.5	9263.5	2691.3	9220.1	2836.5
9174.4	2980.9	9126.4	3124.7	9076.2	3267.6	9023.8	3409.8	8969.1	3551.1
8912.2	3691.6	8853.1	3831.1	8791.9	3969.7	8728.4	4107.3	8662.8	4243.9
8595.1	4379.4	8525.3	4513.9	8453.3	4647.2	8379.3	4779.4	8303.2	4910.5
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6264.9	7335.3	6148.9	7432.8	6031.4	7528.4	5912.4	7622.2	5792.0	7714.2
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4379.4	8595.1	4243.9	8662.8	4107.3	8728.4	3969.7	8791.9	3831.1	8853.1
3691.6	8912.2	3551.1	8969.1	3409.8	9023.8	3267.6	9076.2	3124.7	9126.4
2980.9	9174.4	2836.5	9220.1	2691.3	9263.5	2545.5	9304.6	2399.0	9343.5
2251.9	9380.0	2104.3	9414.2	1956.2	9446.1	1807.6	9475.6	1658.5	9502.9
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-3022.5	-9302.2	-2876.0	-9348.5	-2728.8	-9392.5	-2580.9	-9434.3	-2432.4	-9473.6
-2283.3	-9510.7	-2133.6	-9545.4	-1983.4	-9577.7	-1832.8	-9607.7	-1681.6	-9635.3
-1530.1	-9660.5	-1378.1	-9683.3	-1225.9	-9703.8	-1073.3	-9721.8	-920.5	-9737.5
-767.4	-9750.8	-614.1	-9761.6	-460.7	-9770.1	-307.2	-9776.1	-153.6	-9779.7
0.0	-9780.9	153.6	-9779.7	307.2	-9776.1	460.7	-9770.1	614.1	-9761.6
767.4	-9750.8	920.5	-9737.5	1073.3	-9721.8	1225.9	-9703.8	1378.1	-9683.3
1530.1	-9660.5	1681.6	-9635.3	1832.8	-9607.7	1983.4	-9577.7	2133.6	-9545.4
2283.3	-9510.7	2432.4	-9473.6	2580.9	-9434.3	2728.8	-9392.5	2876.0	-9348.5
3022.5	-9302.2	3168.2	-9253.6	3313.2	-9202.7	3457.3	-9149.5	3600.6	-9094.1
3743.0	-9036.4	3884.5	-8976.5	4025.0	-8914.4	4164.5	-8850.0	4303.0	-8783.5
4440.4	-8714.9	4576.8	-8644.0	4712.0	-8571.1	4846.0	-8496.0	4978.9	-8418.8
5110.5	-8339.6	5240.9	-8258.3	5369.9	-8175.0	5497.7	-8089.6	5624.1	-8002.3
5749.1	-7912.9	5872.7	-7821.6	5994.8	-7728.4	6115.4	-7633.3	6234.6	-7536.3
6352.2	-7437.5	6468.2	-7336.8	6582.7	-7234.3	6695.5	-7130.0	6806.7	-7023.9
6916.2	-6916.2	7023.9	-6806.7	7130.0	-6695.5	7234.3	-6582.7	7336.8	-6468.2
7437.5	-6352.2	7536.3	-6234.6	7633.3	-6115.4	7728.4	-5994.8	7821.6	-5872.7
7912.9	-5749.1	8002.3	-5624.1	8089.6	-5497.7	8175.0	-5369.9	8258.3	-5240.9
8339.6	-5110.5	8418.8	-4978.9	8496.0	-4846.0	8571.1	-4712.0	8644.0	-4576.8
8714.9	-4440.4	8783.5	-4303.0	8850.0	-4164.5	8914.4	-4025.0	8976.5	-3884.5
9036.4	-3743.0	9094.1	-3600.6	9149.5	-3457.3	9202.7	-3313.2	9253.6	-3168.2
9302.2	-3022.5	9348.5	-2876.0	9392.5	-2728.8	9434.3	-2580.9	9473.6	-2432.4
9510.7	-2283.3	9545.4	-2133.6	9577.7	-1983.4	9607.7	-1832.8	9635.3	-1681.6
9660.5	-1530.1	9683.3	-1378.1	9703.8	-1225.9	9721.8	-1073.3	9737.5	-920.5
9750.8	-767.4	9761.6	-614.1	9770.1	-460.7	9776.1	-307.2	9779.7	-153.6

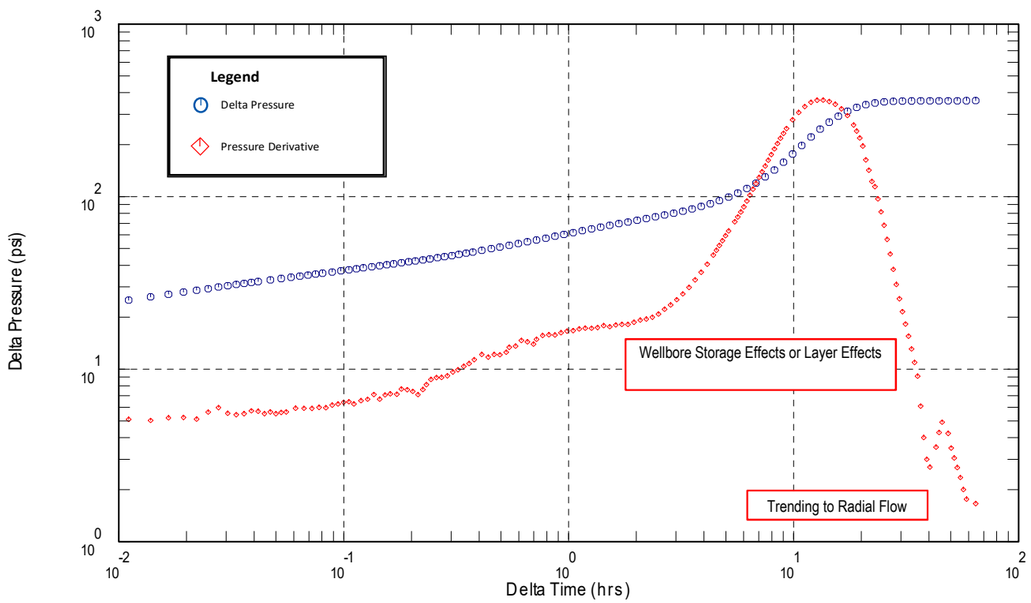
ATTACHMENT 5

ATTACHMENT 5
ANNUAL FORMATION PRESSURE TESTS
ANALYSIS YEARS 2001 - 2016

ATTACHMENT 5
Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2001 Ambient Pressure Falloff**	***Test Date*** ..... April 2001 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2001 Falloff

Log-Log Match



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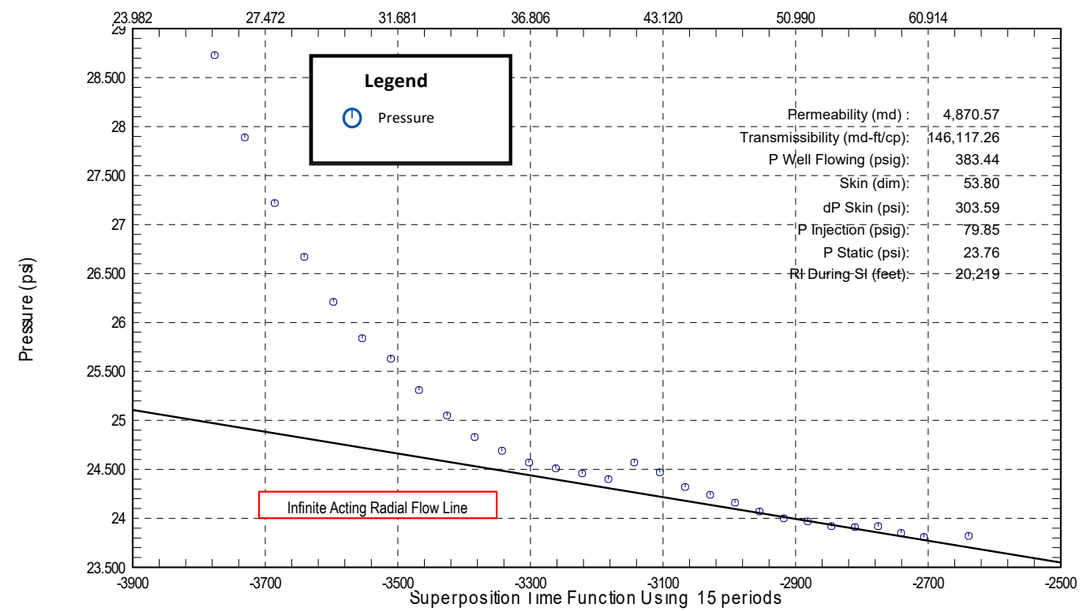
State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2001 Ambient Pressure Falloff**	***Test Date*** ..... April 2001 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2001 Falloff

Detailed Superposition Analysis



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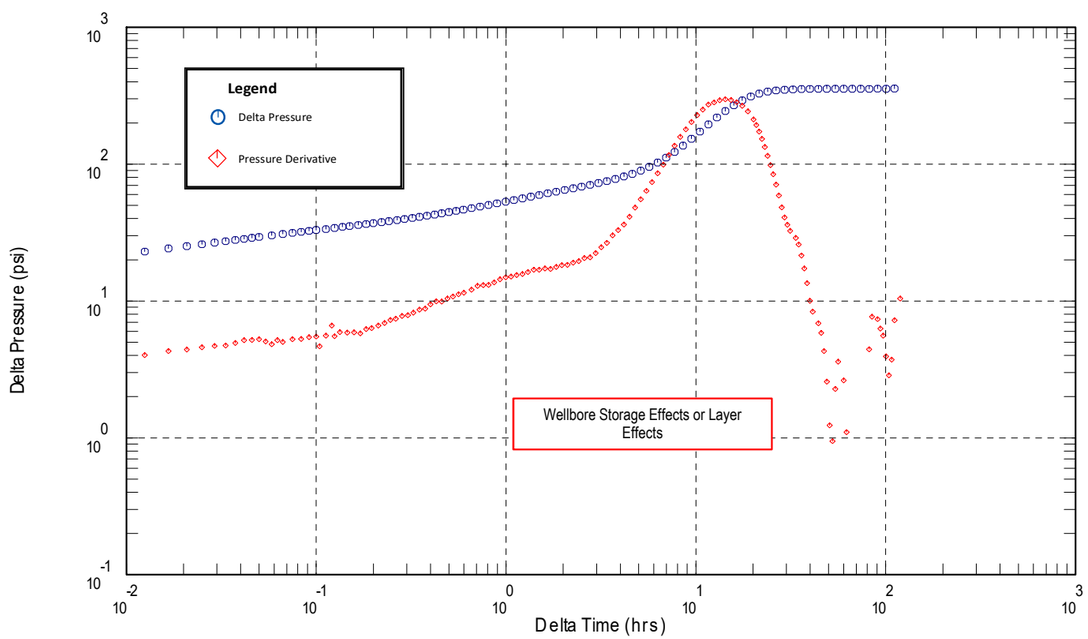
ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2002 Ambient Pressure Falloff**	***Test Date*** ..... April 2002 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2002 Falloff

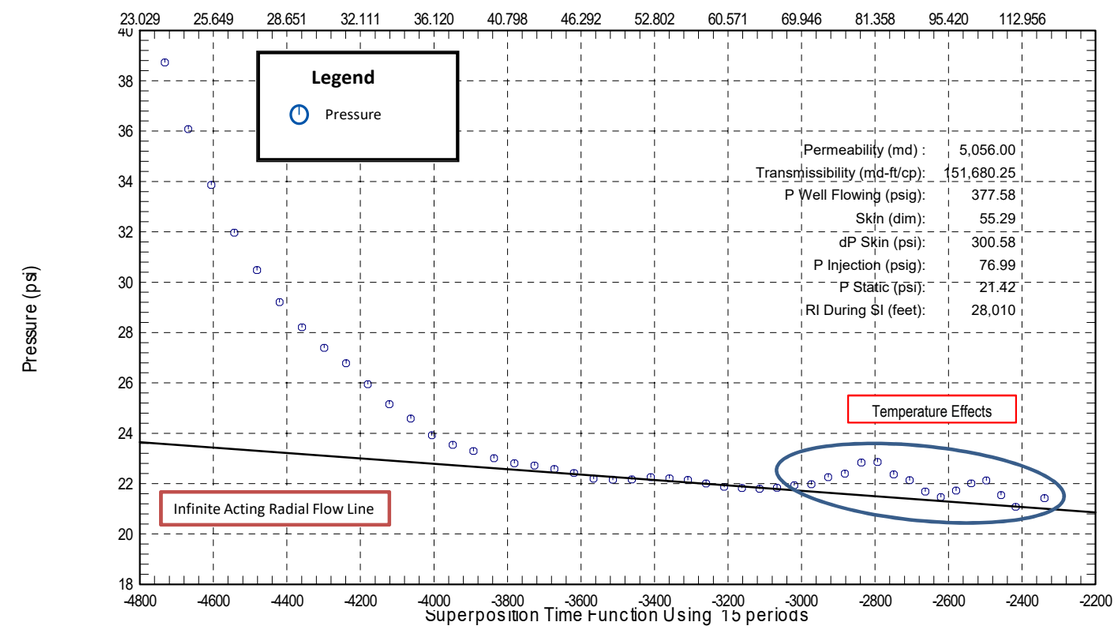
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2002 Ambient Pressure Falloff**	***Test Date*** ..... April 2002 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2002 Falloff

Detailed Superposition Analysis



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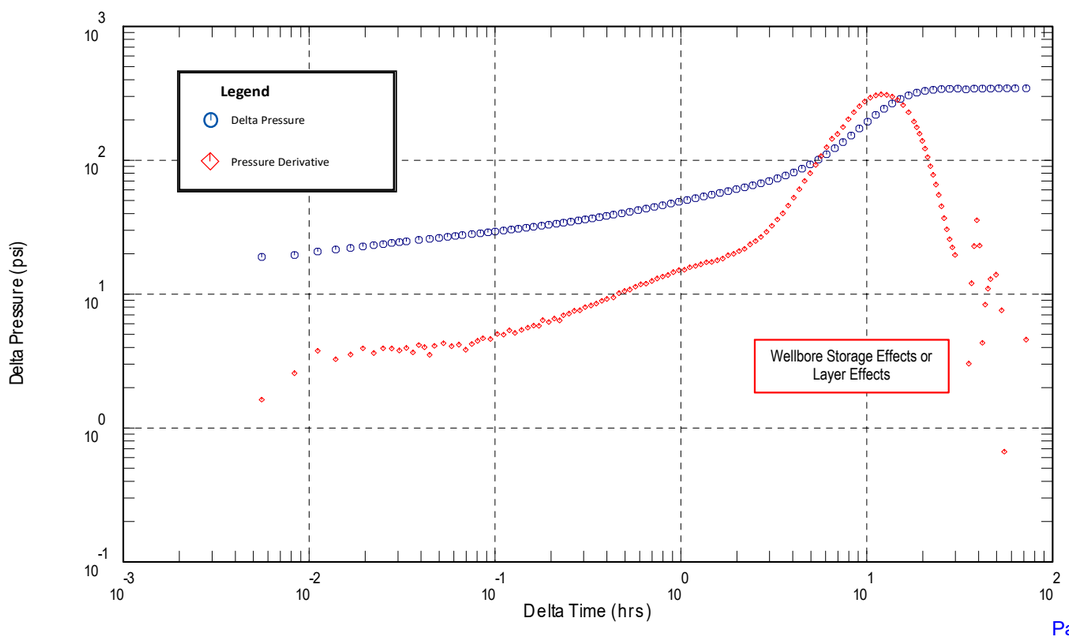
ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2003 Ambient Pressure Falloff**	***Test Date*** ..... April 2003 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2003 Falloff

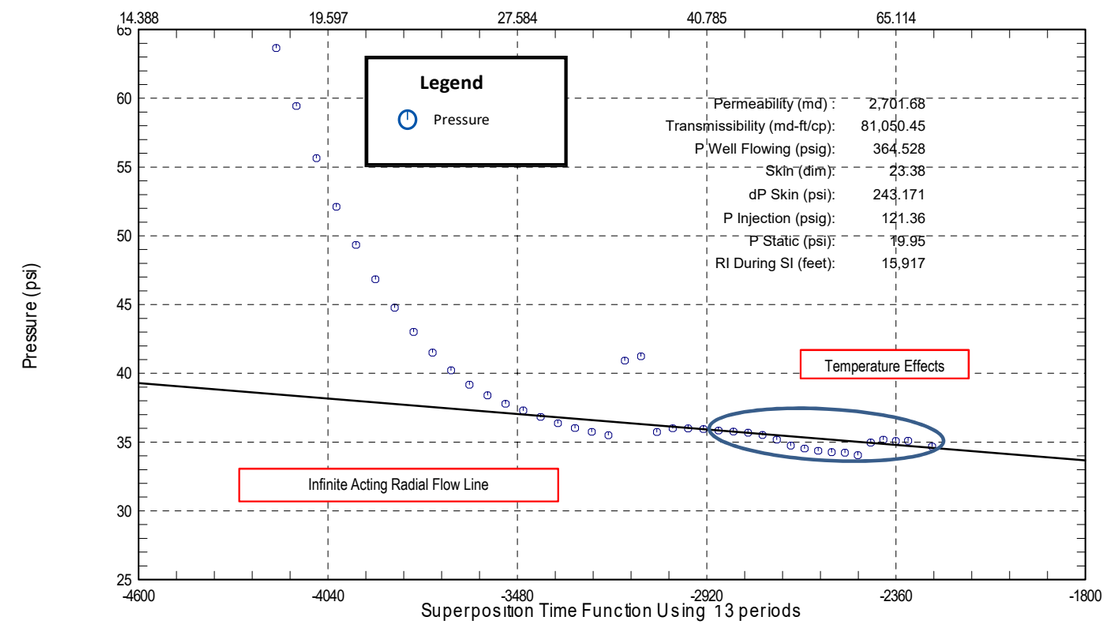
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2003 Ambient Pressure Falloff**	***Test Date*** ..... April 2003 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2003 Falloff

Detailed Superposition Analysis



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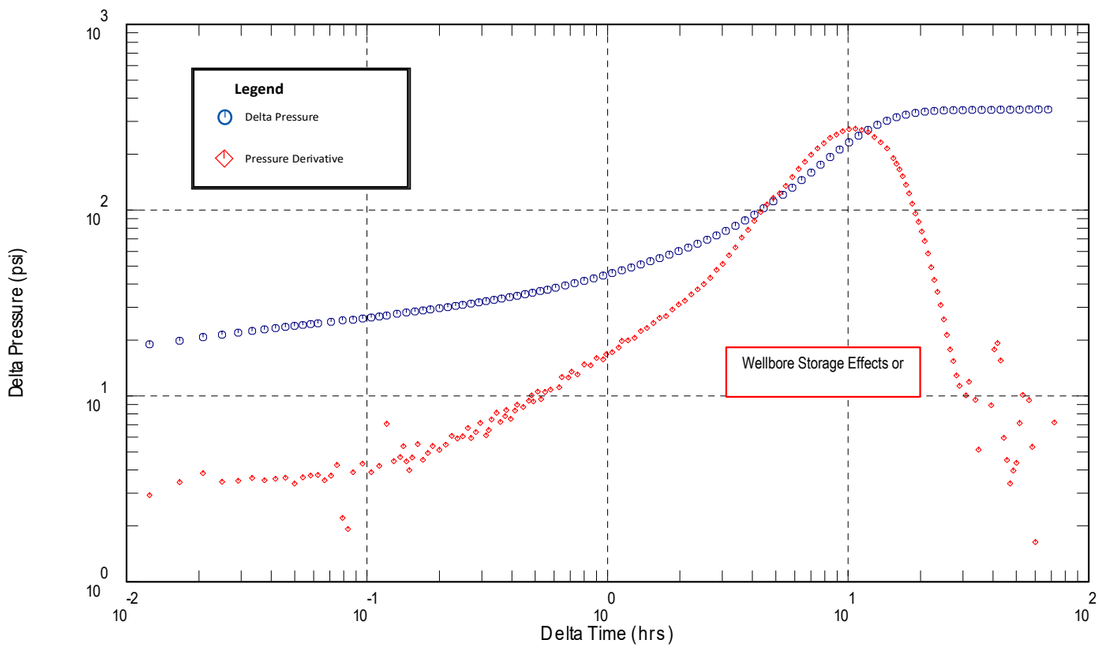
ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2004 Ambient Pressure Falloff**	***Test Date*** ..... May 2004 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2004 Falloff

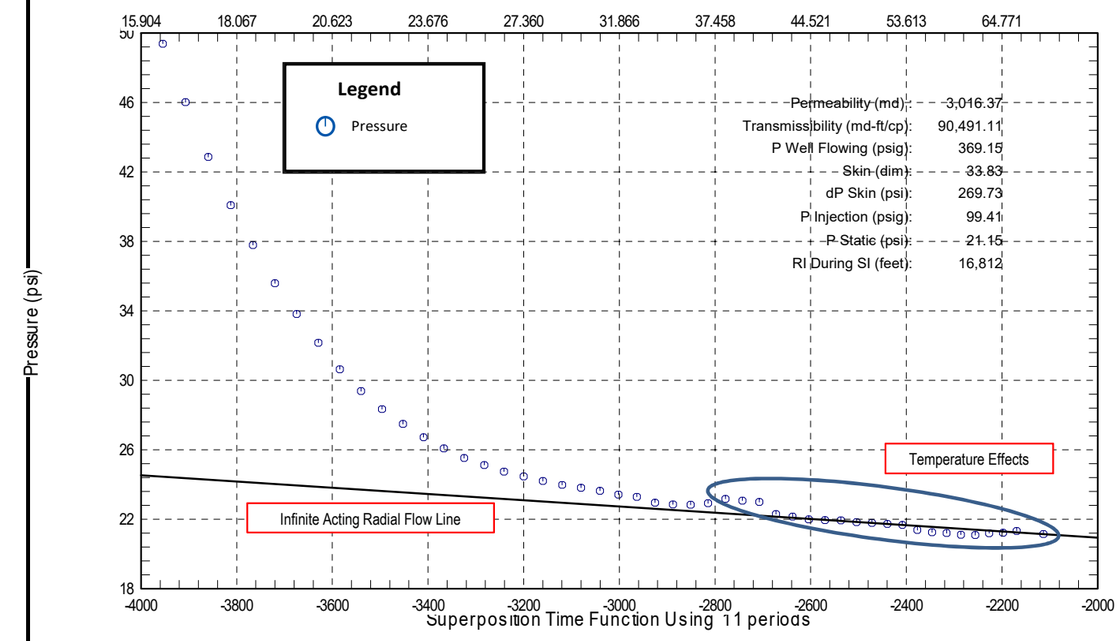
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2004 Ambient Pressure Falloff**	***Test Date*** ..... May 2004 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2004 Falloff

Detailed Superposition Analysis



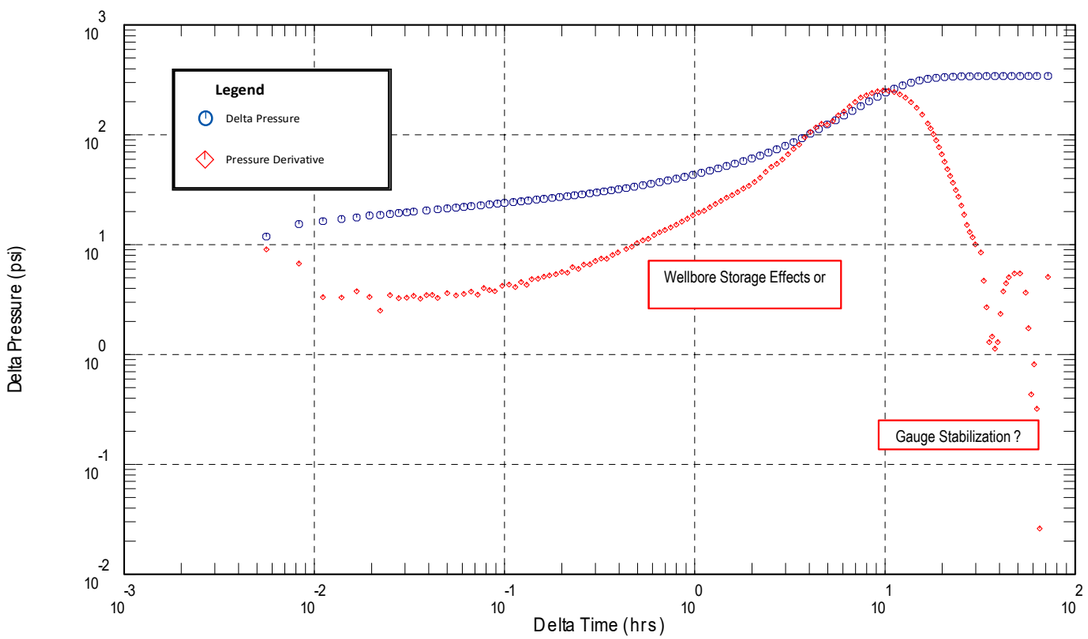
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2005 Ambient Pressure Falloff**	***Test Date*** ..... May 2005 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2005 Falloff

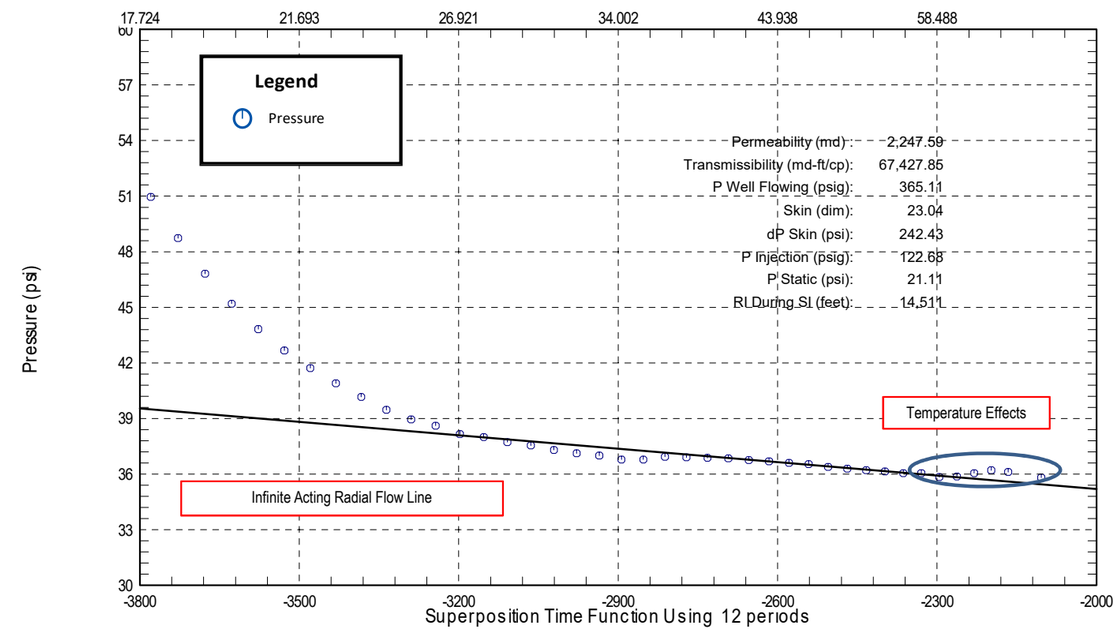
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2005 Ambient Pressure Falloff**	***Test Date*** ..... May 2005 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2005 Falloff

Detailed Superposition Analysis



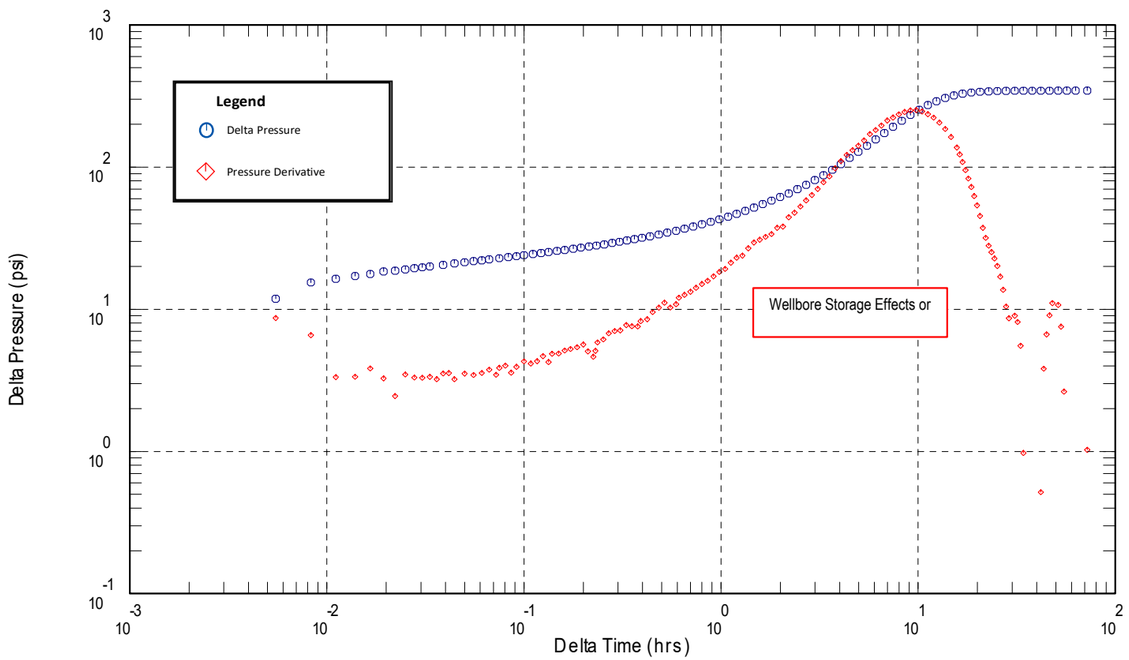
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2006 Ambient Pressure Falloff**	***Test Date*** ..... May 2006 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2006 Falloff

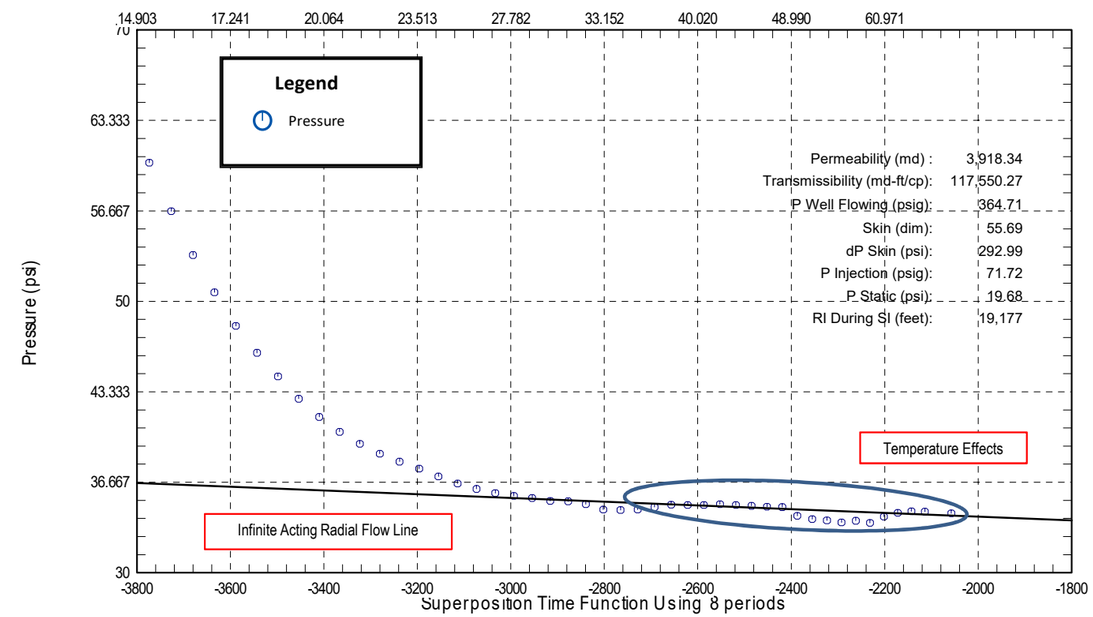
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2006 Ambient Pressure Falloff**	***Test Date*** ..... May 2006 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2006 Falloff

Detailed Superposition Analysis



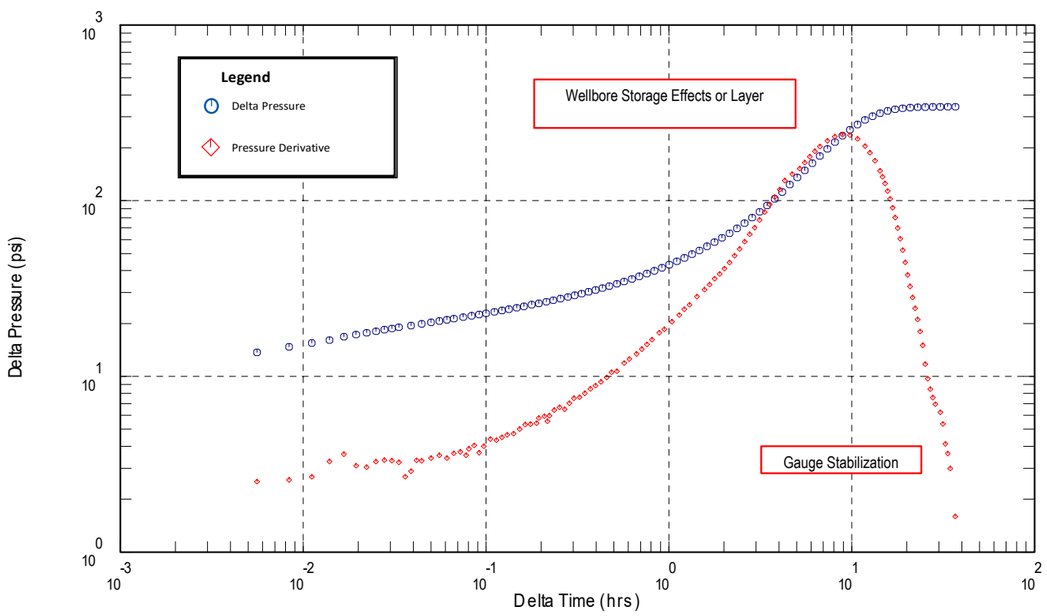
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2007 Ambient Pressure Falloff**	***Test Date*** ..... May 2007 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2007 Falloff

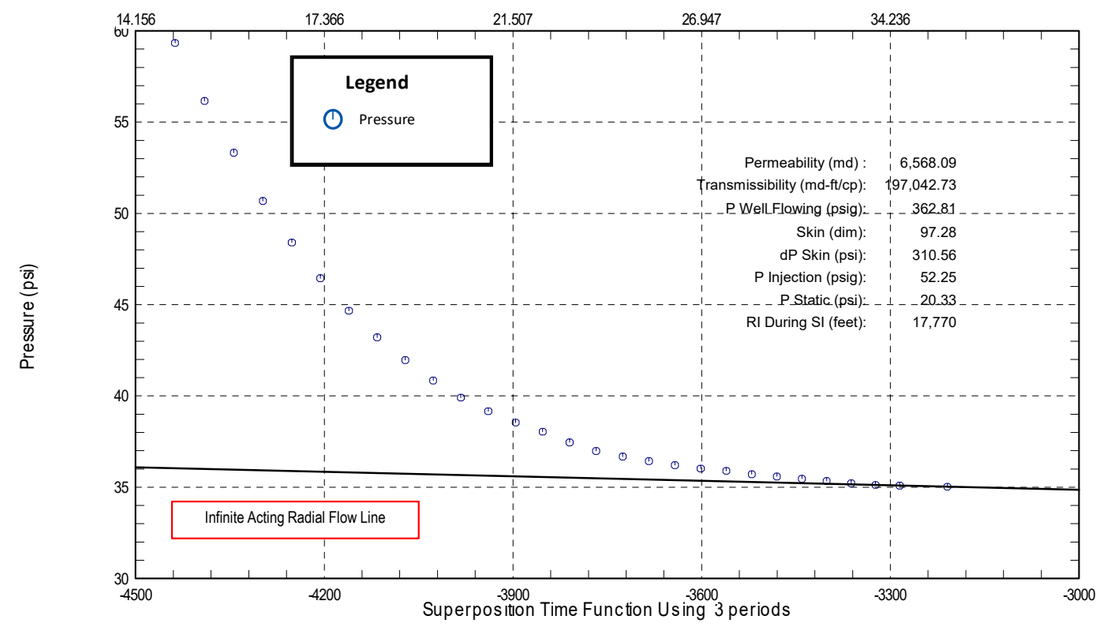
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2007 Ambient Pressure Falloff**	***Test Date*** ..... May 2007 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2007 Falloff

Detailed Superposition Analysis



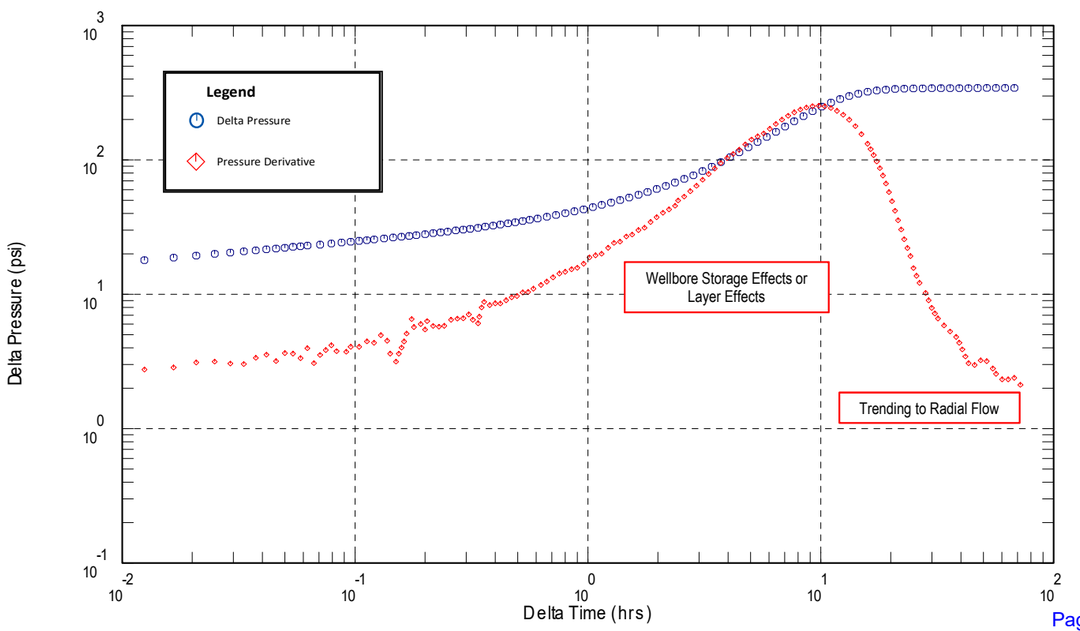
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2008 Ambient Pressure Falloff**	***Test Date*** ..... May 2008 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2008 Falloff

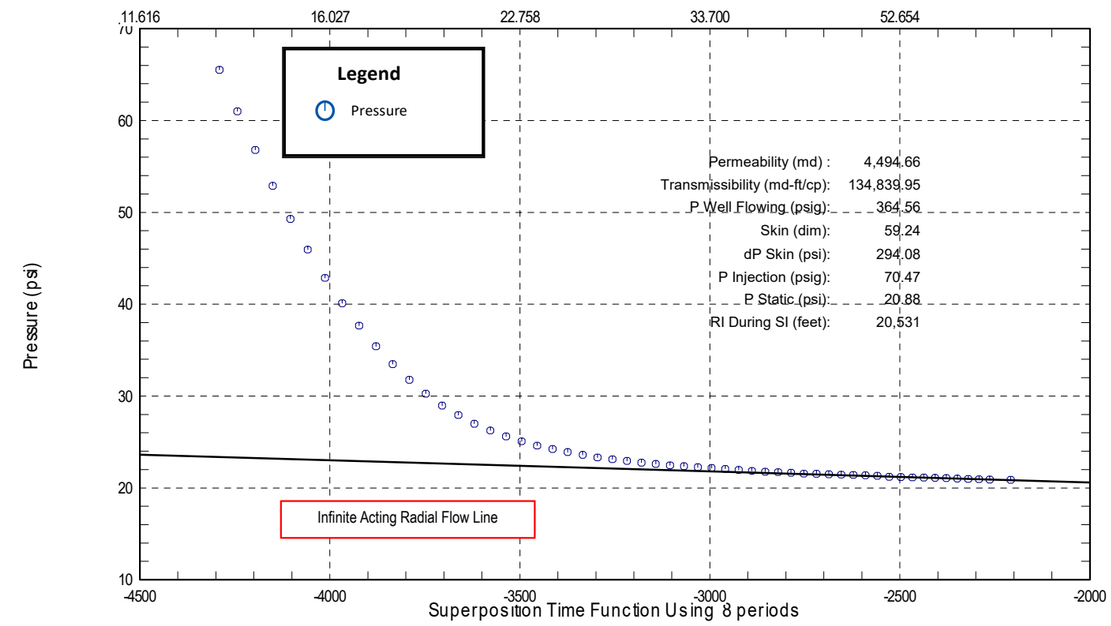
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2008 Ambient Pressue Falloff**	***Test Date*** ..... May 2008 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2008 Falloff

Detailed Superposition Analysis



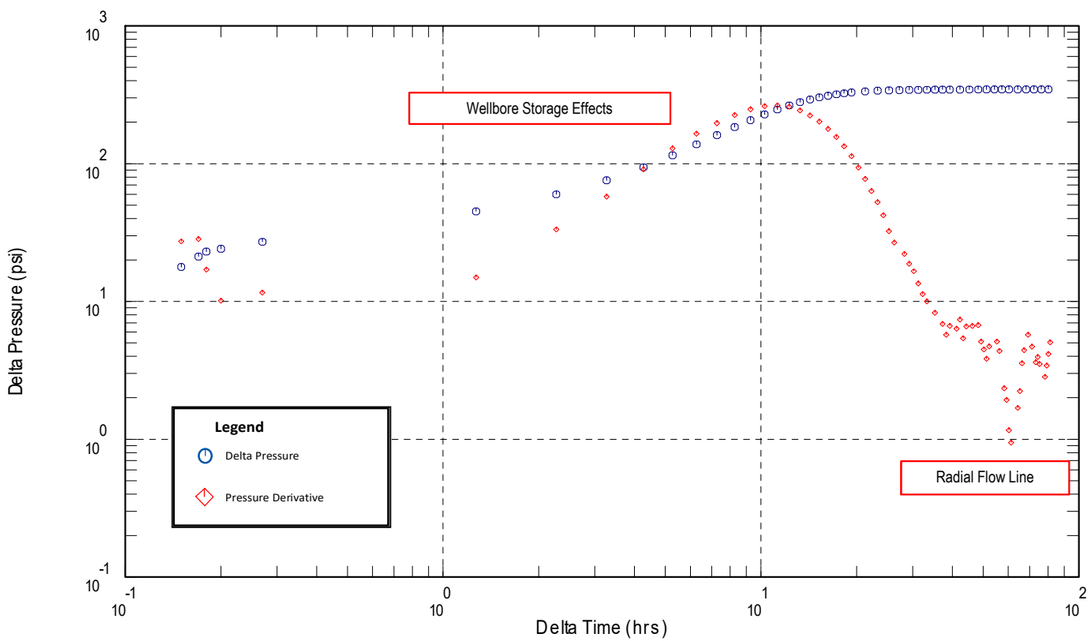
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2009 Ambient Pressure Falloff**	***Test Date*** ..... May 2009 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2009 Falloff

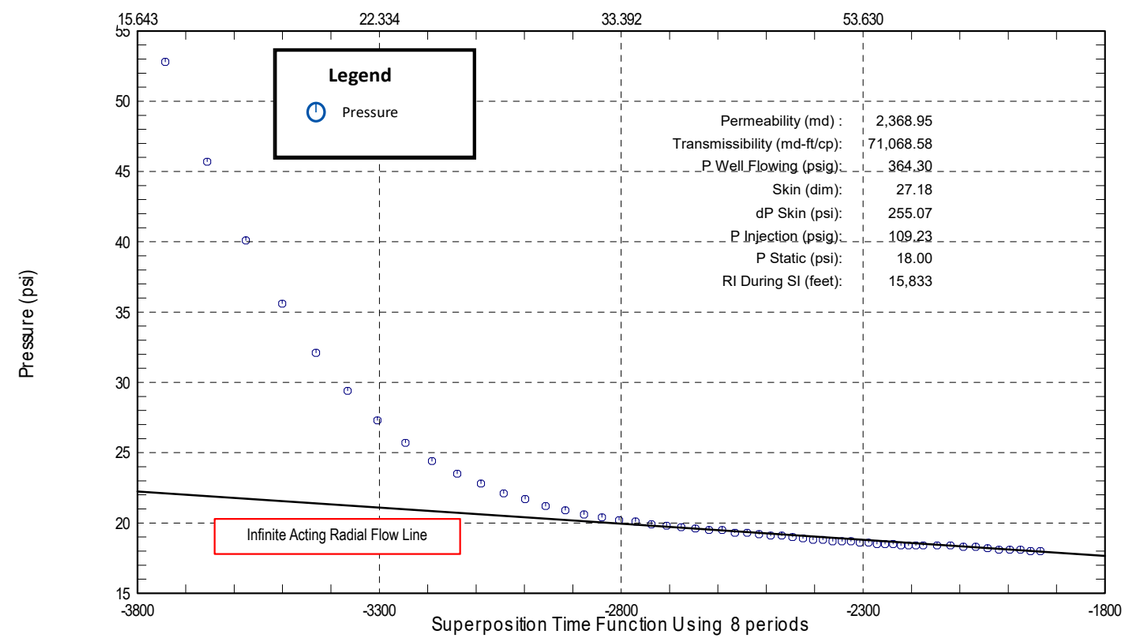
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2009 Ambient Pressure Falloff**	***Test Date*** ..... May 2009 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2009 Falloff

Detailed Superposition Analysis



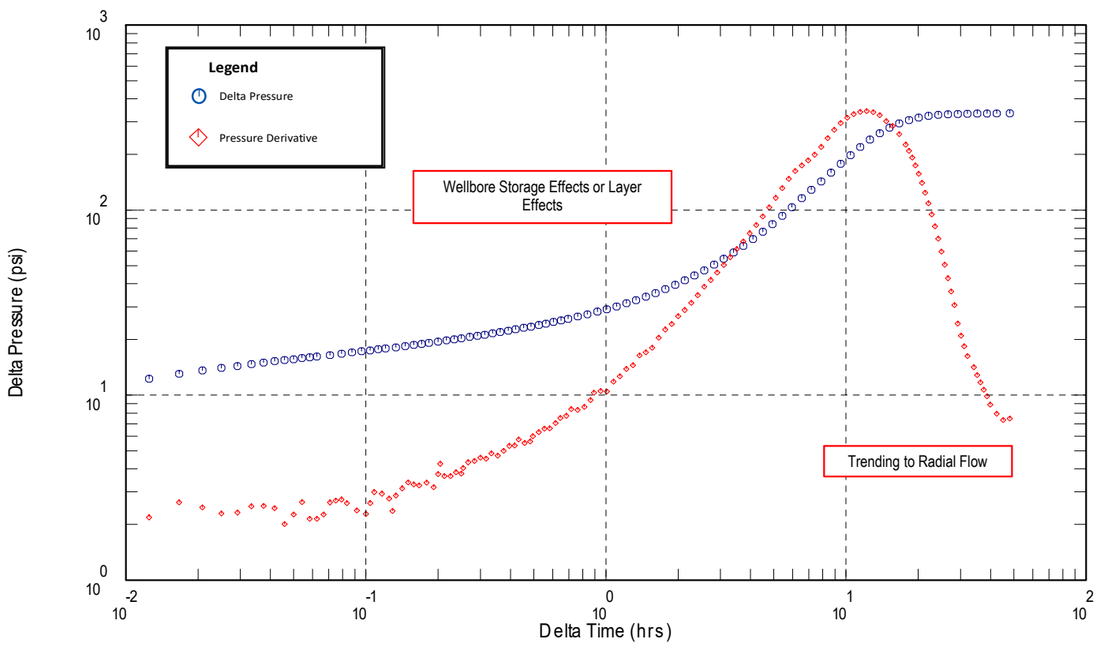
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2010 Ambient Pressure Falloff**	***Test Date*** ..... May 2010 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2010 Falloff

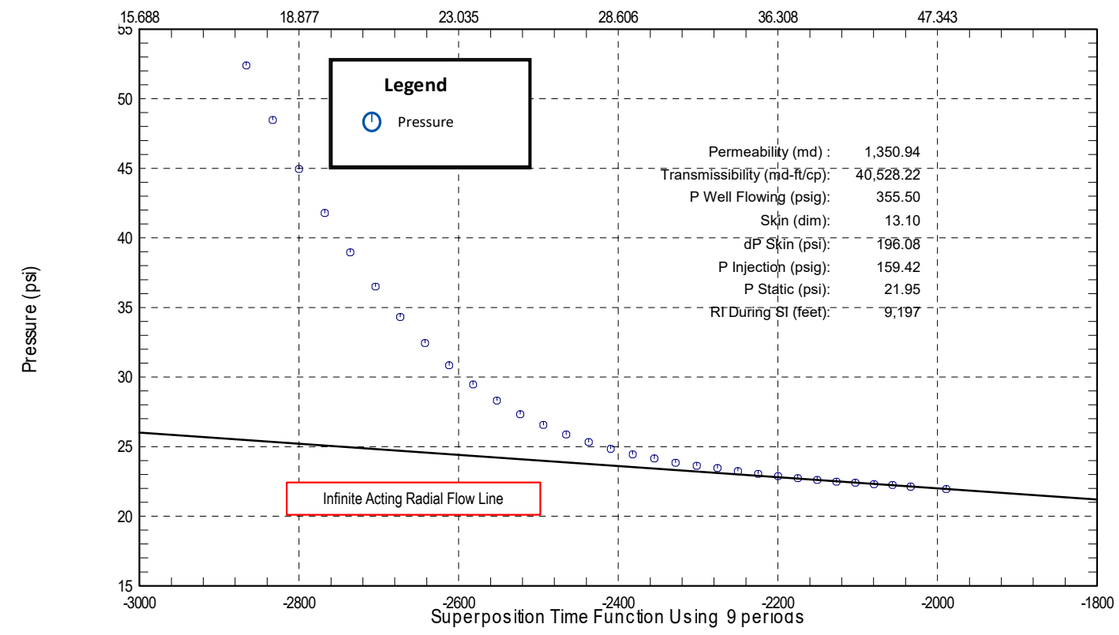
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2010 Ambient Pressure Falloff**	***Test Date*** ..... May 2010 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2010 Falloff

Detailed Superposition Analysis



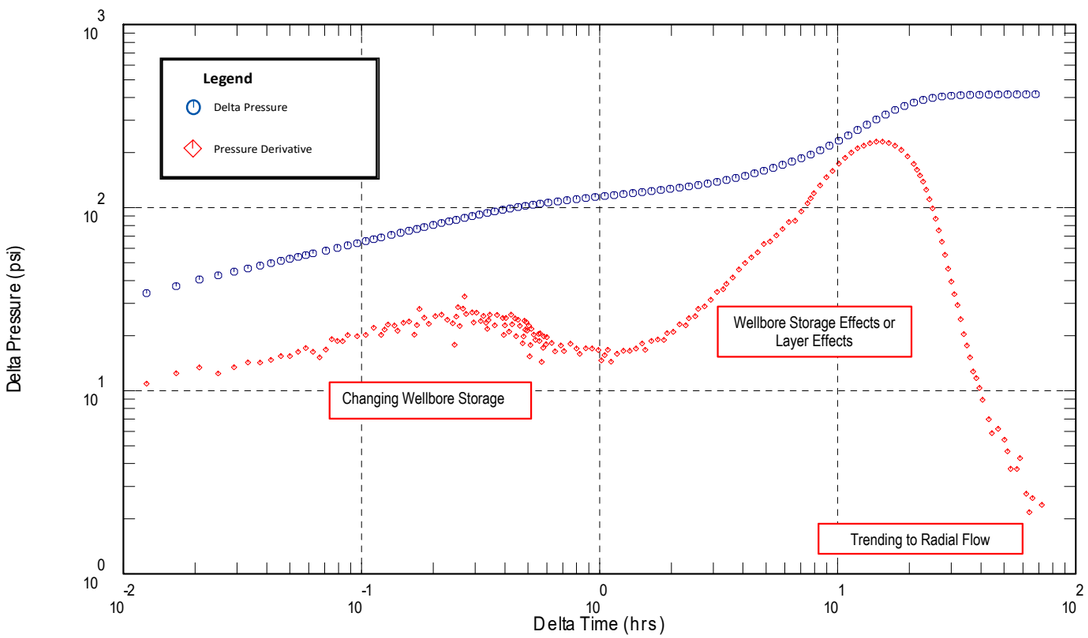
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2011 Ambient Pressure Falloff**	***Test Date*** ..... May 2011 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2011 Falloff

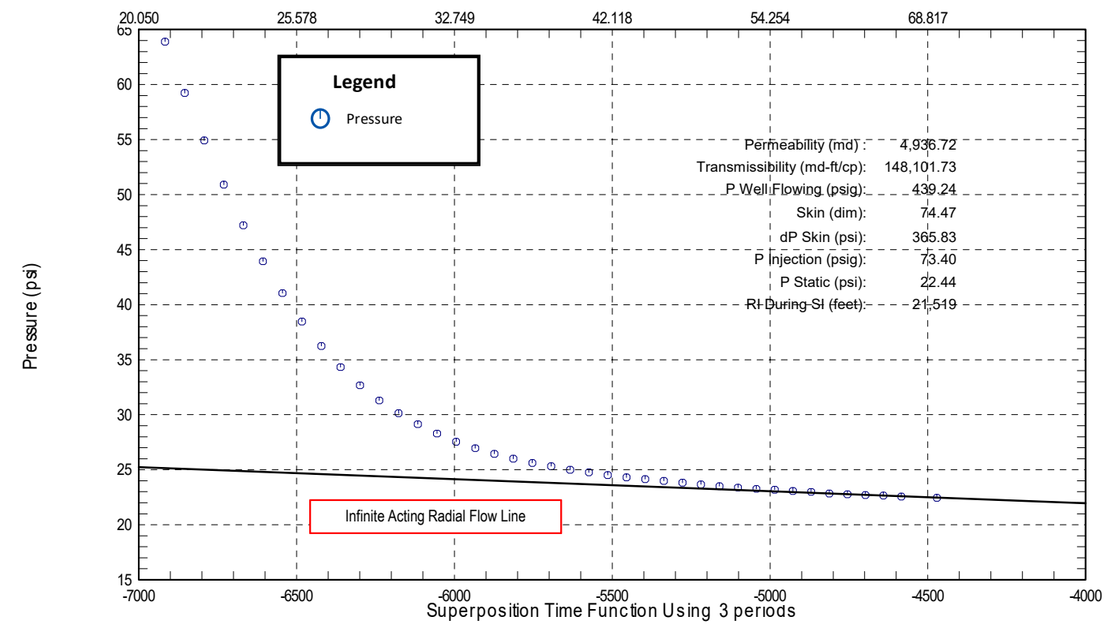
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2011 Ambient Pressure Falloff**	***Test Date*** ..... May 2011 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2011 falloff

Detailed Superposition Analysis



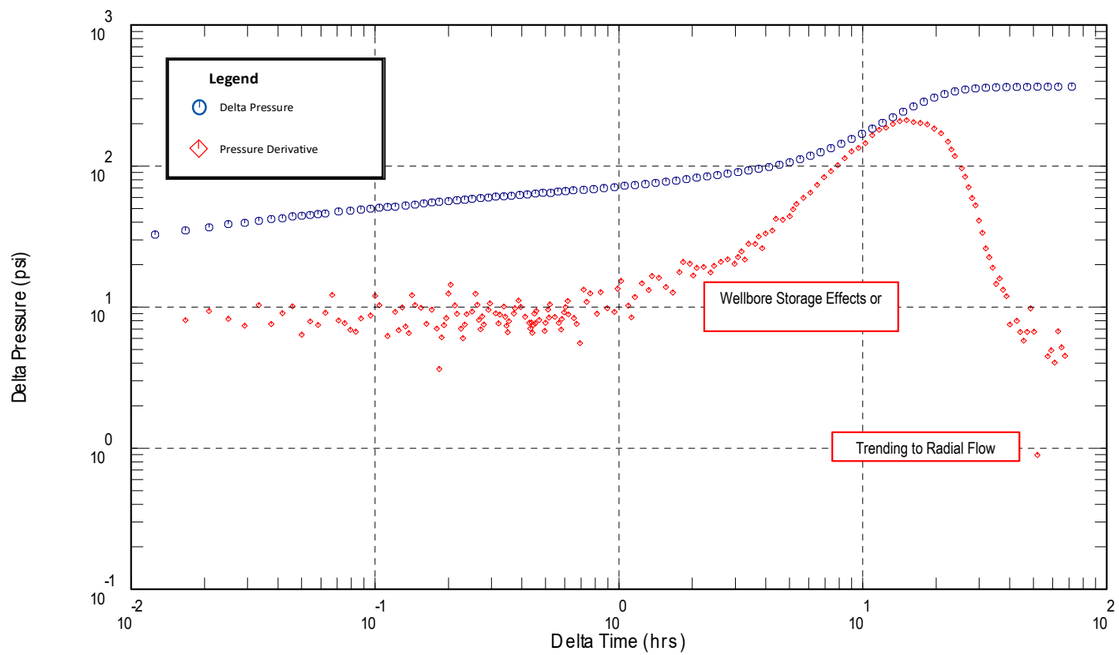
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2012 Ambient Pressure Falloff**	***Test Date*** ..... May 2012 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2012 Falloff

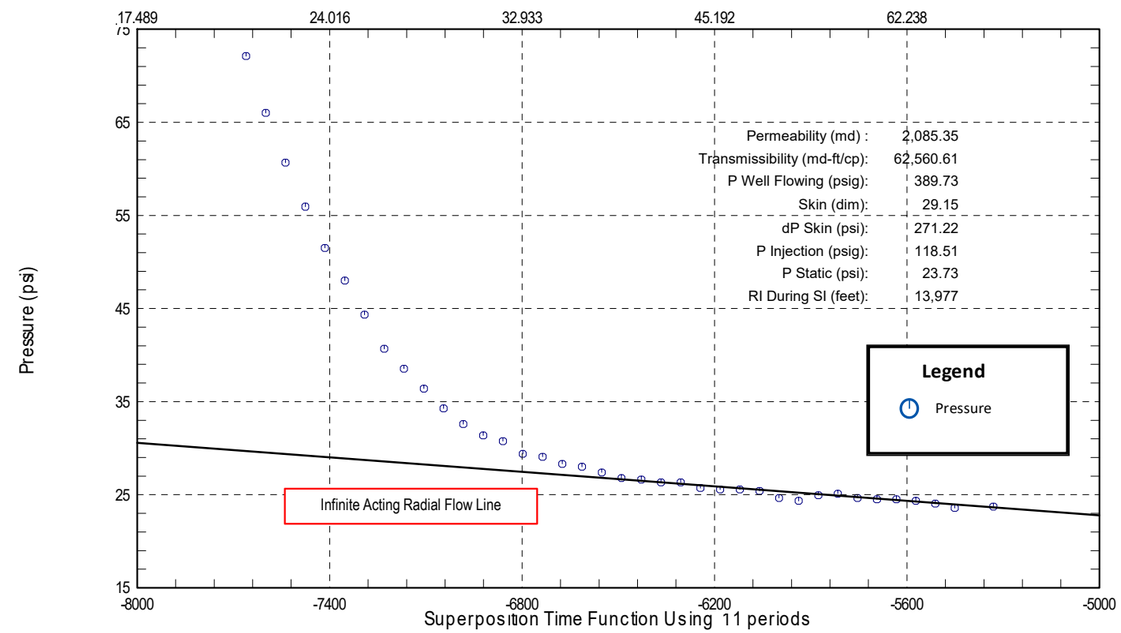
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2012 Ambient Pressure Falloff**	***Test Date*** ..... May 2012 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2012 Falloff

Detailed Superposition Analysis



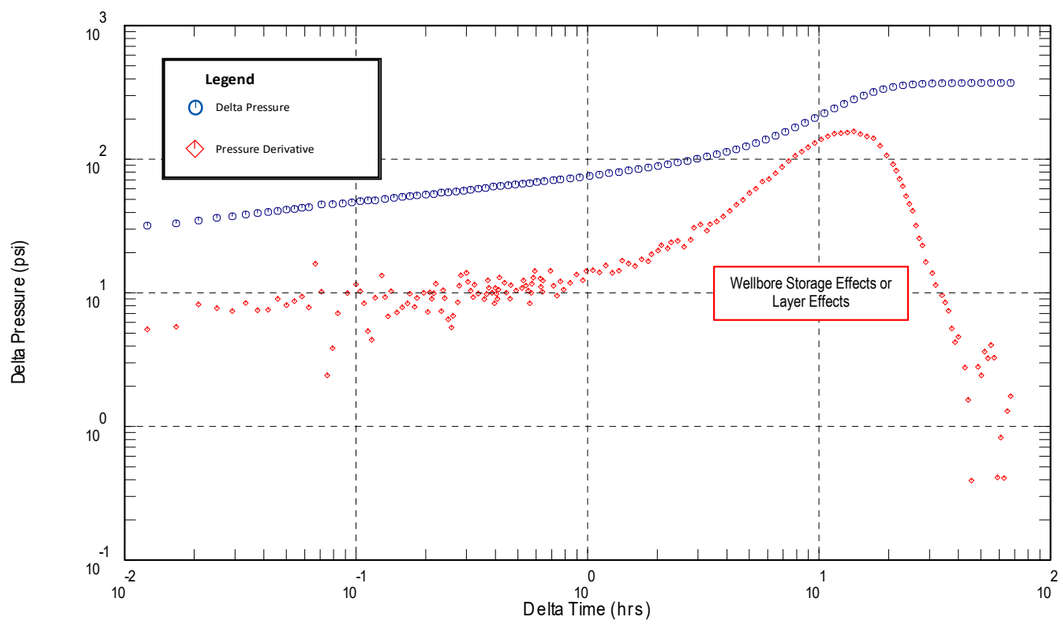
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2013 Ambient Pressure Falloff**	***Test Date*** ..... Aug 2013 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2013 Falloff

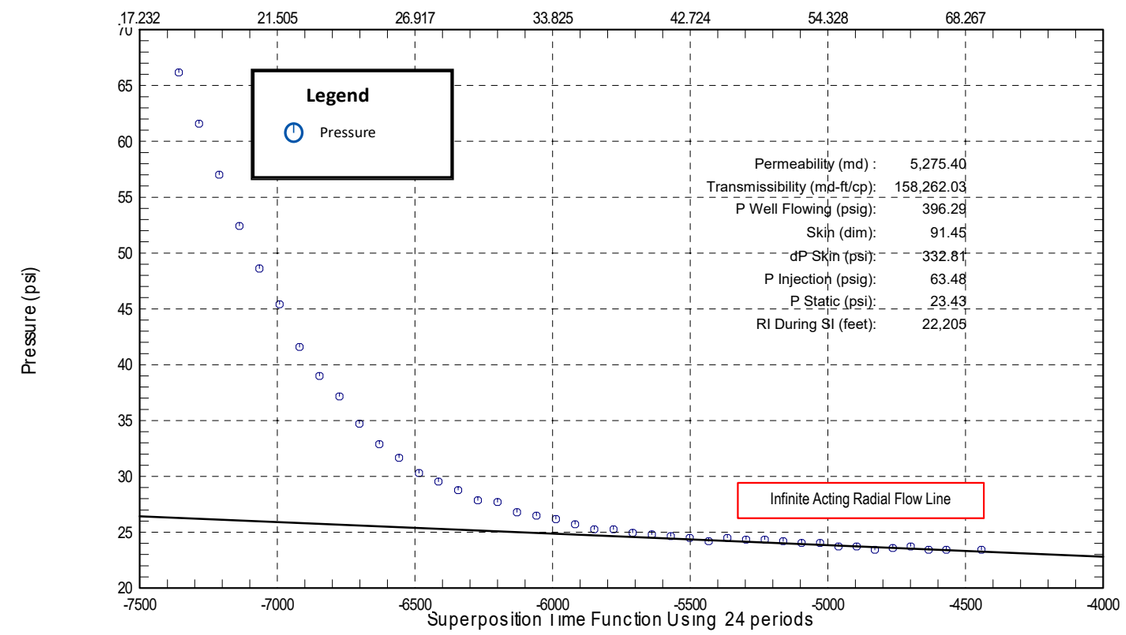
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2013 Ambient Pressure Falloff**	***Test Date*** ..... Aug 2013 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2013 Falloff

Detailed Superposition Analysis



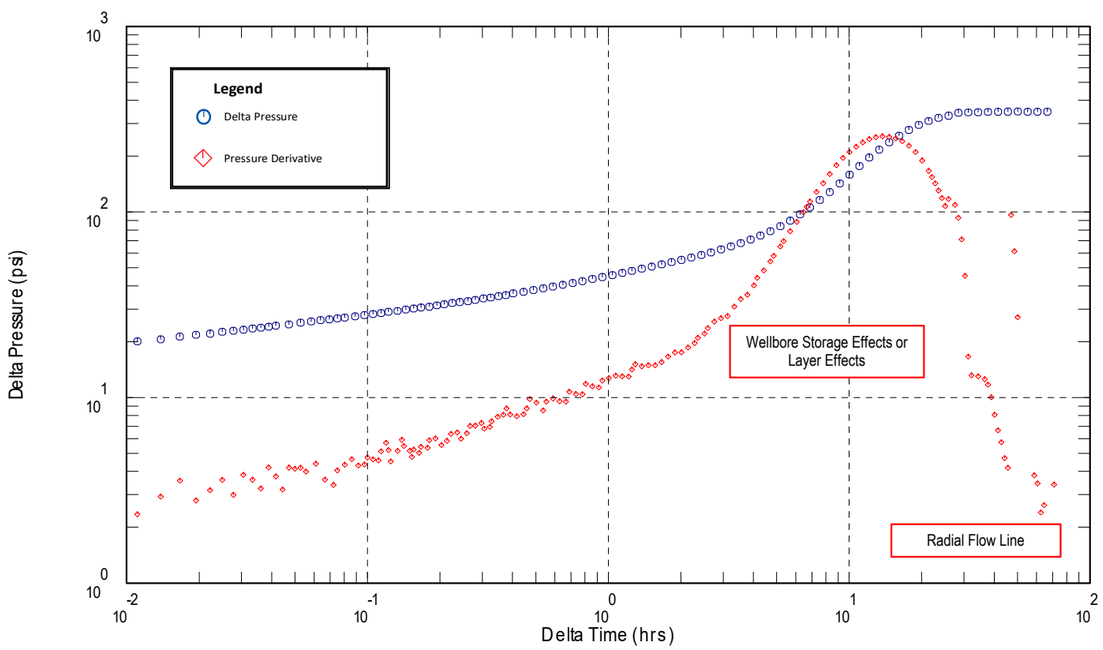
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2014 Ambient Pressure Falloff**	***Test Date*** ..... Jul 2014 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2014 Falloff

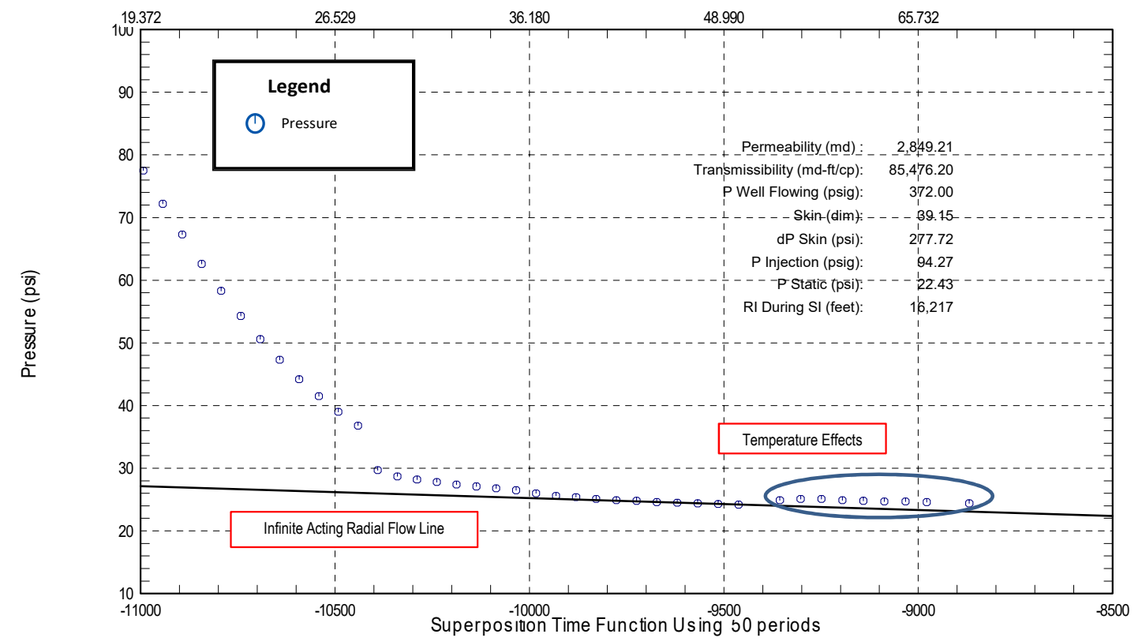
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2014 Ambient Pressure Falloff**	***Test Date*** ..... Jul 2014 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2014 Falloff

Detailed Superposition Analysis



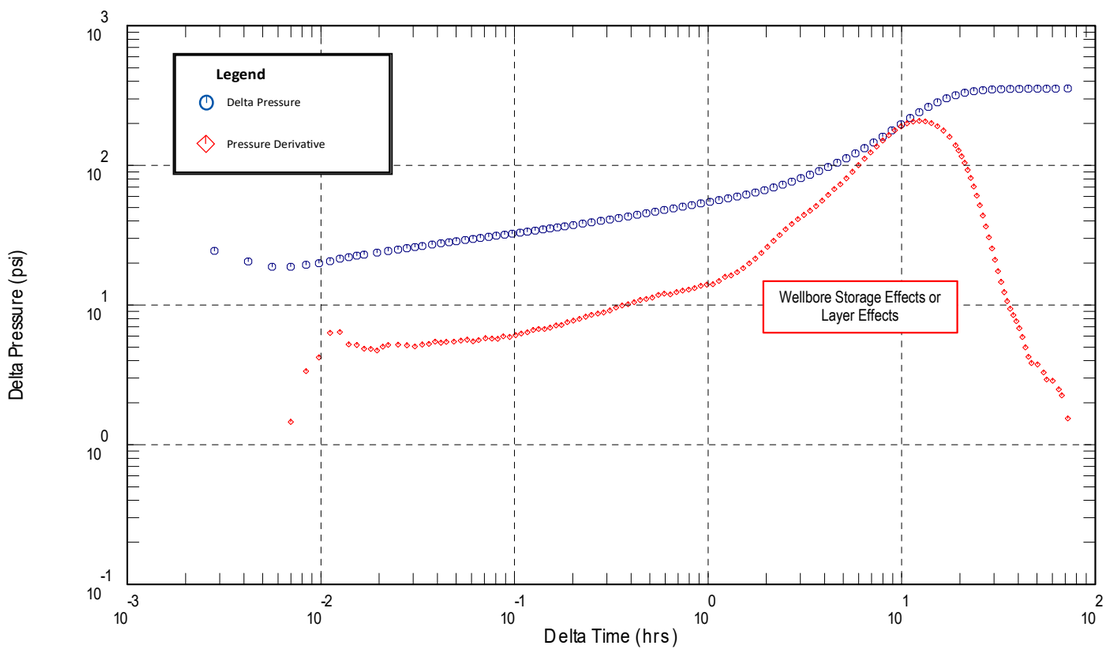
Page 2

ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2015 Ambient Pressure Falloff**	***Test Date*** ..... Sept 2015 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2015 Falloff

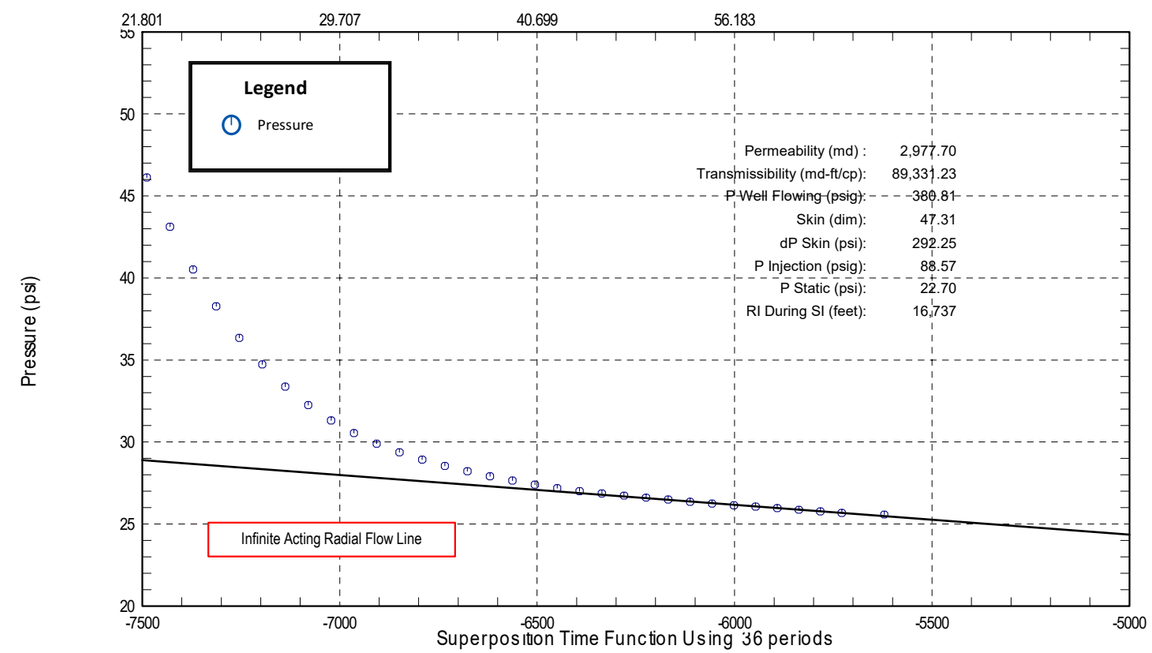
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2015 Ambient Pressure Falloff**	***Test Date*** ..... Sept 2015 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2015 Falloff

Detailed Superposition Analysis



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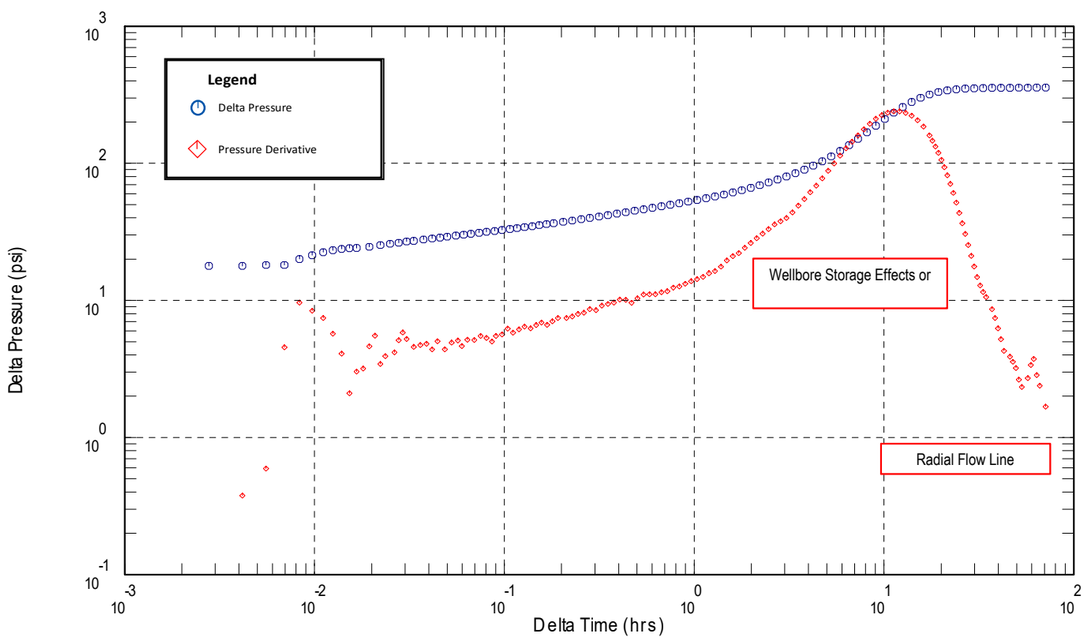
ATTACHMENT 5

Consolidated Ambient Injection/Falloff Test Analysis
Pryor Chemical Company

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2016 Ambient Pressure Falloff**	***Test Date*** ..... Aug 2016 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2016 Falloff

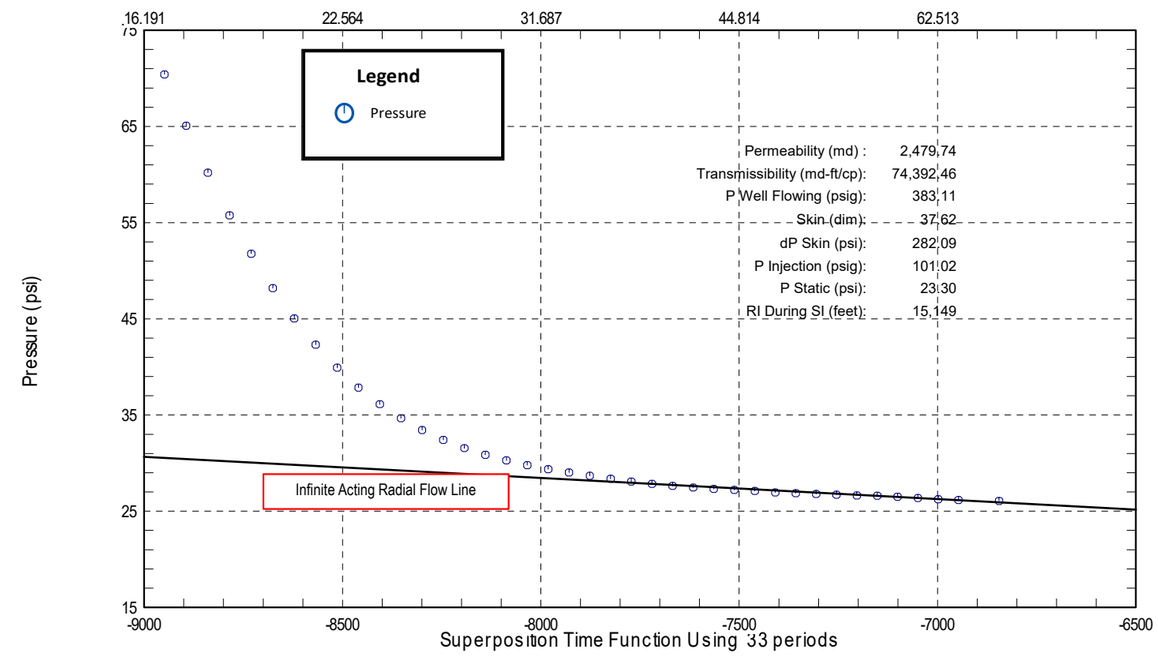
Log-Log Match



Page 1

State ..... Oklahoma ***County*** ..... Mayes ***Field*** ..... PCC	**Pryor Chemical Company** ***Injection Well 1*** **2016 Ambient Pressure Falloff**	***Test Date*** ..... Aug 2016 ***Analysis Date*** ..... April 2017 ***Report Number*** ..... 2016 Falloff

Detailed Superposition Analysis



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